Atlas of Contemporary

AESTHETIC BREAST SURGERY

Lee L. Q. **Pu**
Mark L. **Jewell**

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AESTHETIC BREAST SURGERY

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To my wife, Yu-Shan (Emily), and my children, Felix, Dustin, and Adrian, whose love, sacrifices, understanding, and unselfish support have made writing and editing of this book possible.

To my parents and my younger brother, who have supported me for all of these years and have trusted me to pursue my dream to become an excellent academic surgeon through more than a decade's effort.

To my professors and teachers, who inspired me throughout my surgical education to set a higher standard in my career and to work harder to achieve it.

To my worldwide friends and colleagues in plastic surgery, who have made so many remarkable contributions to our specialty and have consistently encouraged me to do the same.

Lee L.Q. Pu

To my wife, Mary Lind Jewell, and our children, Mark L. Jewell, II; James L. Jewell, MD; and Hillary L. Jewell, RNNP, MIPH, whose love, sacrifices, understanding, and unselfish support have made writing and editing this book possible.

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I am blessed to have so many great colleagues and friends throughout the world, who have taught me so much throughout my career.

Mark L. Jewell

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Preface

Mark L. Jewell and Lee L.Q. Pu

Aesthetic breast surgery is a common surgical procedure performed by many plastic surgeons around the world. It is an essential part of aesthetic surgery, and good outcomes would benefit many women with significant improvement in the quality of their lives. Many plastic surgeons, including both editors, started and maintained their careers by doing aesthetic breast surgery and have gained extensive clinical experience over the years.

Although there are many published books on aesthetic breast surgery, most books are either too extensive or not sufficiently comprehensive. Because of the popularity of aesthetic breast surgery, there is a need to create an atlas of aesthetic breast surgery that is not too extensive, but is comprehensive enough to cover all contemporary aesthetic breast surgery.

In 2017, both editors were approached by the world-renowned medical publisher, Elsevier, to create an atlas of aesthetic breast surgery. We were asked to put together an atlas that would be relatively handy and could be used worldwide by most busy plastic surgeons in their daily practice. With these goals in mind, we have assembled the work of our internationally renowned contributing authors, along with accompanying video, into the most contemporary book of its kind ever published.

We have invited our contributing authors, based on their recognized expertise in various areas of aesthetic breast surgery, to serve as educators, so that you as the reader can learn their personal approach to the various procedures in aesthetic breast surgery. Our goal in this book is to help you as the reader to "flatten the learning curve" and benefit from the expertise of our master surgeon contributors, who share their personal approaches to aesthetic breast surgery.

We have divided this 25-chapter atlas into 5 sections. Section 1 focuses on breast augmentation, with 7 chapters on different approaches of breast augmentation with the implant, fat grafting, and composite methods with both implant and fat grafting. Section 2 focuses on revision breast augmentation, a new and complicated topic in breast augmentation. The 5 chapters cover implant exchange and management of implant malposition, rippling, capsular contracture, and symmastia. Section 3 focuses on mastopexy, with 4 chapters that address patient selection and the different techniques of this popular aesthetic breast surgery. Breast augmentation and mastopexy, a unique combination, is described in an individual chapter. Section 4 focuses on breast reduction, with 4 chapters that describe patient selection and different techniques of this commonly performed aesthetic breast surgery. Section 5 focuses on other aesthetic breast surgery procedures. In this section, 5 chapters present breast reshaping techniques, correction of male gynecomastia and female congenital breast asymmetry, and transgender breast surgery, one of the new topics in aesthetic breast surgery. Each chapter has a standard format and is relatively easy to read and follow. The chapters are well illustrated, and videos of some of the procedures are provided.

When you read our book, you will undoubtedly see that our master surgeon contributors use similar processes for the analysis, planning, and surgical enactment of aesthetic breast surgery. We have asked our contributors to precisely present their surgical approach for excellent outcomes along with other technical pearls. We think you will agree that successful outcomes for our patients requires mastery of the entire process of aesthetic breast surgery, as outlined in each chapter.

In 2020 you can no longer rely on performing aesthetic breast surgery according to what you learned years ago. Aesthetic breast surgery is a dynamic topic, and we have produced the most up-to-date surgical atlas of techniques in aesthetic breast surgery. We have focused on the entire

process of successful aesthetic breast surgery, including patient education, accurate management of expectations, technical excellence during surgery, a process to manage adverse events, and secondary procedures.

This comprehensive but concise atlas of aesthetic breast surgery contains the most cutting-edge procedures in aesthetic surgery. It is an excellent reference book for plastic surgery trainees, young plastic surgeons in practice, and even senior plastic surgeons who want to learn more contemporary techniques in aesthetic breast surgery.

We hope you enjoy reading this atlas and find it useful in your busy clinical practice. We wish you the best as you work to become a master surgeon in all aspects of aesthetic breast surgery!

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My heartfelt appreciation goes to the co-editor, my close friend and colleague, Dr. Mark L. Jewell, from Eugene, Oregon. He maintains a very successful private practice and is on the teaching faculty of Oregon Health and Science University plastic surgery training program. Dr. Jewell is a past president of the American Society for Aesthetic Plastic Surgery and is a world-renowned aesthetic plastic surgeon and a frequent invited speaker both nationally and internationally because of his expertise in aesthetic breast surgery. He brings not only a wealth of clinical experience in aesthetic breast surgery but also vision and skill in writing and preparing *Atlas of Contemporary Aesthetic Breast Surgery.* It has been an incredible honor for me to work with him for the past 3 years.

My sincere appreciation also goes to all of the contributors to this atlas. Their clinical expertise, hard work, and desire to achieve excellence in aesthetic breast surgery have been indispensable in the creation of *Atlas of Contemporary Aesthetic Breast Surgery.* Without the contributions from these renowned experts, we would not have been able to publish this unique atlas.

I wish to express my gratitude to Belinda Kuhn and her entire publishing team. Belinda is an incredible professional and able to deliver unparalleled service in medical publishing. Under her leadership, this book project started with the table of contents and invitation to the contributors and progressed to the finished book. It has been a pleasure and a privilege to work with Belinda and her publishing team. They have ensured the best possible quality of each chapter, and this atlas could not be successful without the effort and hard work of this excellent team.

I have been very fortunate to hold a full-time academic position at the University of California Davis, in Sacramento, California. This renowned institution has superb faculty, staff, and residents. Many of my former and current faculty associates have created an intellectually stimulating environment for the creation of *Atlas of Contemporary Aesthetic Plastic Surgery.* Many of my former and current faculty colleagues covered my patients, enabling me to concentrate on writing, editing, and attending the meetings related to this project. I would like to thank my current administrative assistant, Mrs. Delia Luna, who provided tireless administrative support in manuscript preparation.

Lastly, I wish to express my heartfelt gratitude to my wife, Yu-Shan (Emily), who has supported me for all these years in my academic career and kept everything in order at home, allowing me to concentrate on this project; to my sons, Felix, Dustin, and Adrian, who have taught me the joy of life outside of work; and my younger brother, Lijun (Leo), who has always encouraged me to take on difficult tasks. I also wish to express my gratitude and respect to my former professors and training program directors, Dr. Zhong-Gao Wang, Dr. James F. Symes, Dr. Marvin A. McMillan, and Dr. Thomas J. Krizek. Their inspiration and support have made me able to successfully bring this many projects to completion. I also wish to express my great appreciation to Dr. James L. Baker, who taught me aesthetic surgery and introduced me to the field of aesthetic surgery and the American Society for Aesthetic Plastic Surgery. In addition, I also wish to express my gratitude to my worldwide friends and colleagues in plastic surgery for their encouragement and support during this book project.

Lee L.Q. Pu, MD, PhD, FACS, FICS

I am honored to work with my close friend and colleague, Lee L.Q. Pu, MD, Professor of Plastic Surgery at the University of California Davis, to develop *Atlas of Contemporary Aesthetic Breast Surgery.* Lee Pu is an amazing breast surgeon, excellent educator, and visionary with regard to innovation in aesthetic breast surgery. When he approached me to work with him to develop an innovative textbook, the first of its kind, it took me less than a second or two to conclude that this was a worthy project for the two of us. We decided, based on our experience, that *Atlas of Contemporary Aesthetic Breast Surgery* would be useful to plastic surgeons of all experience levels. A few years later, we have completed the project. It was a lot of work for the two of us, the staff at Elsevier, and our colleagues throughout the world who submitted chapters. Looking back, editing this atlas reminded me of a Thomas Edison saying that invention is 2% inspiration and 98% perspiration. The best part of this project was the opportunity to work with the best and brightest aesthetic breast surgeons in the world, who contributed chapters. Lee and I are honored by their willingness to put into print what they do every day in their clinical practices.

I would like to recognize my lovely wife, Mary Lind Jewell, RPT, for her love and support during the writing and production of the atlas. Mary is the patient coordinator in my clinic and one of the most knowledgeable women in the entire world regarding aesthetic and reconstructive breast surgery. Together, over the last 42 years, we have developed processes for producing excellent outcomes, with a zero rate

of perioperative infection in primary breast augmentation and a high level of patient satisfaction. Through service mapping and process engineering (Toyota Production System), we have been able to address common problems that are a cause for reoperation.

I would like to recognize my daughter, Hillary Lind Jewell, RNNP, MIPH, who is our clinic surgical nurse. Hillary's presurgery and postsurgery management of our patients has contributed to their excellent outcomes.

I also would like to recognize Rebecca Fickas, RN, my surgical nurse, who has worked tirelessly with me for the last 36 years. Her contribution to making my surgical suite function at best in class levels, consistently, over all these years bespeaks her dedication to a job well done.

My staff, Stacy Breaux and Becky Codington, deserve recognition for their involvement in helping me achieve mastery of aesthetic breast surgery. We have a collective experience of 172 years of work in aesthetic and reconstructive breast surgery, including U.S. Food and Drug Administration premarket approval studies on breast implants. It is through these studies that one learns about outcomes, patient satisfaction, and how to improve the quality of one's work.

Three colleagues, Scott Spear, MD, John Tebbetts, MD, and Pat Maxwell, MD, deserve mention with regard to the impact that the four of us have had in aesthetic and reconstructive breast surgery. We all met in 1979 at the chief residents conference and have worked together ever since. Through our collective work and leadership, we have been able to inspire others to do better every day in their clinical practices. I was especially honored to work with the late Scott Spear, MD, when he was president of the ASPS and I was president of the ASAPS. It is my hope that Bill Adams, MD, can continue the progress that we have made. I am honored to have Dirk Richter, MD, and Maria Weidner, MD, as colleagues who have supported my involvement at ISAPS in aesthetic breast surgery.

My professors who inspired me as a medical student and resident deserve recognition. David Robinson, MD, Frank Masters, MD, Philip Craft, MD, and Cauley Hayes, MD, influenced me to achieve, innovate, teach, and publish. I am thankful to have Robert Singer, MD, as a mentor throughout my time at the ASAPS. We have worked closely together in important areas of leadership, communications, and patient safety.

My most important acknowledgment goes to my wife, Mary Lind Jewell, and our children, Mark L. Jewell, II; James L. Jewell, MD; and Hillary L. Jewell, RNNP, MIPH, whose love, sacrifices, understanding, and unselfish support have made editing and writing this book possible. To my grandchildren, Reed Jewell, Sadie Jewell, and Olivia and Stella Myhre.

Mark L. Jewell, MD

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SECTION **1**

Breast Augmentation With Implant

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1

Breast Augmentation With Implants—Inframammary Approach

CAROLINE GLICKSMAN

Introduction

Over the last 20 years, considerable effort has been placed on re-evaluating breast augmentation and shifting the focus away from simply volumizing the patient to a more comprehensive approach to breast augmentation. Peer-reviewed articles and prior book chapters have already stressed the critical importance of thorough patient education and informed consent and defining breast augmentation as a "process."[1]

It has become abundantly clear that we need to create well-informed and engaged patients who understand the limitations of their tissues and their responsibility to maintain good breast health, and to eventually replace their implants as both the implants and the patient age.[2] Key considerations in breast augmentation should no longer focus on the "cup" size to be achieved,[3] but rather on maintaining adequate overlying tissue coverage, matching the gel fill with the feel of the breast, the management of patient expectations, and selecting a device and a procedure that will produce long-term stable aesthetic results. The inframammary fold (IMF) incision remains the standard to which all other incisions are compared. It provides the most direct access and clear visualization to the subglandular, dual-plane, and subfascial pockets, with the potential for the least trauma and contamination. The anatomy of the IMF has been eloquently described and is a clear visual marker for defining the lower pole of the breast.[4]

Despite considerable literature on the benefits of an IMF incision, surgeon and patient concern remains about placing a scar on the breast. Hypertrophic scars can potentially occur anywhere on the body and may be the result of poor execution, patient biologic status, or both.[5] Few data have been published on patient preference for scar location, but a well-placed and hidden inframammary scar is far less noticeable to most patients than a periareolar scar.

The last decade has seen the introduction of new silicone and saline breast implants on the worldwide market. The specific type of gel used allows some control over the gel distribution with the shell. Each device has clear benefits and trade-offs, but more important is the effect produced by each of these factors on the soft tissues of the lower pole of the breast over time and on the IMF in particular. This chapter will focus on primary breast augmentation through an inframammary approach. Special attention is drawn to the IMF anatomy and the surgical procedure, including stabilization of the new IMF when indicated, and the short-term and long-term management of the patient undergoing breast augmentation.

Preoperative Evaluations and Special Considerations

With aesthetic breast procedures it is critically important that patients are permitted and expected to participate in the decision-making process, weighing the pros and cons of the risks and benefits of each choice. Patients do not always understand what they are told or may, in hindsight, feel as though their decision was not based on all appropriate information.[6–9] Using a staged approach, surgeons and their staff may need to repeat various topics several times and require written documentation that the patient understands the choices offered. Once streamlined into a busy breast augmentation practice, this approach produces patients who understand, accept, and take responsibility for their decisions. Signing a single informed consent document before surgery does not always imply understanding.[10] If possible, patients undergoing breast augmentation should be given a second consultation reassuring those patients who want to be part of the decision-making process that they will be given ample time to weigh all of their surgical and device options. It is most important that patients should be given sufficient opportunity to become well-informed, shared decision makers.[2]

Historically, breast implant selection was based on the subjective desires of both the patient and surgeon. Techniques such as asking the patient to bring in a photograph to illustrate the type of breast she wants provides very little useful information from an operative planning standpoint. Similarly, the practice of stuffing implants into a bra can be

extremely deceiving because this cannot simulate the stretch or fill of the existing breast and muscle tissue. Although each of these methods may contribute to a better understanding of the goals and desires of a patient, they are subjective findings that cannot compare with the capabilities of three-dimensional (3-D) imaging technology. In addition, although many surgeons and patients also use the term *desired base width,* the actual base width is perhaps the most critical measurable dimension that affects the long-term outcome of a breast augmentation. It is the combination of prioritizing the quantifiable measurements, while also ensuring adequate soft tissue coverage over all areas of the selected implant, that offers the potential for stable and enduring outcomes.[11]

The final implant selection should be based on objective tissue-based planning (Fig. 1.1A–D), matching the feel of the breast to the cohesivity, the viscoelastic properties of the device, and the aesthetic goals of a well-educated patient.[12]

3-D imaging technology has become an integral part of a comprehensive breast augmentation consultation. Preoperative simulations help create well-informed and engaged patients and their significant others. Several systems currently exist, including Canfield Imaging Systems (Canfield Scientific, Parsippany, NJ) and Divina (AZ3 Technologies, LLC, United States, Guatemala, and Costa Rica). These systems have become increasingly interactive, and unlike viewing other patients' presurgical and postsurgical images, patients are given the opportunity to view their own possible outcomes before surgery. The 3-D technology reproduces the manual measurements previously obtained during the physical examination.

During the simulation, patients can view themselves from different angles and carefully examine their own anatomy, including existing asymmetries. The time spent with the patient can be invaluable in teaching what may be possible based on the patient's specific anatomic landmarks and soft tissues. Various volumes and projections of breast implants can be demonstrated with sensational accuracy. Asymmetries in volume and shape can be addressed and possibly reduced with the use of various devices (Fig. 1.2A–C). Studies have demonstrated the precision of these systems in primary breast augmentation.[13]

The breast type is the key to selecting the fill of the implant. Looser, emptier breasts may be better suited to more elastic, less cohesive devices, where the implant is not required to shape the breast. Very tight breasts may benefit from a more cohesive, less elastic gel that can produce shape over time. This is especially true for constricted base or tuberous breasts. Another way to select the implant type in breast augmentation is to use a gel fill that is similar to the feel of the existing breast parenchyma. The fundamental goal is the selection of breast implants that will prioritize long-term outcomes over short-term patient satisfaction.

3-D imaging technology is especially useful in determining the location of the IMF and incision planning. Through the simulation process, patients gain an understanding of why the width and height of a round implant or the height of a shaped implant matters. Implant selection needs to be based on the individual chest wall anatomy and desired outcome. Placing an implant too high or positioning the implant too low on the chest during a simulation can also demonstrate potential malposition deformities or explain the effect of an oversized implant over time (Fig. 1.3A–D).

The use of prophylactic antibiotics for procedures that breach the skin or mucosa is also recommended to prevent endogenous bacteria from reaching an implanted device for as long as the patient has a breast implant.[38] Finally, patients undergoing breast augmentation will all continue to age, gain and lose weight, birth children, breastfeed, and eventually go through menopause. A close and enduring relationship with our patients ensures optimal results, sound breast health, and years of happiness for our patients and our practices.

Surgical Techniques

Anatomy and Function of the Inframammary Fold

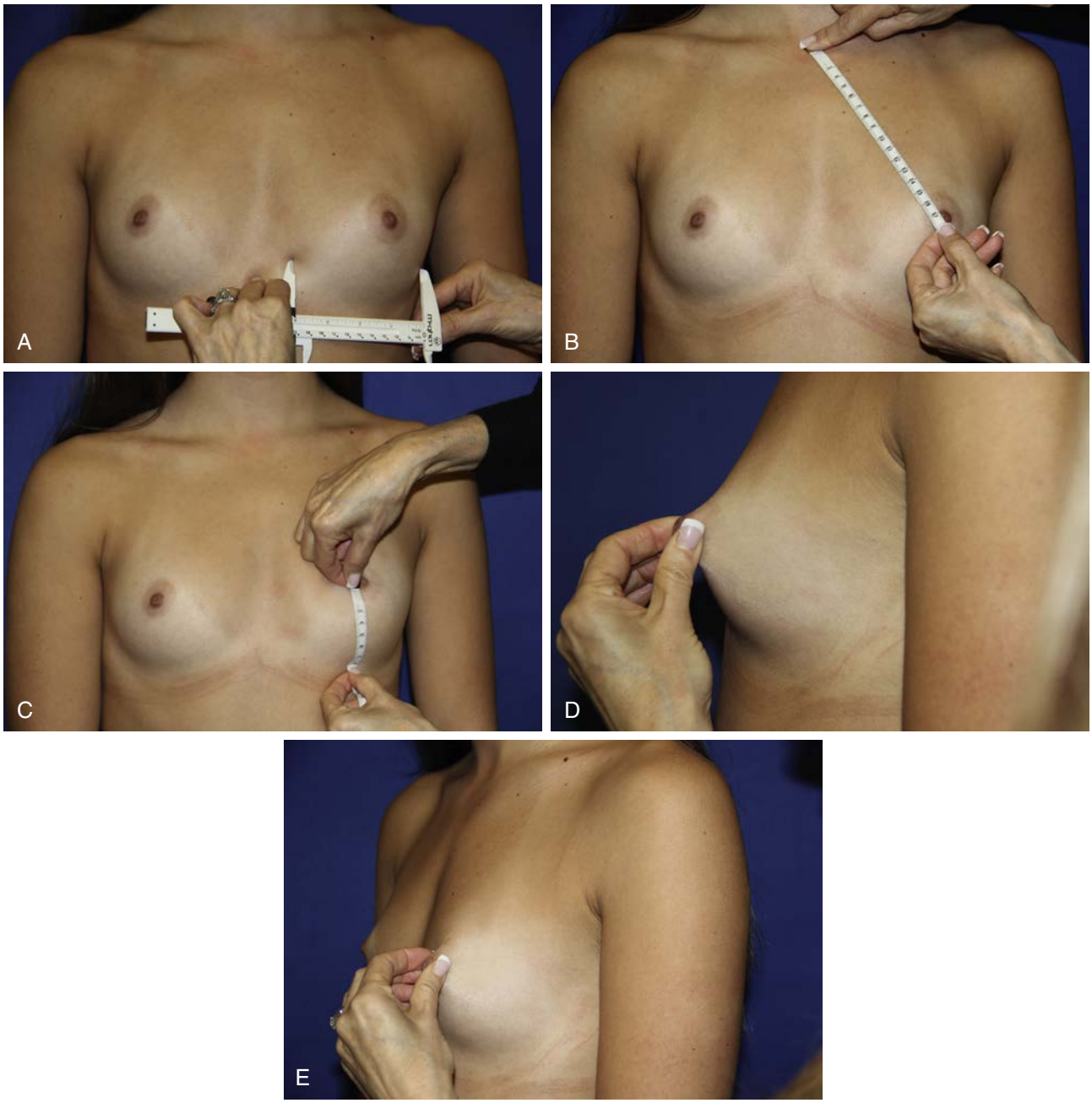
The IMF anchors the lower pole of the breast to the chest wall and can be almost absent in cases of severe hypoplasia of the breast. Cadaver studies through the 20th century described the IMF as a crescent-shaped ligament between the skin and the anterior surface of the pectoralis major muscle.[14] The structure has further been described as both a ligamentous structure and a dense collagen network, functioning as a zone of adherence between the dermis and underlying pectoralis fascia.[15,16]

More recent cadaver studies have identified a network of fascial condensations that connect the deep muscle fascia to the anterior breast capsule—termed the *triangular fascial condensation* (Fig. 1.4) A second zone of horizontal ligaments arises from the deep fascia of the rectus abdominus to the Scarpa fascia and inserts into the inferior limit of the fold. The precise relationship between the inferior border of the pectoralis major muscle and the IMF has been further studied, and the actual IMF is visually identified approximately 2 cm below the inferior pectoralis origin.[17]

In addition to the central portion of the IMF there are medial and lateral inflection points of the IMF and these are located medially, where the breast meets the sternum, and laterally, where the breast meets the anterior axilla. Manual traction applied on the breast medially and laterally can easily identify the endpoints of the breast in a thin patient. More careful analysis may be required in patients with more body fat, because medially the two breasts may meet and laterally the breast may blend into the posterior axilla and back. The same maneuvers are used to more accurately calculate the true breast base width.[18]

Systems to Determine New Intramammary Fold

Biodimensional tissue–based systems, first introduced by Tebbetts,[19] have been elaborated upon by numerous surgeons (see Fig. 1.1A–D). These systems are widely used because

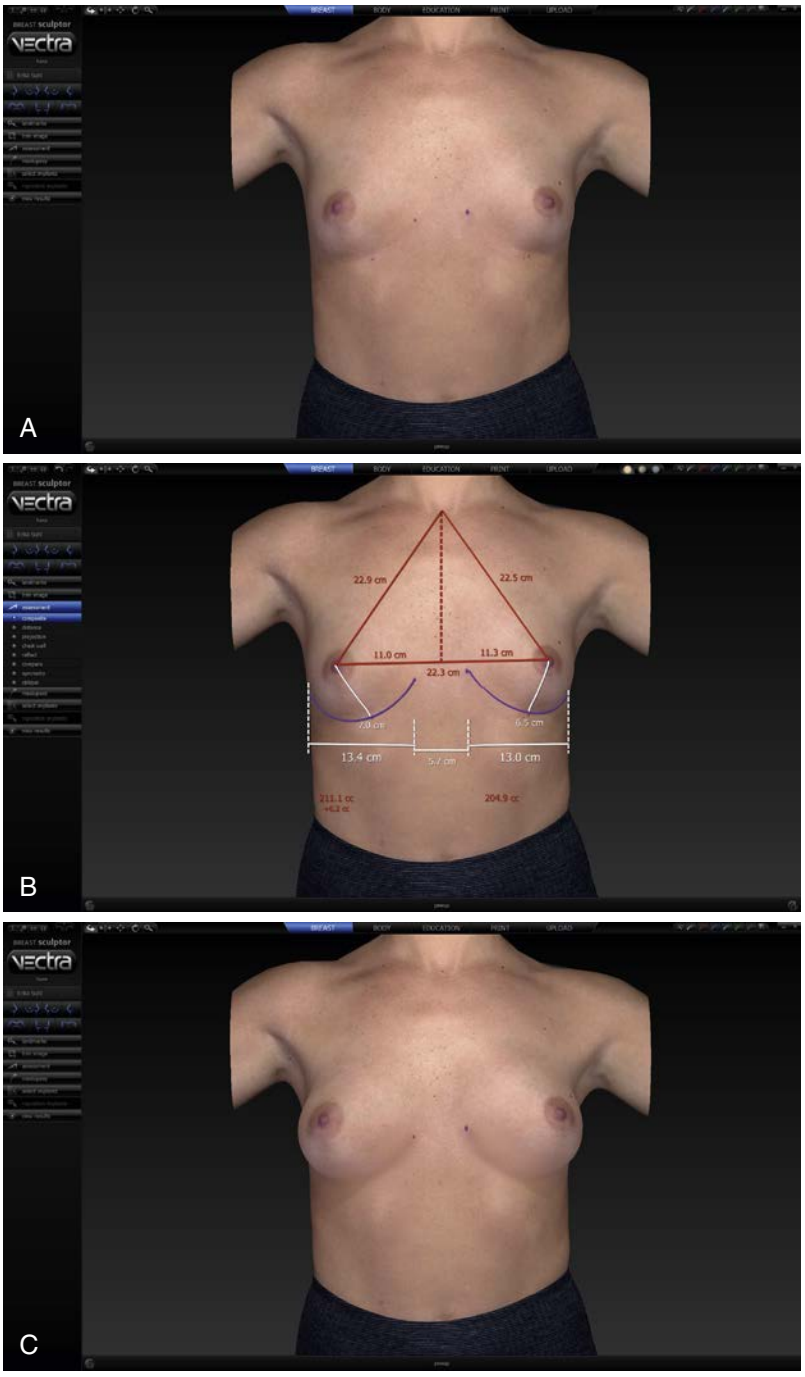


• **Fig. 1.1** (A) Base width (BW) to determine to diameter of the implant (breast base width [BBW] will be smaller). (B) Sternal notch to nipple (SN/N). (C, D) Anterior pull or stretch indication and soft tissue pinch indicate the quality of skin and soft tissue coverage (skin stretch). (E) Nipple-to-inframammary fold (N/IMF) measurement to select implant BW and determine where to place the IMF incision. Nipple to fold on stretch N/IMF.

they are suitable for a variety of both shaped and round devices; they include the High Five decision support system, defined by Adams[20]; the Akademikliniken Method, described by Hedén[21]; and the Randquist method.[22] Newer published systems, including the ICE (implant dimensions, capacity of lower pole, excess skin required in lower pole) principle, attempt to simplify some of the more elaborate formulas.[23]

The common thread between the three leading systems is that the larger the base width–diameter, projection, volume, and lower ventral curvature (LVC) of the device selected, the longer is the nipple-to-fold distance required. The concept behind using the implant's LVC (Fig. 1.5) is that this number can be used to help calculate the ideal amount of skin required between the nipple and the IMF. The LVC is calculated as the surface distance from the implant's ideal nipple position down to the lower implant border. Several manufacturers are now providing this information for all of their implant models.[24,25]

Yet another system, the simplified evaluation system, is a preoperative assessment tool for determining the new IMF based solely on the vertical dimension of the implant,

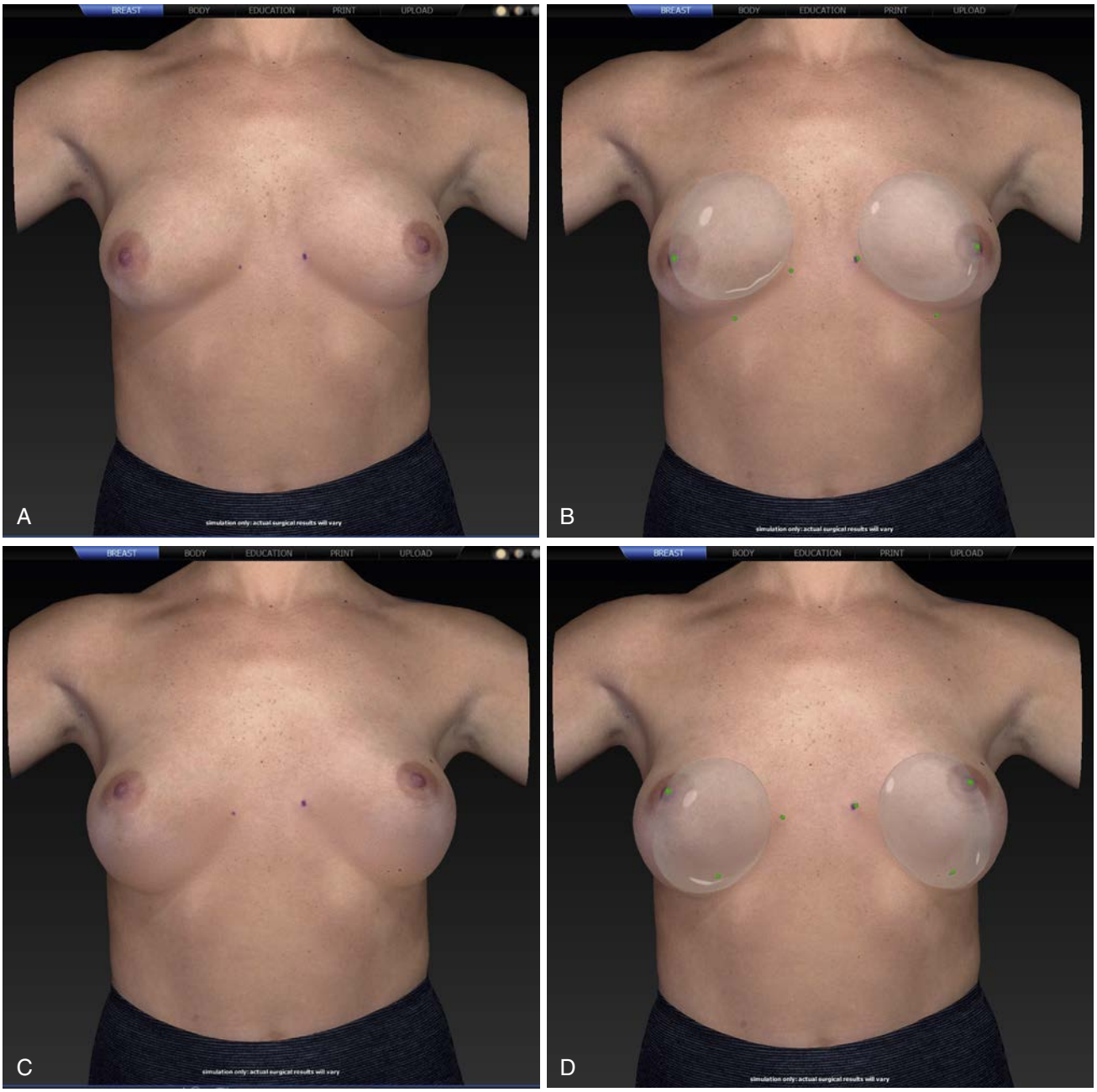


• **Fig. 1.2** Vectra 3-D planning and simulations. (A) Preoperative 3-D image. (B) Preoperative assessment. (C) Preoperative 3-D image.

not on the breast base width or volume of the implant.[26] The authors also do not adjust their calculations for varying implant projections. This system does not account for the lower pole skin stretch or compliance, and there are known long-term consequences of placing a high projecting, larger volume implant into a looser skin envelope.[27]

Many approaches support the logic of preoperatively calculating the planned IMF location based on (1) the base width, height, or diameter and the projection of the selected implant; (2) the quantity of gland and parenchyma present; (3) the quality of tissues and skin stretch; and (4) the shell and viscoelastic properties of the selected device. All preoperative marking systems must take into account these variables if they are to produce predictable long-lasting outcomes. Measurements of the existing nipple-to-fold distance should always be taken on stretch to stimulate the effect of the implant on the tissues (Table 1.1).

Finally, not all implants perform the same way over time. Smooth round gel implants can vary in the degree to which they descend and stretch the skin and capsule of the lower pole over time. This is due in part to their smooth surface, the

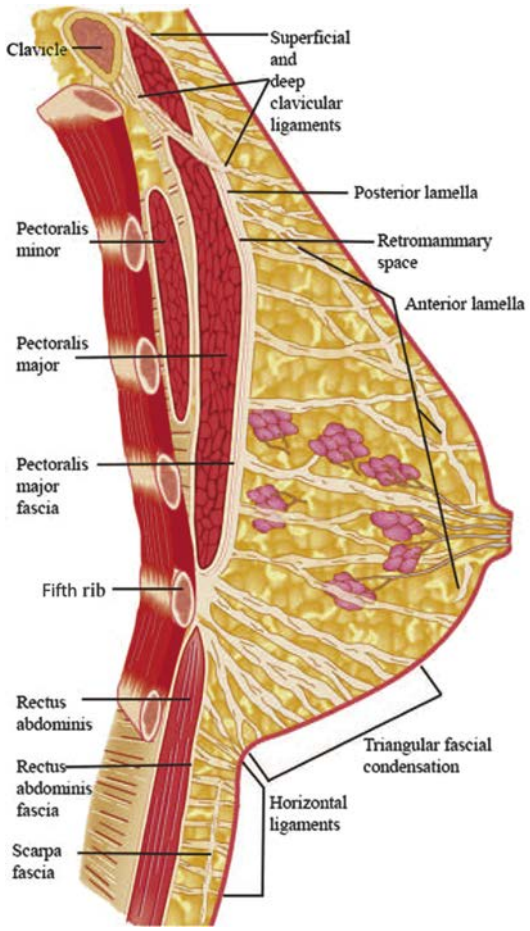


• **Fig. 1.3** (A, B) Vectra 3-D simulation implant too high. (C, D) Implant too low.

viscoelastic properties of the gel, and the thickness of capsule generated in response to the shell characteristics. Care should be taken with some of the newer, softer, more viscoelastic gel implants with smooth surfaces to control the pocket dissection and specifically reinforce the IMF if lowered, to avoid inferior malposition. A good general rule, however, is that if the calculated nipple-to-fold distance for the planned implant is greater than the patient's preoperative nipple-to-fold distance, the IMF needs to be lowered and reinforced. If the fold requires lowering more than a centimeter, with the exception of constricted base breasts or tuberous breast deformities, a smaller volume or base width implant may need to be selected. Perhaps most importantly, if the fold is lowered, it should always be fixed with a layered repair. The final breast position and lower pole contour are not usually realized until at least the 6-month visit and perhaps at 1 year in some patients (Fig. 1.6A–E).

Pocket Location

The pocket location has been determined preoperatively and emphasizes the importance of preserving adequate soft tissue coverage. The subglandular pocket can be considered based on objective measurements of a soft tissue pinch of greater than 2.0–3.0 cm at the upper pole, which should provide adequate coverage of most implants. The selection of an implant that contains a higher percentage of gel fill or



• **Fig. 1.4** Diagram of sagittal section demonstrating the anterior and posterior breast capsule, ligaments, and triangular fascial condensation. (Reprinted with permission from Maclin II, M., Deigni, O., Bengtson, B., 2015. The laminated nature of the pectoralis major muscle and the redefinition of the inframammary fold: clinical implications in aesthetic and reconstructive breast surgery. *Clin. Plastic. Surg.* 42, 465–479.)

LVC= Lower Ventral Curvature of the implant

• **Fig. 1.5** Lower ventral curvature (LVC) of the implant.

a more cohesive implant with higher viscoelastic properties may also help prevent excessive visibility and rippling in this pocket. The subpectoral pocket has been further defined and described by Tebbetts and others as the *dual-plane pocket.* The benefits of the dual-plane pocket include added muscle coverage superiorly, which may allow for more choices in implant style and gel fill. The various dual-plane I, II, and III pockets provide a wide range of surgical options that can be tailored to the specific soft tissue envelope of each patient.[28] Finally, the use of the subfascial pocket has been described, and, although more popular from a transaxillary approach, this pocket can be developed through an inframammary incision. Anatomically, the fascia is often less than 1-mm thick at the inferior aspect of the pocket and dissection in this plane through the IMF incision may be more likely subglandular.[29]

Preoperative Markings

The very minimum that should be marked on the patient preoperatively is the location of the existing IMF, the location of the planned IMF incision (may be the same or lowered), its length, and the width and height of the selected device for each side. Implant selection using tissue-based planning and 3-D simulation should result in a single device selected for the augmentation procedure. Complex chest wall or breast asymmetries or revisions may require ordering more than one device for a planned procedure, but careful preoperative assessment can reduce the need to order excessive numbers of implants. Changes in the preoperative plan, or not having a plan with respect to the final implant base weight, volume, projection, and gel fill will affect the correct location of IMF placement. Measurements may be rechecked the day of surgery, but implant selection should be completed whenever possible during the final consultation visit to avoid the need to alter markings on the day of surgery, especially intraoperatively.

A surgical planning sheet (Fig. 1.7) is finalized in the office and brought to the preoperative holding area for each patient. All of the specific implant information for the patient is available, including information on the selected implants, the device measurements, location for the new IMF and any adjustments needed, and any information about old devices in the case of a revision procedure. The planning sheet can be used to help streamline the preoperative markings and the ordering of implants for each case (Fig. 1.8A–C).

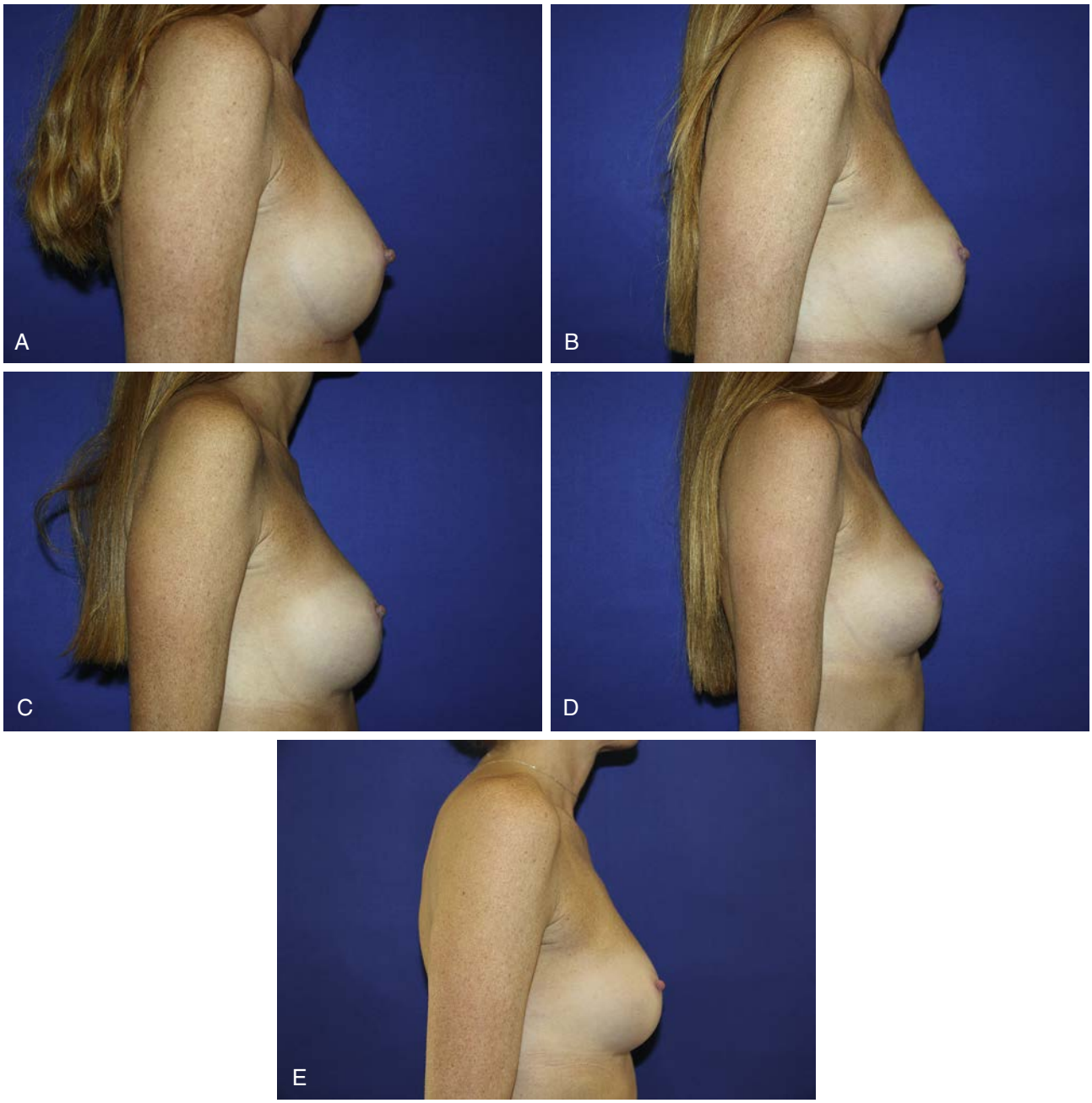
Positioning the Patient

Patients are placed on the operating table in the supine position. Arms can be positioned and secured to arm boards or folded across the lower abdomen, depending on surgeon preference. The positioning should allow access for the

TABLE 1.1 Comparison of Systems Used to Identify the Inframammary Fold Position

System	Measurements	Formula	Fudge Factors-limitations	Round/Shaped
Hedén	• Implant base width/diameter and projection determine the location of new IMF • N/IMF = LVC + Distance to be added for additional glandular tissue	• Akademikliniken method: NM with arms up-½ implant height = Distance in to lower IMF LVC + N to ILP–½ implant height = New length required	• LVC = Lower ventral curvature of the implant (point of maximum projection to implant lower border (ILB) • Considers aesthetic outcome over time and variable effect of gel fills on final outcome	• Can be used for both round and shaped: 50:50
Malucci ICE	• Implant height and projection determine location of IMF • Existing N/IMF on stretch = Capacity (C)	• I–C = E • I = Implant dimensions (height/2 + projection) • C = Capacity of lower pole • E = Excess skin required in lower pole	• Considers aesthetic outcome over time and proportion of upper to lower pole fill • Implant characteristics (height and projection), breast base width, and N/IMF on stretch determine amount of skin that must be recruited	• Can be used for both round (50:50) and shaped (45:55)
Tebbetts Adams High-Five	• Implant base width determines location of IMF	• Implant case width determines N/IMF distance: 200 = 7.0 250 = 7.5 300 = 8.0	• Critical relationship between the breast base width and N/IMF • Implant volume and projection determine effects on tissues over time	• Can be used for both round and shaped devices
Randquist	• Base width of implant and tissue characteristics	• Implant base width 11.0 = 7.5 cm 11.5 = 8.0 cm 12.0 = 8.5 cm 0.4 cm upper pole + 0.5 cm Tight envelope + 0.5 cm Loose skin/parenchyma – 0.5 cm	• Requires measurement of existing N/WF on maximum stretch • Precise pocket dissection and IMF repair to maintain implant position over time	• Round and shaped • Works best with highly cohesive gels that expand lower pole over time
Bouwer et al.	• Uses Pythagorean theorem to determine location of IMF	• $\alpha^2 + \beta^2 + \gamma^2$ • α = ½ implant height • β = Implant projection • γ = Areola-to-IMF distance in cm	• Based on average areola diameter of 4 cm, and average breast thickness of 2 cm • Standardized system with limited regard for tissue characteristics and long-term aesthetics	• Round only
Atiyeh et al.	• Simplified system uses calculated change in nipple position preoperatively + implant width or height	• SN-N_1 = Measured with arms at side • SN-N_2 = Measured arms horizontal • ½ implant vertical height– round LVC: anatomic	• New IMF determined by change in nipple position + ½ implant height. • Lowers both IMFs the same distance and may lead to significant malposition over time	• Can be used with both round and shaped

ILB, Implant lower border; *ILP,* implant lower pole; *IMF,* inframammary fold; *LVC,* lower ventral curvature; *N,* nipple; *SN,* sternal notch.



• **Fig. 1.6** Maintenance of IMF position over 10 years. (A) 3 weeks, (B) 1 year, (C) 3 years, (D) 5 years, (E) 10 years.

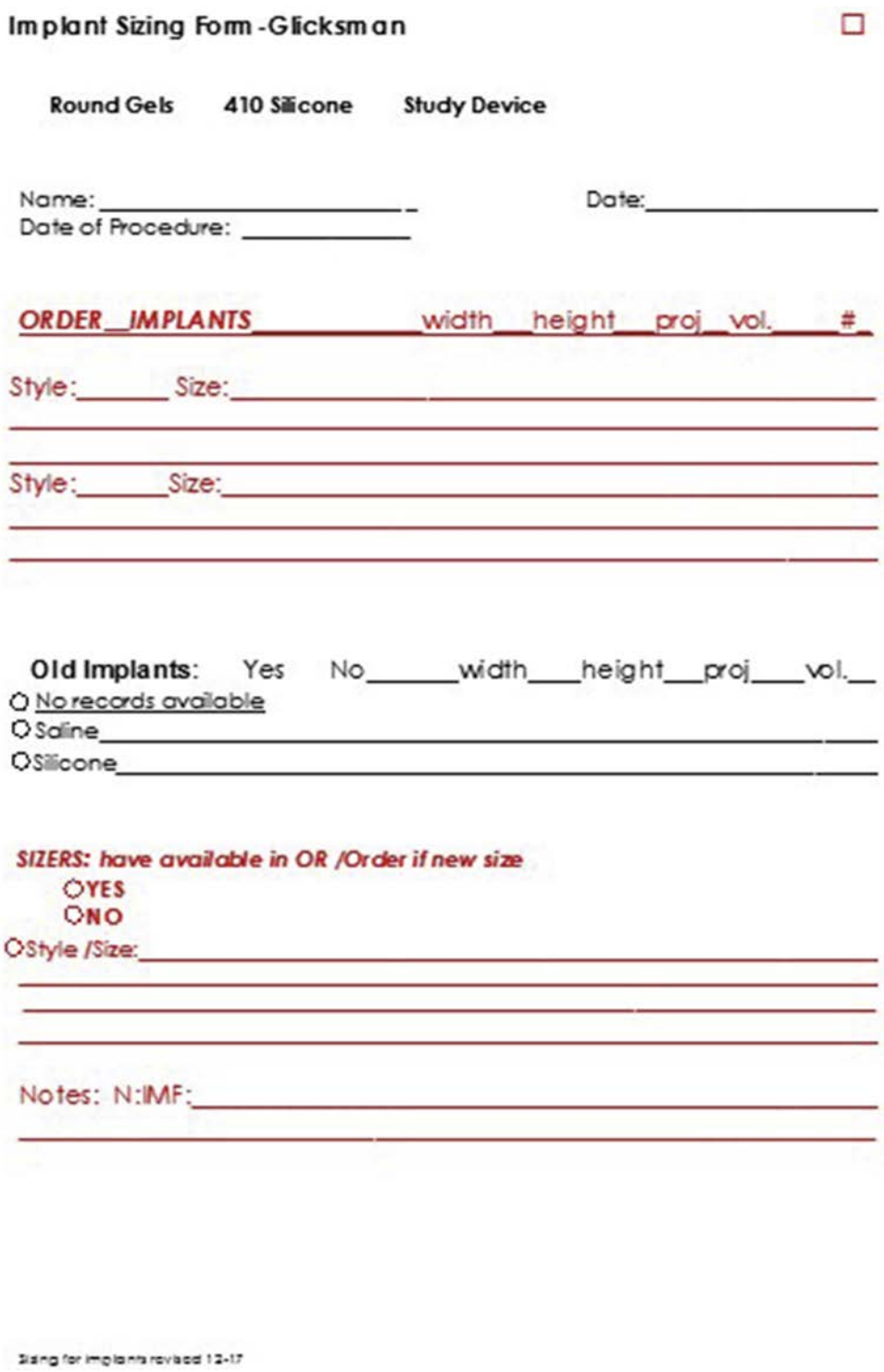
surgeon, who may be standing or sitting, and also take the tension off the pectoralis muscles.

Prepping and Draping

The patient is prepped and draped in usual sterile fashion; solutions for prepping include povidone-iodine (Betadine) and chlorhexidine, and use depends on surgeon preference. A Tegaderm (3M, St. Paul, MN) is placed over both nipple–areola complexes on all patients to reduce the risk for bacterial contamination from endogenous breast flora.[30]

Pocket Dissection Technique

After the incision is made through the skin with a blade, the rest of the pocket dissection is performed with electrosurgical cautery. The use of cutting cautery with a Colorado tip (Stryker Corporation, Kalamazoo, MI) and an electrosurgical unit (ValleyLab Force FX, Medtronic Covidien, Minneapolis, MN) or an electrosurgical cutting device set to blend mode are both acceptable as long as the dissection is performed using prospective hemostasis and maintaining a dry field. Pocket dissection is facilitated by the use of adequate lighting with either a lighted fiber-optic retractor (Tebbetts


Implant Sizing Form -Glicksman

Round Gels 410 Silicone Study Device

Name: _____ Date: _____
Date of Procedure: _____

ORDER IMPLANTS _____ width height proj vol. #

Style: _____ Size: _____

Style: _____ Size: _____

Old Implants: Yes No _____ width height proj vol.

○ No records available
○ Saline _____
○ Silicone _____

SIZERS: have available in OR /Order if new size
○ YES
○ NO
○ Style /Size: _____

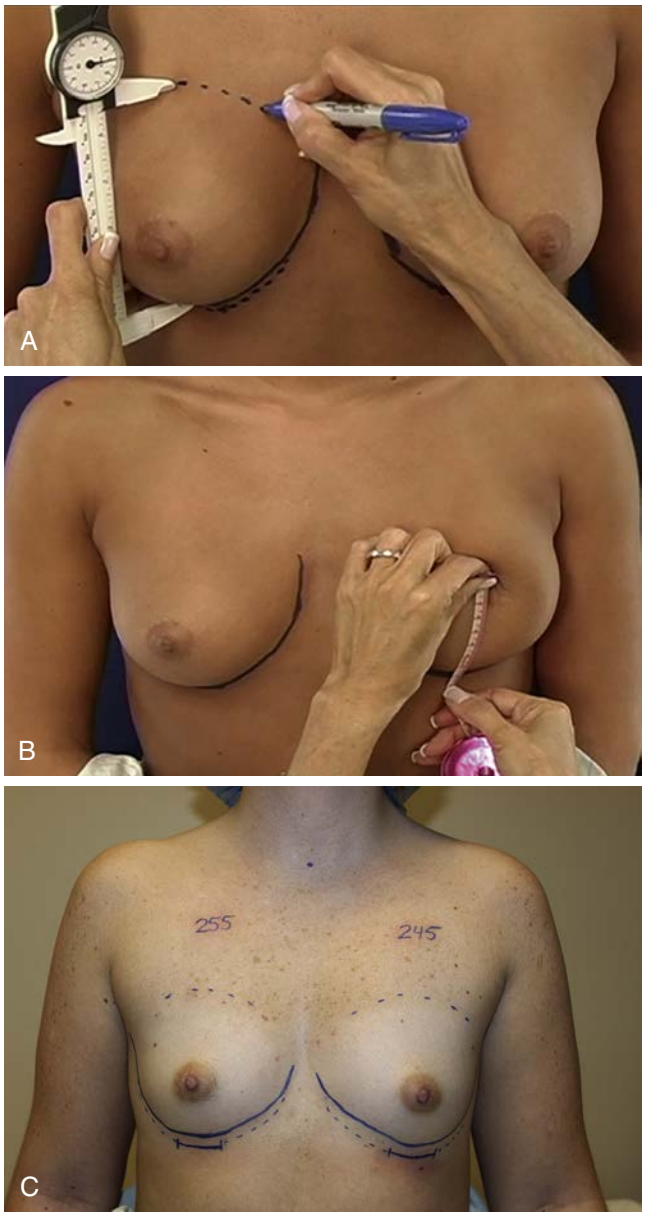
Notes: N:IMF: _____

Sizing for implants revised 12-17

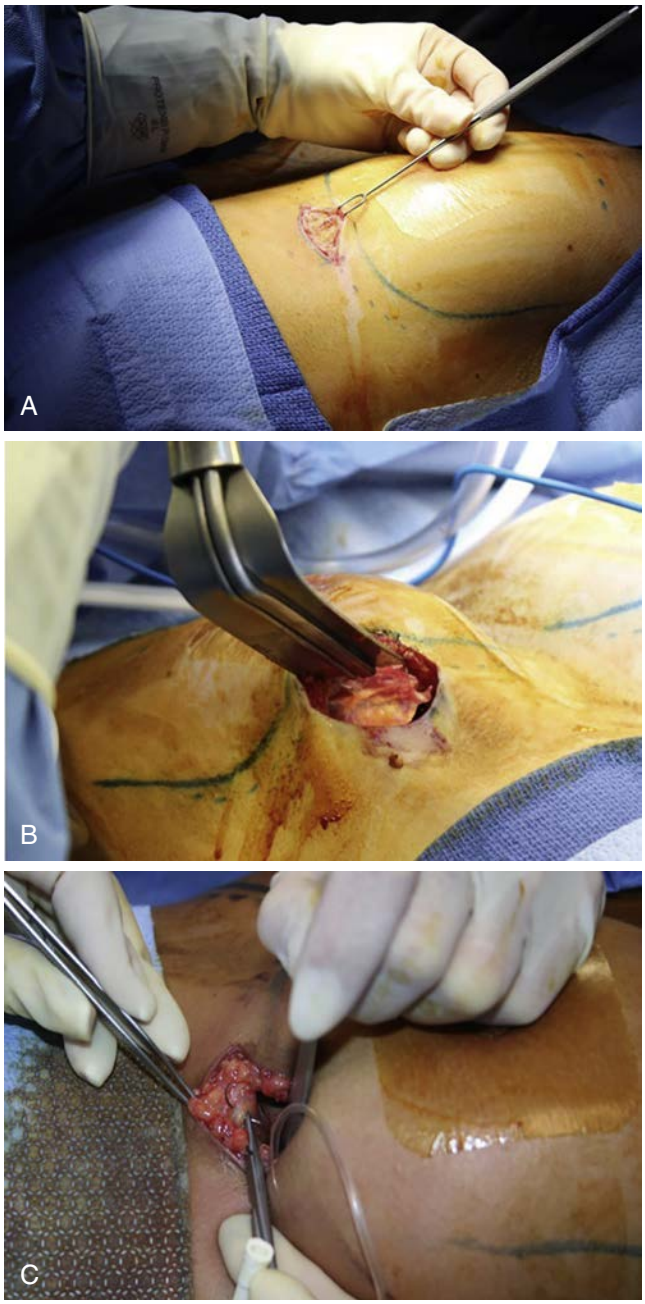
• **Fig. 1.7** Planning sheet.

Fiberoptic Retractor, Black and Black Surgical, Tucker, GA) or a headlamp to ensure complete, prospective hemostasis throughout the entire pocket dissection.

If creating a dual-plane pocket, the administration of a short-acting muscle relaxant by the anesthesiologist helps facilitate dry pocket dissection and the pocket is developed within the markings placed for the selected device. Control of the IMF begins as soon as the skin incision is made. If the existing fold was not intentionally lowered, dissection should protect and vector away from the horizontal fibers of the IMF. Avoidance of any downward retraction of the IMF by the surgeon or the surgeon's assistant may help reduce the risk of overdissection of the IMF. When a new fold has been deliberately designed lower than the original fold, care should be taken not to move the existing fold farther than 1 cm inferiorly. The exception to this understandably includes



• **Fig. 1.8** Preoperative markings. (A) Base width and height. (B) Marking the new inframammary fold on stretch. (C) Completed preoperative markings.



• **Fig. 1.9** Intraoperative dissection technique and closure. (A) Incision. (B) Dual-plane I pocket dissection. (C) Setting the new inframammary fold.

patients with constricted-base breasts or tuberous breasts where the ligamentous attachments of the IMF are being deliberately disrupted.

Once deep to the pectoralis major, dissection is continued superiorly to the upper limits for the dissection marked on the skin (Fig. 1.9A–C). This determines the height of the pocket. Dissection is carried medially, releasing only accessory fibers as needed, toward the sternum. Inferiorly, the pectoralis major attachments may be released from the ribs along the fold. Extreme care should be taken to create a precise pocket, especially laterally. Dissection laterally should be just to the limits of the skin markings that define the breast implant width so the device can fit securely and comfortably and lie flat within the pocket.

With the increasing use of smooth surface implants worldwide, care should be taken to avoid the potential for inferior and lateral displacement over time. Implant surfaces affect the development of a specific capsule response, and some implant surfaces produce very thin capsules, creating even more lower pole and lateral stretch. Steps should always be taken to dissect the lateral pocket incrementally, so as not to overdissect.

Pocket Irrigation

Considerable published literature exists on the need to insert a breast implant atraumatically. It is equally important that

steps be taken to reduce the risk of bacterial contamination of the pocket. Everyone present in the operating room must be familiar with the proper handling of an implantable device. Implants may be soaked in an appropriate triple-antibiotic and povidone-iodine solution or povidone-iodine and saline with at least a 50:50 concentration, which can be injected by the surgeon through the sterile container lid of the implant package. The pocket is irrigated with the same irrigation solution. In 2017 the U.S. Food and Drug Administration lifted its 11-year ban on the use of povidone-iodine in contact with breast implants, allowing one of the implant manufacturers (Allergan Inc., Irvine, CA) to change their labeling and directions for use. It is advised that gloves must be changed before handling the implants. Drains in most cases are not needed.

Implant Insertion

Techniques should be used to insert the implant with the least amount of manipulation, minimizing the need to remove and replace the permanent implant. Although some surgeons use sizers to check their pocket dissection, the use of sizers to determine breast size or shape should not be necessary if implants were selected preoperatively. Published guides provide additional steps to further reduce the potential for implant and pocket contamination, such as the 14-Point Plan proposed by Deva and Adams. Although the precise cause and classification of breast implant–associated anaplastic large-cell lymphoma (BIA-ALCL) remains unclear at the time of this writing, the role of bacterial contamination in the cause of both capsular contracture and more serious conditions surrounding a breast implant have been well demonstrated.[31,32]

Closure and Setting the Inframammary Fold

The location of the IMF, which was determined preoperatively, should be closed in a manner that provides long-lasting stability. The technique of wound closure is particularly important because a multilayered closure helps maintain a secure and sterile pocket. Setting the fold carefully also anchors the incision to the chest wall in the precise location selected. If secured carefully, the resulting scar will remain well-hidden in the new or existing IMF. The closure should secure the superficial Scarpa fascia to the underlying deep fascial layers with either a permanent or absorbable suture. The repair should include a minimum of three or four layers.[33,34] Careful closure of the IMF creates a natural appearing fold where the skin of the breast joins the skin of the upper abdomen. The fixation of the IMF is especially critical after being lowered more than 1 cm, as in constricted or tuberous breasts, and when selecting smooth gel implants.

Postoperative Care and Expected Outcomes

Postoperative regimens vary by surgeon preference, but the avoidance of hematomas, wound problems, and implant malposition require that we provide detailed instructions to our increasingly active patient population. Patients are encouraged to resume most daily activities within 24–48 hours, including showering and driving a car. Caring for small children and pets that requires lifting and chasing should be avoided for several weeks. Narcotics are generally not prescribed, or necessary, for the great majority of patients. A return to any exercises that produce a shearing force to the breast, such as running, chest muscle weight training, or jumping, should be avoided for at least 6 weeks.[35] Preferences for the various sports bras and underwire-style bras should be left to the patient as long as they are supportive and comfortable. Wearing a supportive bra for at least 4–6 months, if not longer, is recommended.[36,37]

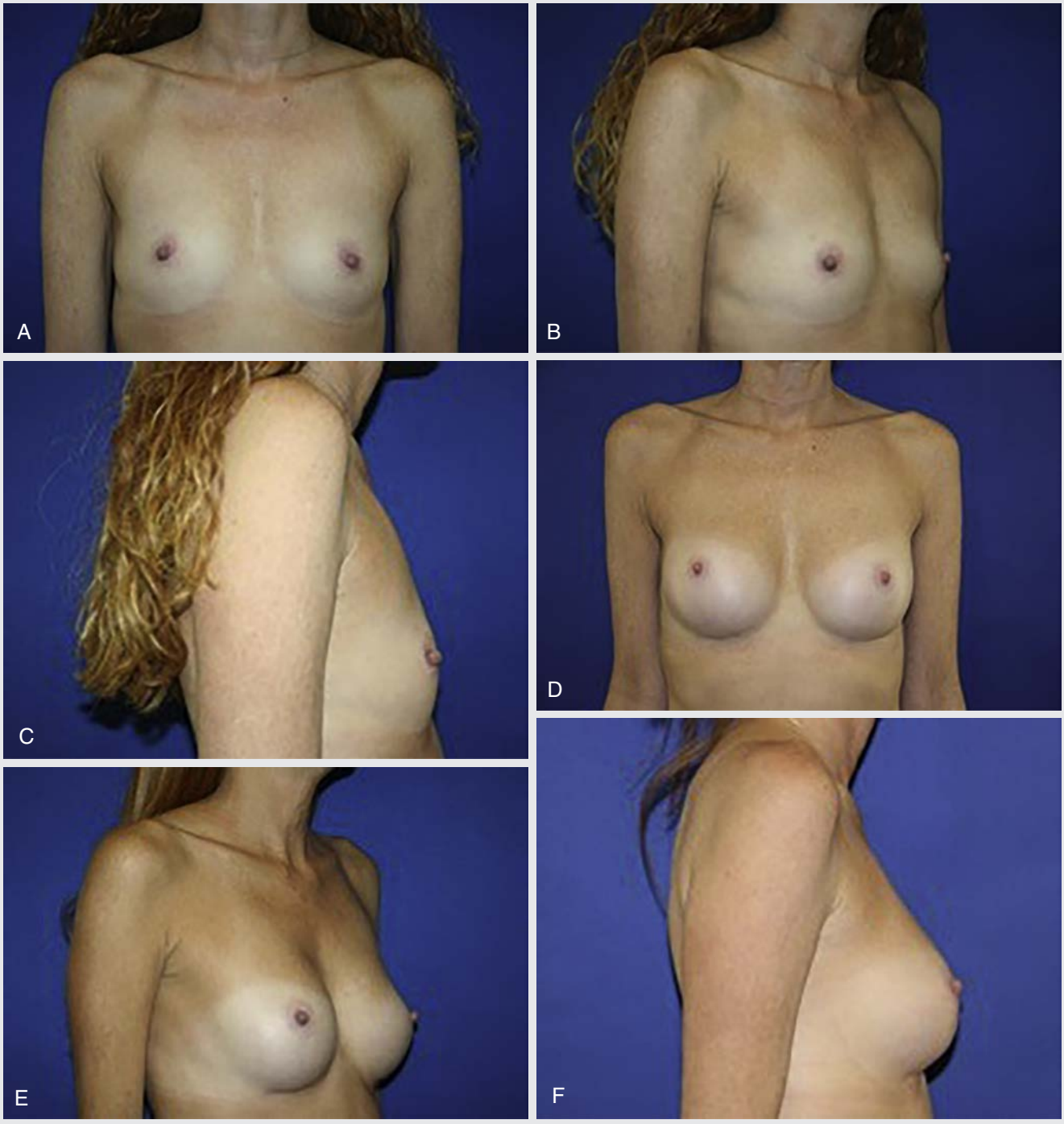
Silicone gel breast implants are not lifelong devices. Patients should be followed at 6 months and 1 year and then encouraged to follow up with their surgeon every 2 years. These visits can be short follow-up appointments that provide the surgeon the opportunity to observe long-term outcomes with specific implants and techniques.

Patients should be instructed to avoid the risk of endogenous bacterial infections, including prophylactic antibiotics for procedures that breach the mucosa. They also should be advised to seek appropriate medical treatment of any bacterial infection. Patients with implants should be encouraged to continue their annual breast screenings for cancer and follow up with their plastic surgeon every 2 years.

Case Examples

CASE 1.1

Preoperative images are presented of a 42-year-old mother of two. Primary breast augmentation was performed with cohesive implants through IMF without the need to lower the fold (Case 1.1A–C). Postoperative images at 5 years demonstrate IMF stable position (Case 1.1D–F). Postoperative images at 9 years demonstrate maintenance of IMF position (Case1.1G–I).



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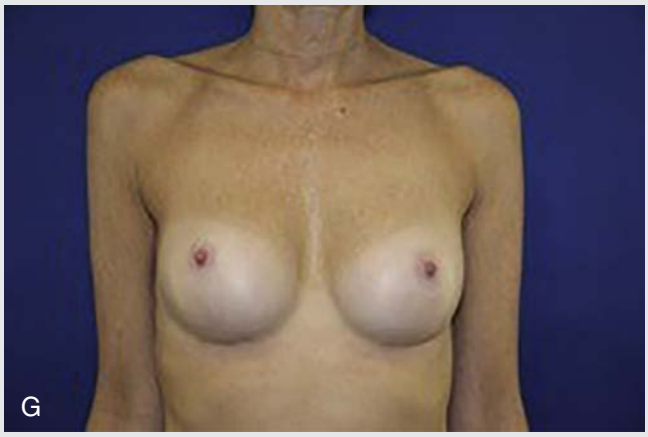
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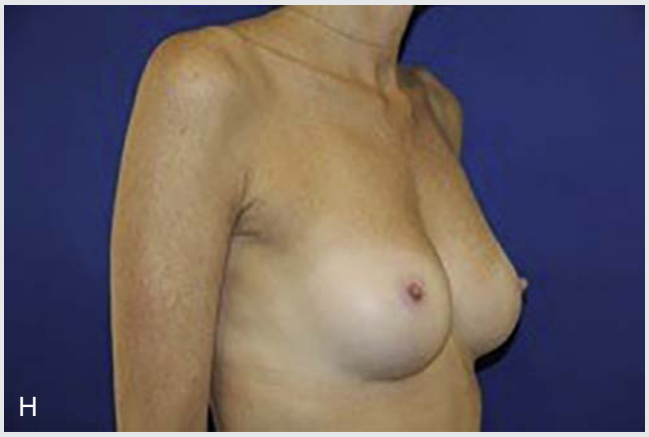
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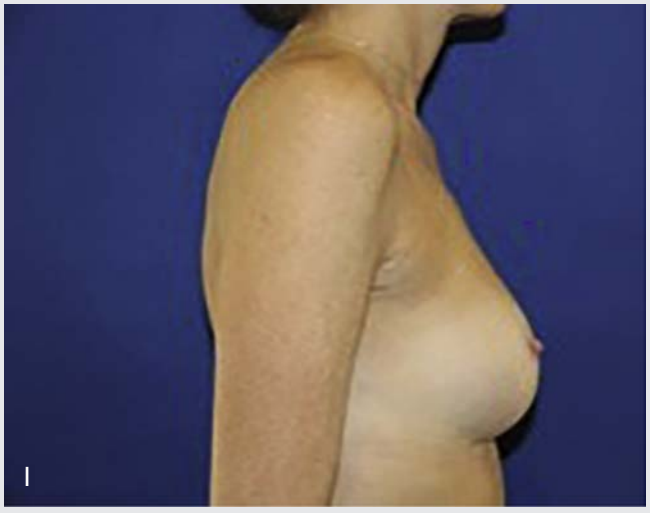
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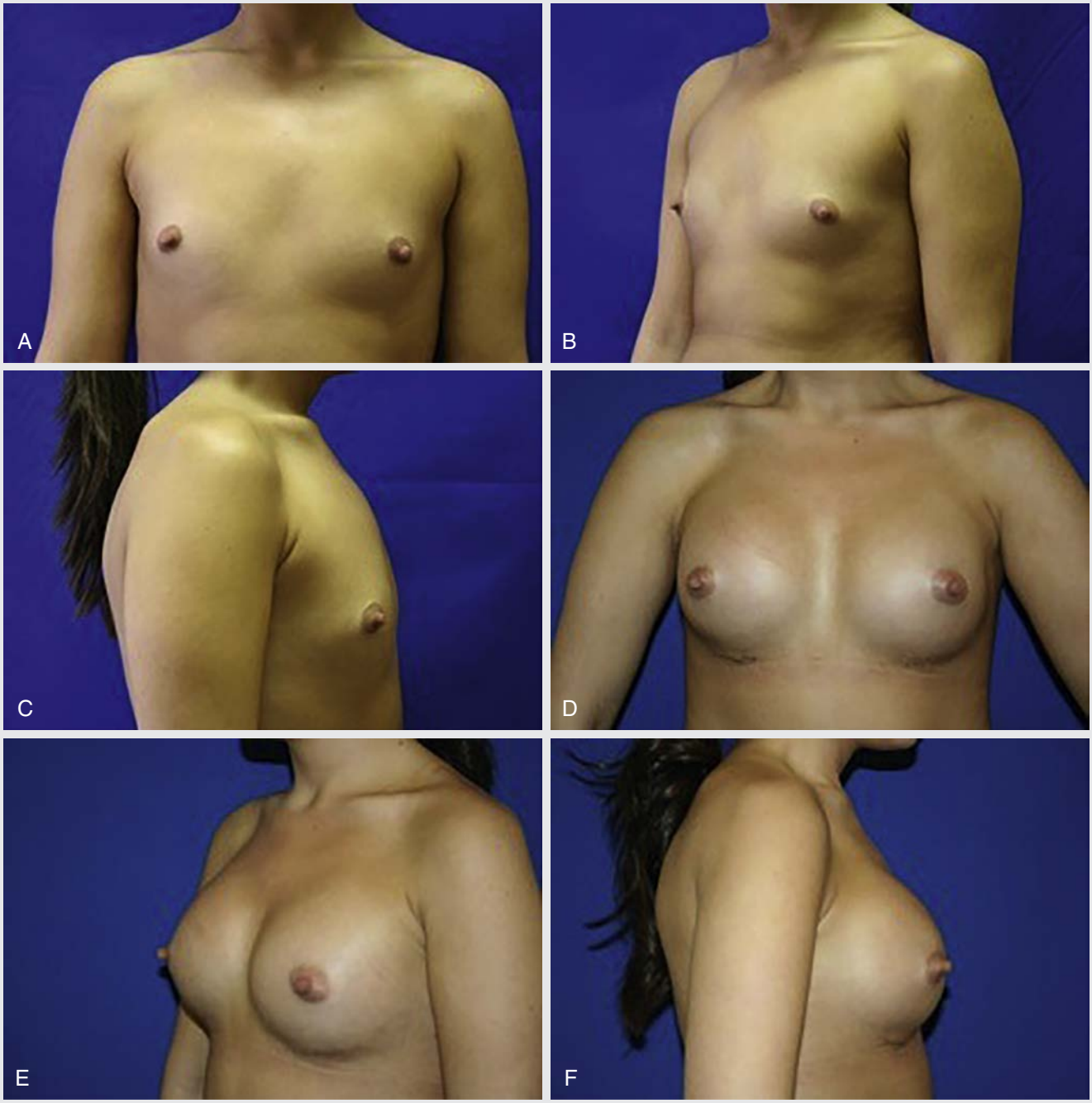
CASE 1.2

Preoperative view obtained of a 24-year-old with unilateral hypoplasia of the right breast. IMF position was determined preoperatively based on the dimensions of the selected implant and anticipated final position (Case1.2A–C). Early postoperative images at 4 weeks demonstrate lowered and fixed IMF, which initially appears low on the breast and chest (Case 1.2D–F). Postoperative images at 10 years demonstrate lowered and fixed IMF with stability (Case 1.2G–I).



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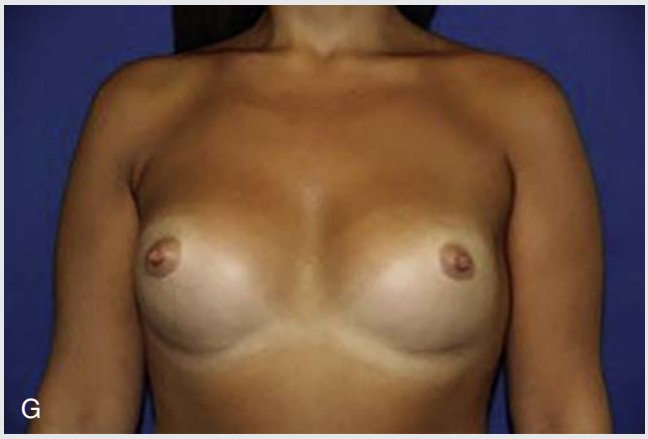
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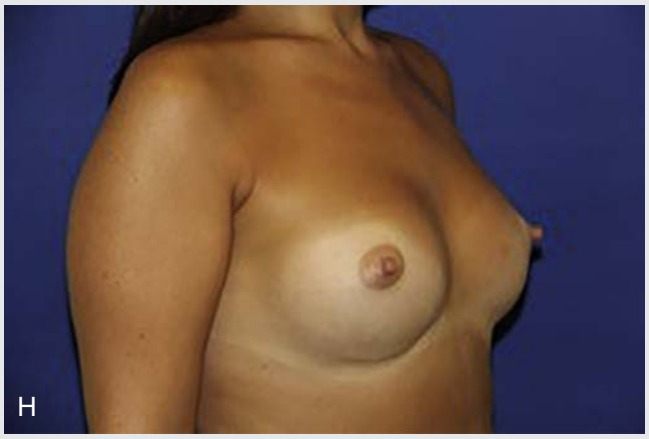
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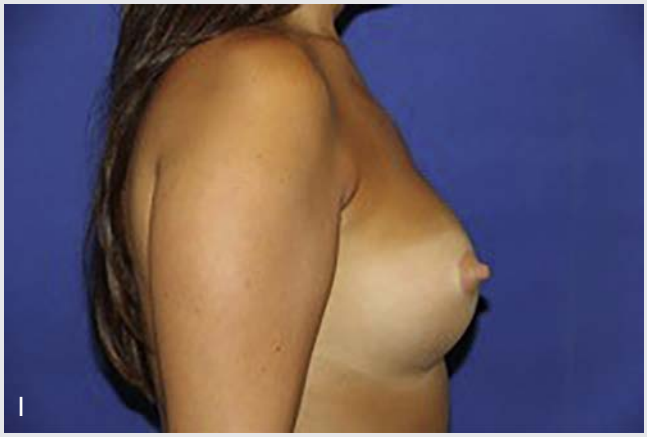
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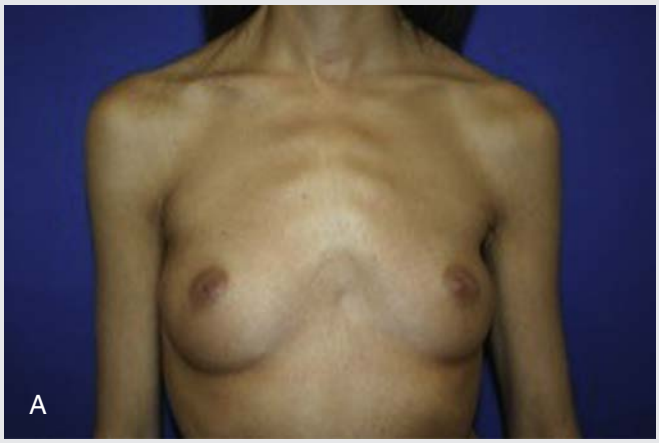
CASE 1.3

Complex congenital chest wall deformity was imaged in a 30-year-old patient with nail-patella syndrome and breast asymmetry (Case 1.3A–C). Preoperative planning includes 3-D simulations to analyze chest wall deformity and degree of asymmetry (Case 1.3D, E). Postoperative results at 3 years are shown in Case 1.3F–H. Postoperative images at 10 years demonstrate benefits of natural weight gain to achieve better soft tissue coverage and softening of visible edges. Alternatively today, fat grafting would be recommended to provide better symmetry and improve natural appearance (Case 1.3I–K).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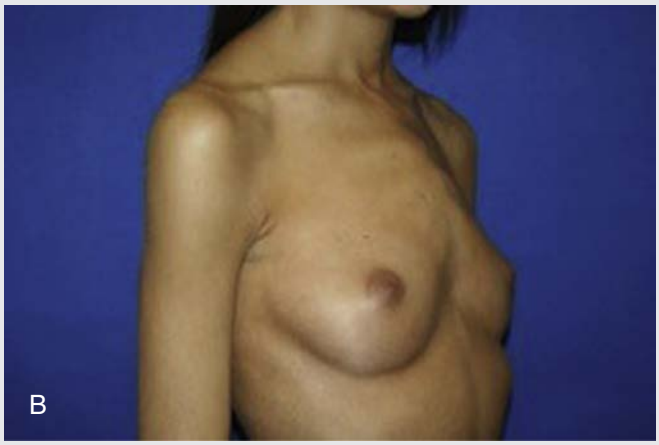
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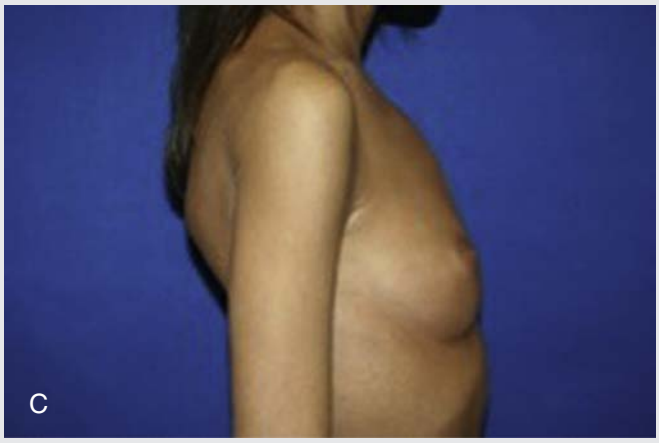
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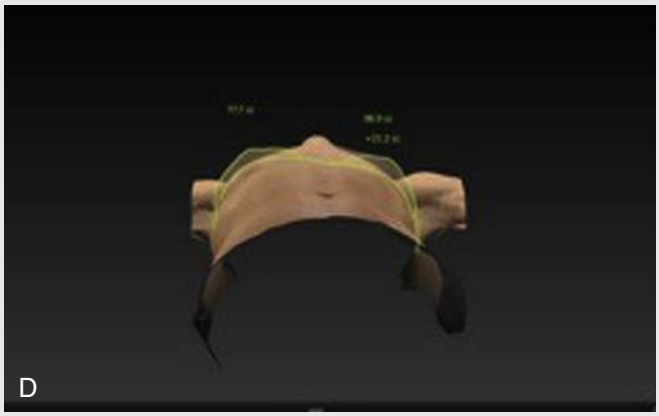
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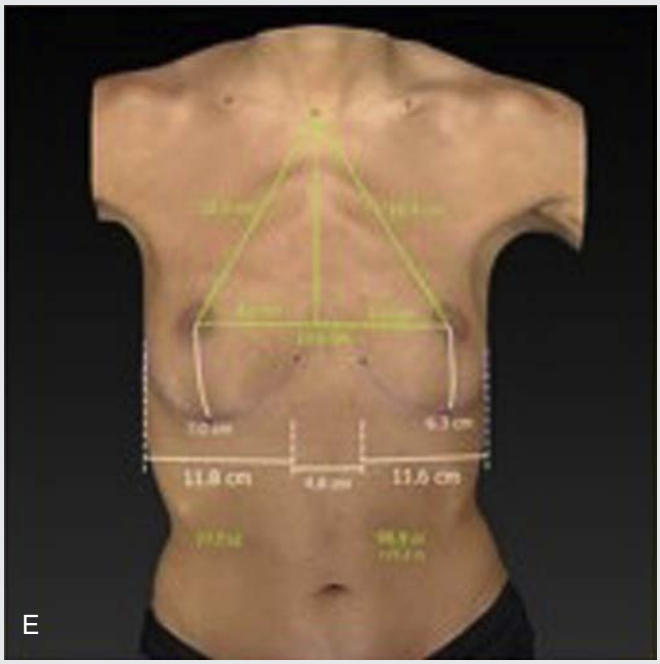

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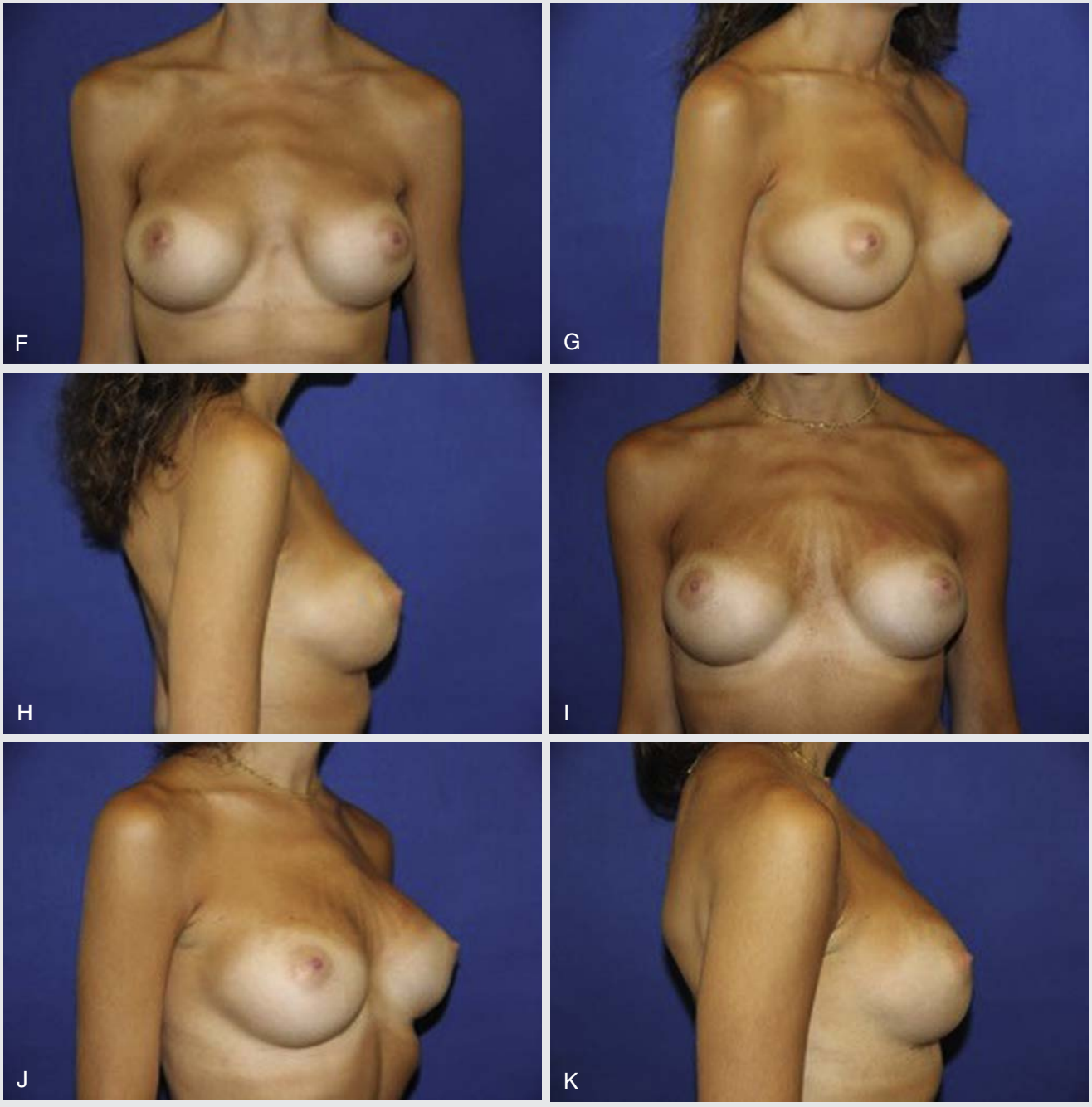
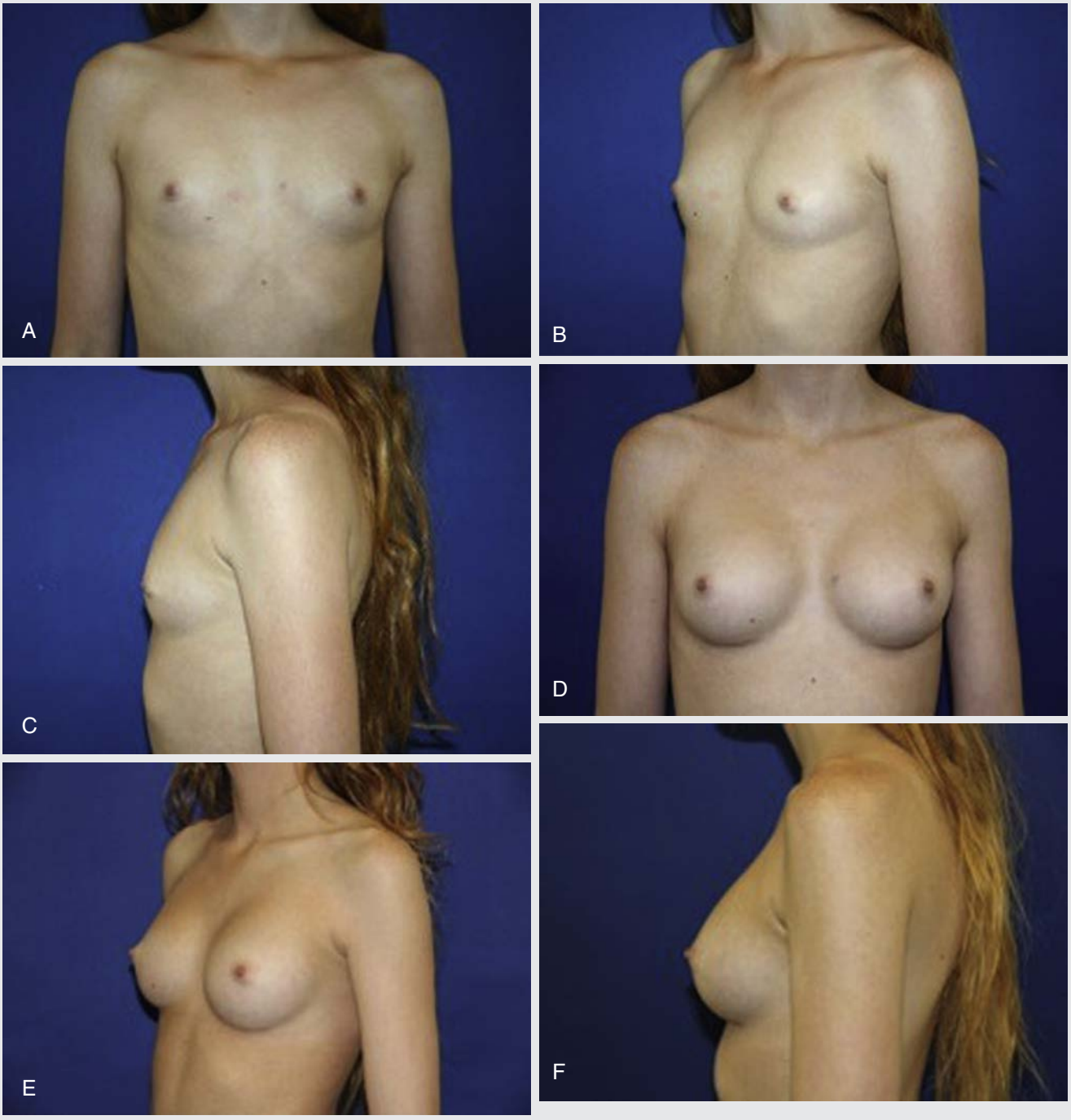
CASE 1.3-CONT'D



CASE 1.4

A 22-year-old nulliparous woman presented with hypoplasia and mild asymmetry. A cohesive round implant was selected preoperatively using biodimensional planning and the final incision designed to fall within the new IMF location (Case 1.4A–C). A 2-year postoperative breast augmentation is shown with the fold lowered 2 cm and fixed with deep sutures to the Scarpa fascia (Case 1.4D–F).



Management of Complications

Breast augmentation complications can be divided into surgical complications and implant-related complications. The early surgical complications include hematoma, swelling, pain, infection, and obvious early malposition. Hematomas are quite rare with the adoption of techniques that eliminate blunt, blind dissection. The leading drivers of implant-related complications include revision for size change, malposition, visibility and palpability, and capsular contracture. Revision for size change can be almost eliminated by creating a well-educated patient who participates in the implant selection process and is held accountable for those decisions. Despite precise surgical techniques and planning, malpositions and capsular contracture may occur over time. Patients should be advised that a revision procedure will not take place until at least 6 months to a year after surgery, allowing implants to settle and early asymmetries to dissipate. The financial arrangements for procedures required to correct complications should be spelled out before surgery to avoid any potential conflicts after surgery.[36,37]

Secondary Procedures

All patients will eventually undergo a revision breast augmentation or explantation because no implant lasts a lifetime. The goal in breast augmentation is to obtain at least 10 years and hopefully slightly longer before a revision is required. With the addition of in-office high-resolution ultrasound, patients can be followed with more accuracy.

It is recommended that any revision for capsular contracture or rupture include a complete capsulectomy, if possible, to avoid placing a new implant in a potentially contaminated pocket.[38] Revisions for size change, either larger or smaller, should include a frank discussion concerning the long-term effects of the device long term on the pocket and breast parenchyma. Eventually, many patients elect to remove their implants completely and may choose to undergo a mastopexy or fat transfer or simply explant without replacement.

Conclusion

Breast augmentation surgeons have the undeniable potential to produce long-lasting beautiful results with extremely low revision rates. Implant selection for each patient should be uniquely modified to match the patient's soft tissues measurements, type of breast parenchyma, and desires. The choice of pocket is defined by the soft tissue coverage and preference of the surgeon. When necessary, the IMF needs to be adjusted; if the implant is lowered accurately and set predictably, the scar should remain well hidden and stable. The surgical procedure begins with marking the patient for the preselected device, and, intraoperatively, precise steps are taken to minimize bacterial contamination of the device and pocket. Finally, the long-term care of the patient with breast implants should adhere to the same guidelines as patients with any other implanted prosthetic device.

PEARLS FOR SUCCESS

- The process of patient education needs to be comprehensive, allowing patients to become well informed and engaged.
- Informed consent is more than a single document to be signed before surgery.
- Implant selection for each patient should be uniquely modified to match the patient's soft tissue measurements, type of breast parenchyma, and desires.
- The choice of pocket is defined by the soft tissue coverage and preference of the surgeon but plays an important role in the shape and look of the implant and breast over time.
- Lowering the IMF should be considered when necessary to create an ideal relationship between the implant volume, breast implant base width and N:IMF distance.
- The surgical procedure begins with marking the patient for the preselected device; intraoperatively, precise steps are taken to minimize bleeding and any bacterial contamination of the device and pocket.
- An adequate layered repair of the IMF is crucial to create a stable and accurate platform for the lower pole of the implant.
- The postoperative management of the patient should include the use of support bras and limited upper body exercise based on surgeon preference but should avoid activities that could produce muscle injury or an expansion of the pocket.
- Patients should be encouraged to continue their recommended annual breast screening as recommended by the American College of Radiology.
- The long-term care of patients with breast implants should adhere to the same guidelines as patients with any other implanted prosthetic device. Patients should be advised to schedule routine follow-up examinations.

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2

Breast Augmentation With Implant—Periareolar Approach

DEBRA J. JOHNSON

Introduction

Breast augmentation using implants has been an important part of plastic surgery practice since the first breast implant was developed in 1963. More recently, some leading plastic surgeons have promoted an inframammary fold (IMF) approach when placing a breast implant.[1] They think this method minimizes implant contact with breast tissue that could be contaminated by bacteria. If contamination can be avoided, the risk of biofilm formation is decreased and theoretically the complications of capsular contracture and the development of breast implant associated–atypical large cell lymphoma (BIA-ALCL) might be diminished.[2]

However, many surgeons and patients continue to prefer a periareolar incision because visualization of the surgical field is optimized, and the resulting scar, hidden in the color change between the areola and the breast skin, is well camouflaged. The periareolar is my preferred incision and, over the past almost 30 years of practice, has resulted in no cases of BIA-ALCL, one peri-implant infection, and a grade 3–4 capsular contracture incidence of less than 1%.

This chapter details my preferred approach for periareolar breast augmentation, including preoperative evaluation and special considerations, the operative technique, postoperative care, and secondary procedures. Pearls for success are also discussed.

Indications and Contraindications

Ideal candidates for periareolar breast augmentation are healthy patients with no breast pathologic conditions present. The patient should have reasonable desires and expectations, and the patient's anatomy and degree of symmetry should provide an adequate basis for a successful outcome. The patient should understand the risks and benefits of breast implants and the need for ongoing surveillance for breast health.

Patients who are poor candidates for breast augmentation are those with co-morbidities that increase the risk of complications and those with unrealistic expectations. Patients who cannot comprehend the risks or who are unwilling to return for long-term follow-up should be dissuaded from surgery.

Patients desiring implant volumes that cannot be supported by their anatomy are educated regarding the negative sequelae of overly enlarged breasts.

Preoperative Evaluation and Special Considerations

A patient desiring implant augmentation is evaluated with regard to overall health and particularly breast health. If the woman is of an age at which screening mammography is indicated, testing is performed preoperatively. I want to query the patient on her family history of breast cancer. I also want to know her childbearing history and whether she has plans for any additional children and breastfeeding.

Suitable candidates undergo breast examination to determine the quantity and quality of the breast tissue, skin thickness, and quality; the position of the nipple–areolar complexes; and the base diameter of the breasts. Any asymmetries of breast volume, breast mound location, breast width, nipple position, and areolar diameter are documented and discussed with the patient.

The patient is then informed of the range of implant sizing available for her, with the largest size being a high-profile implant that matches her base diameter. I refuse to place implants larger than recommended, because I think they create unnatural appearing breasts and do not provide good long-term results.

In my opinion, women with a strong family history of breast cancer should be steered toward submuscular saline implant augmentation so that future mammographic clarity is optimized. A patient with breast size asymmetry is counseled that the smaller breast is the "limiting factor." Although she may desire the largest implant that will "fit" the smaller or narrower breast, the implant for the larger breast will have

less volume, with the goal of improved symmetry between the two breasts. My opinion is that women who have not completed childbearing should be encouraged to forego augmentation until after the final pregnancy and to have ceased breastfeeding for at least 4 months before augmentation. Women desiring augmentation before completing childbearing are informed of the possibility of pregnancy- and breastfeeding-induced changes to the appearance of the breasts that might require additional maintenance work in the future. I inform them that breast augmentation may affect a woman's ability to breastfeed, although many of my patients who have undergone periareolar breast augmentation have successfully breastfed.

After the breast examination and discussion of the details of augmentation surgery and postoperative care, I have the patient use the Mentor sizing system of silicone breast forms placed within a soft bra (Fig. 2.1). I inform her of the range of sizes she can consider based on her breast base diameter. When the patient finds a size she likes in a bra, I ask her to also put on her shirt (we also provide snug tank tops) so she can see how she will look in clothes. This sizing by the patient helps guide me in visualizing her goal. I inform the patient that I will be guided by the implant size she has picked, but I will use sterilized "sizers" in the operating room to verify the appropriate volume, and that I may alter the implant size somewhat from her original choice to ensure a favorable result.

If the patient presents with a small areolar diameter (less than 3 cm) through which an implant cannot be easily placed, I inform her of the need to opt for an IMF approach (Fig. 2.2).

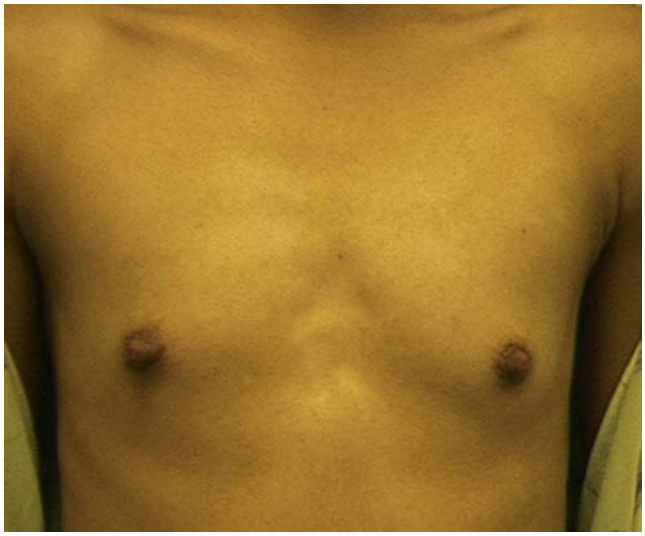
Surgical Technique

Although breast augmentation is often performed under general anesthesia, I prefer to perform breast augmentations using local anesthesia and intravenous sedation. This is more economical for the patient and is quite comfortable. The patient is sedated with a combination of midazolam and morphine sulfate, and then rib blocks are placed using 0.25% bupivacaine with 1:200,000 epinephrine, approximately 10 mL per side (Fig. 2.3).

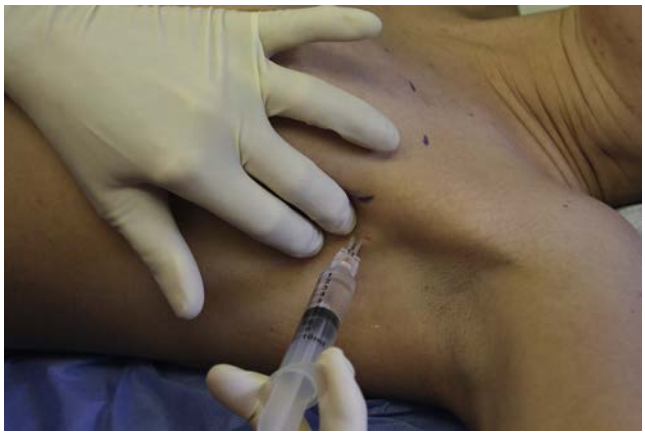
After prepping and draping, the planned periareolar incision line is drawn, taking care to be right along the edge of the areola. The incision runs from 3 o'clock to 9 o'clock in smaller areolae and from about 4 o'clock to 8 o'clock in areolae that are more generous. The natural borders of the breast are marked circumferentially to guide the dissection (Fig. 2.4). Local anesthetic consisting of ¼% lidocaine with 1:400,000 epinephrine is injected into the incision line and then used throughout the procedure to maintain comfort for the patient.

The incision is created, and all superficial bleeding vessels are cauterized with a needle-point cautery. Double skin hooks are placed on either side of the incision, and the underlying tissue is divided with the electrocautery on cutting mode (Fig. 2.5). Skin hooks may need to be replaced with small to medium Richardson retractors to expose

• **Fig. 2.1** Mentor breast implant sizing system is used to determine patient's desired breast implant size.



• **Fig. 2.2** A patient with a small areolar diameter that would be unsuitable for a periareolar incision.



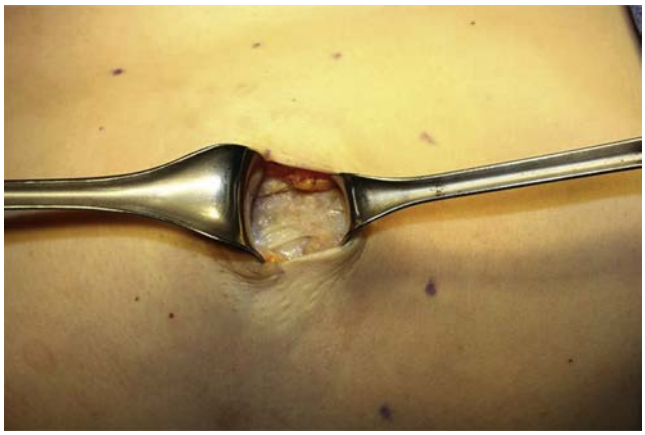
• **Fig. 2.3** Placement of 0.25% bupivacaine with 1:200,000 epinephrine rib blocks before initiation of breast augmentation surgery.

the base of the dissection. Dissection is carried straight down through the breast tissue to the pectoralis fascia in most patients (Fig. 2.6). However, in nulliparous women the subcutaneous dissection is aimed obliquely toward the IMF to reach the lower border of the pectoralis. This dissection minimally disrupts the breast tissue connections to the nipple ducts, with the goal of preserving the ability to breastfeed later on.

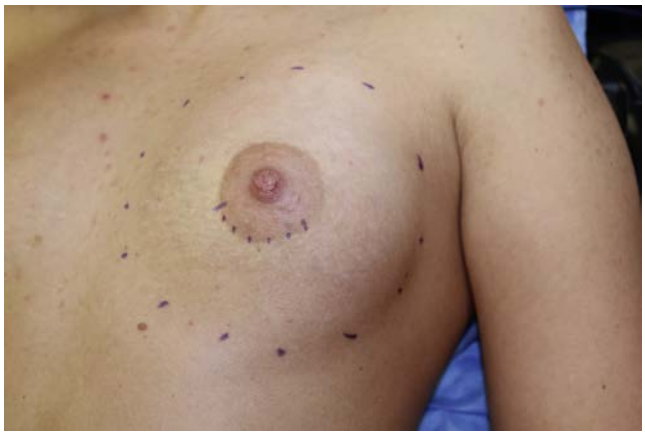
Once the dissection reaches the pectoral muscle, the pectoralis fascia is incised with the electrocautery (Fig. 2.7). The fascia and muscle are then grasped with Allis clamps on either side of the muscle fiber line. Gently pulling the clamps upward, the muscle is divided in the direction of the muscle fibers, obliquely, until the loose areolar tissue of the submuscular space is encountered (Fig. 2.8). If the muscle is thick, the Allis clamps may need to be repositioned deeper to improve visualization.

On visualizing the areolar tissue, the Allis clamp is pulled upward and the index finger is inserted under the upper pectoral muscle to bluntly elevate it off the rib cage. It is usually quite simple to release the muscle from 9 o'clock to 3 o'clock superiorly up to the previously marked upper natural breast border (Fig. 2.9).

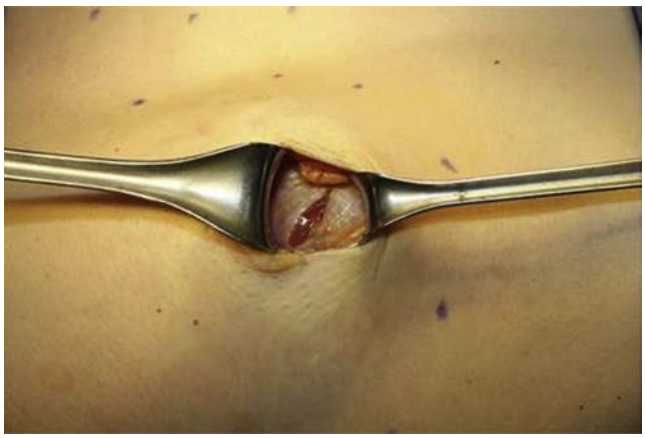
A lighted retractor is inserted beneath the upper muscle. A retractor with a suction port removes smoke plume and greatly improves visualization. A long Richardson retractor



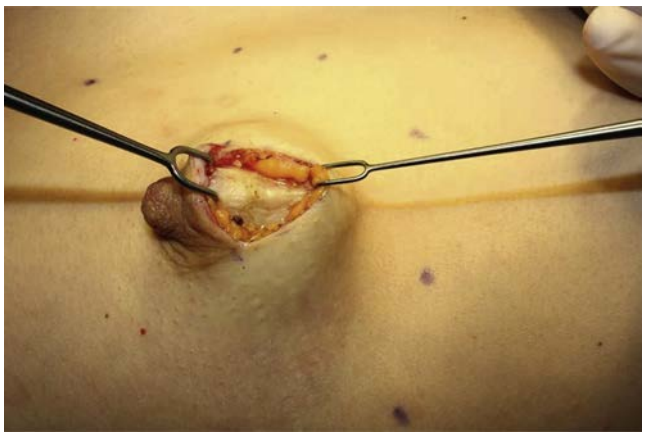
• **Fig. 2.6** Larger retractors can allow easy visualization of the pectoral fascia.



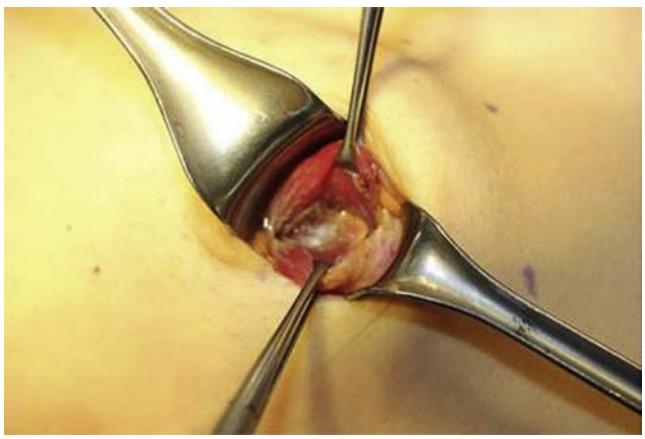
• **Fig. 2.4** The periareolar incision line and the natural borders of the breast are marked before placing the incision for breast augmentation.



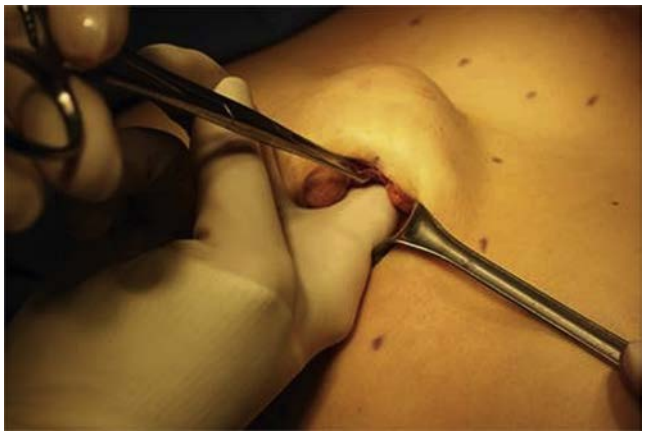
• **Fig. 2.7** The pectoral fascia is incised and then can be grasped with Allis clamps to allow for division of the muscle along the direction of its fibers to reach the subpectoral space.



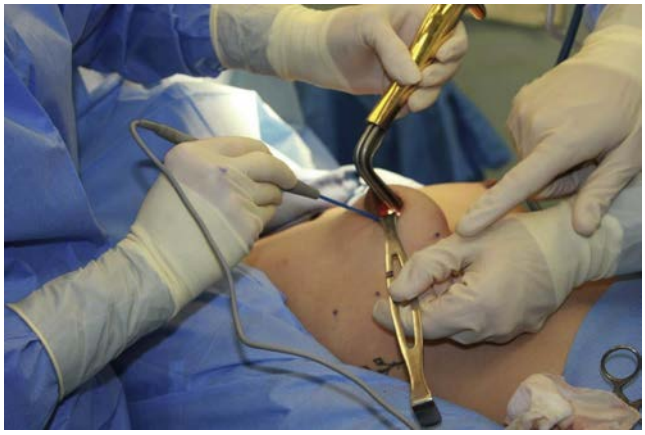
• **Fig. 2.5** Double skin hooks are placed on either side of the skin incision to expose the underlying breast tissue for downward dissection to the pectoralis muscle.



• **Fig. 2.8** The pectoral muscle is divided until the loose areolar plane beneath the muscle is exposed.



• **Fig. 2.9** Blunt dissection using the index finger gently elevates the muscle in the superior pole of the breast.



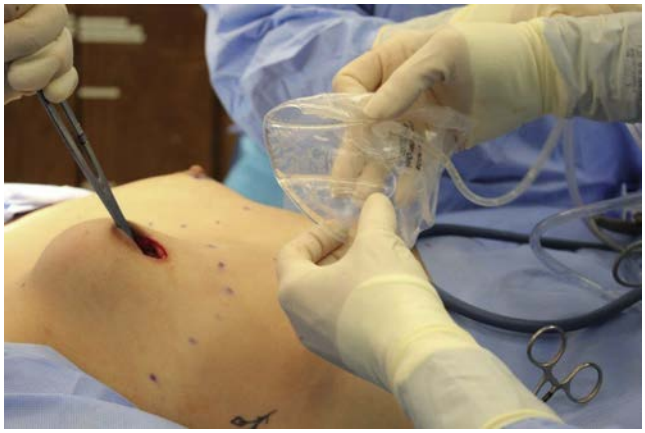
• **Fig. 2.10** Pectoral muscle insertions can be easily visualized and divided using the lighted retractor and electrocautery.

(2 cm wide and 5 cm long) is placed 180 degrees in opposition and held by the assistant. The muscular insertions of the lower pole can then be visualized, injected with local anesthesia (using a 22-gauge spinal needle), and divided using an extended-length electrocautery tip (Fig. 2.10). All bleeding vessels are cauterized as they are encountered. Dissection begins from the mid-medial breast to the mid-IMF, periodically adjusting the retractors and adding more local anesthetic as needed. The same procedure is carried out under the lateral muscle, dissecting from mid-lateral to the mid-IMF. The distal pectoral muscle is divided, exposing the subcutaneous fat, and the dissection stops at the IMF. Index finger sweeping circumferentially demonstrates the completeness of the dissection to the natural borders of the breast. If any constricting bands of muscle are encountered, the lighted retractor is reinserted, and the offending bands are divided.

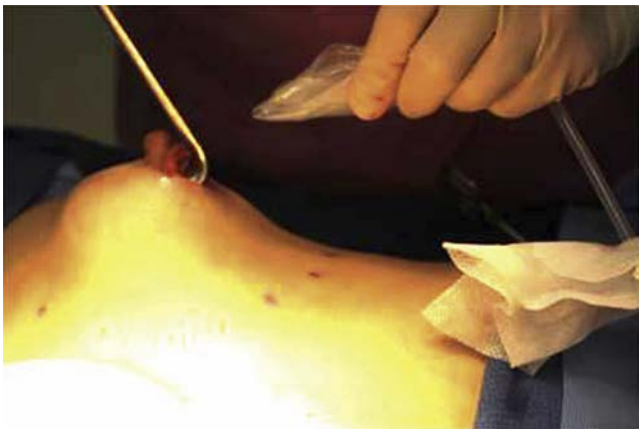
If a dual-plane technique is indicated, once the blunt dissection of the superior half of the muscle is completed, the lower pole of the breast is elevated in the subglandular plane, using the lighted retractor to visualize the plane between the muscle and the breast. Once the two planes are dissected, the pectoral muscle separating the two planes can be divided transversely, medially, and laterally using electrocautery.

After the pocket dissection is completed, the wound is copiously irrigated with saline. The pocket is checked for hemostasis by direct visualization with the lighted retractor. The saline-filled sizer is deflated, rolled, and inserted into the pocket. It is then filled to the appropriate volume with saline (Fig. 2.11).

The patient can be elevated to the sitting position, if desired, for further verification of implant position and size adjustment. The temporary sizer is removed and the wound is irrigated with antibiotic solution. I use bacitracin 50,000 units/500 mL saline for irrigation, but many surgeons prefer a triple antibiotic–povidone-iodine (Betadine) solution. Gloves are changed, and new retractors are used to separate the incision line, breast tissue, and muscle. Saline implants have the internal air removed, are then jelly-rolled and inserted manually into the pocket, and then filled with closed-system tubing (Fig. 2.12). If the patient prefers a silicone implant and the periareolar incisional opening is adequate, I will manually insert the silicone implant. If the



• **Fig. 2.11** A saline sizer is deflated and prepared for insertion into the pocket to assess the pocket and determine the ultimate implant size to be inserted.

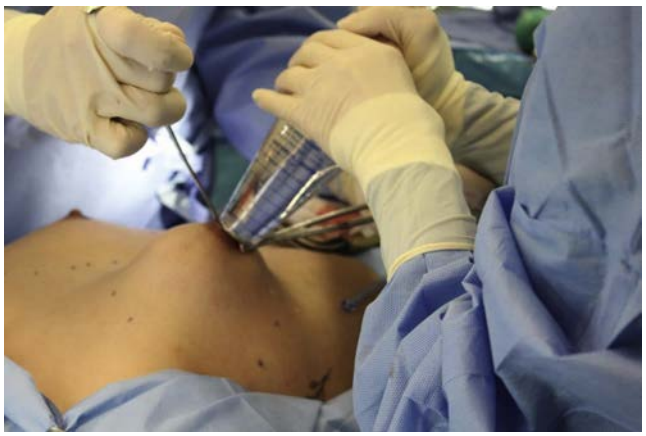


• **Fig. 2.12** The selected saline implant is deflated, jelly-rolled, and then inserted into the pocket with the fill tube attached to the implant and to the closed-system IV bag of normal saline.

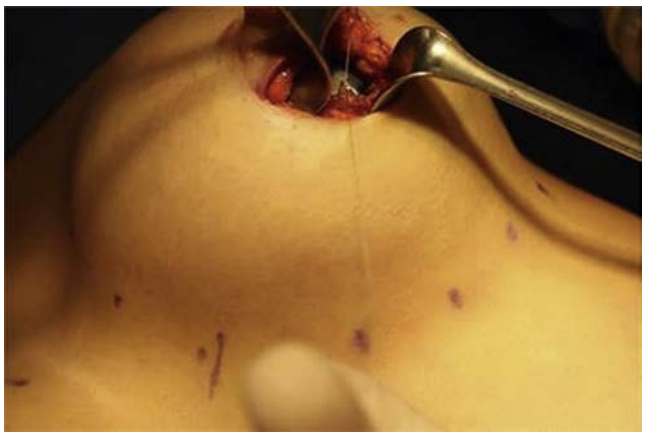
areolar opening is smaller and/or the silicone implant relatively larger, a funnel insertion device is used (Fig. 2.13). I typically do not use drains.

The muscle layer is closed with 4-0 polyglactin figure-of-8 interrupted sutures, to prevent the suture sawing through the

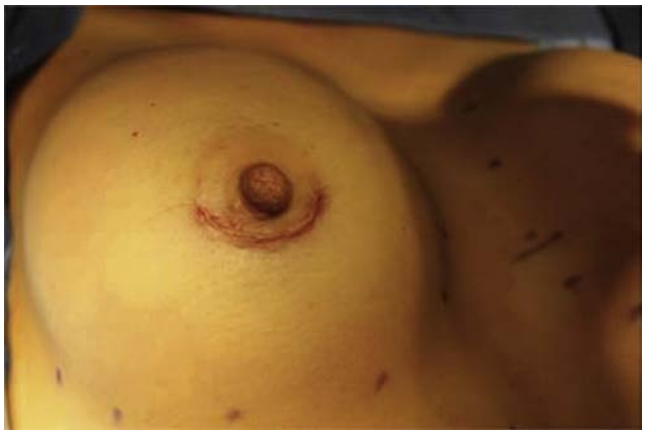
muscle (Fig. 2.14). If a dual-plane technique is used, the inferior cut edge of the pectoral muscle can be sutured to the basal layer of the breast tissue. If the breast tissue is thick, additional sutures can be placed deeply to reapproximate the breast. The skin is then closed with a 5-0 polyglactin suture, covered with ½-inch adhesive strips along the incision line in a V fashion, 2- × 2-inch gauze, and lightly applied tape (Figs. 2.15–2.17). The patient is placed in a soft, front-closure bra and taken to the recovery room (Fig. 2.18).



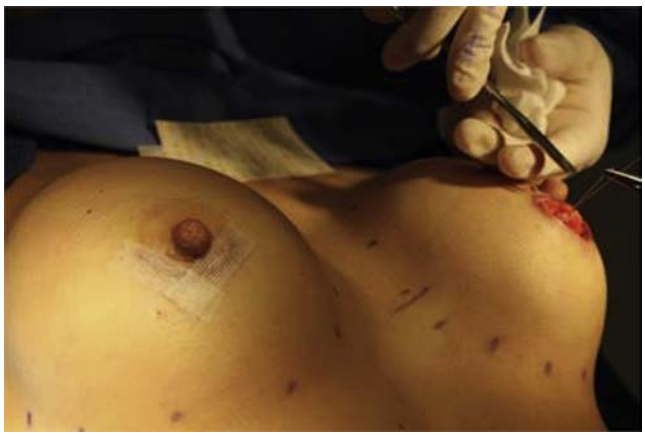
• **Fig. 2.13** Insertion of a silicone implant can be facilitated using a funnel-shaped insertion device.



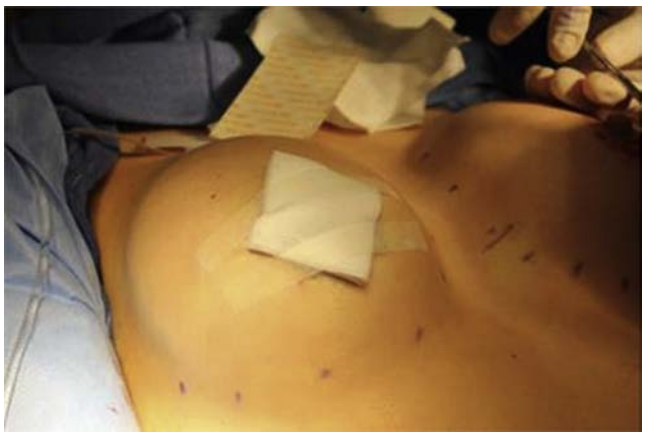
• **Fig. 2.14** The pectoral muscle is closed over the underlying implant with figure-of-8 sutures to reapproximate the muscle.



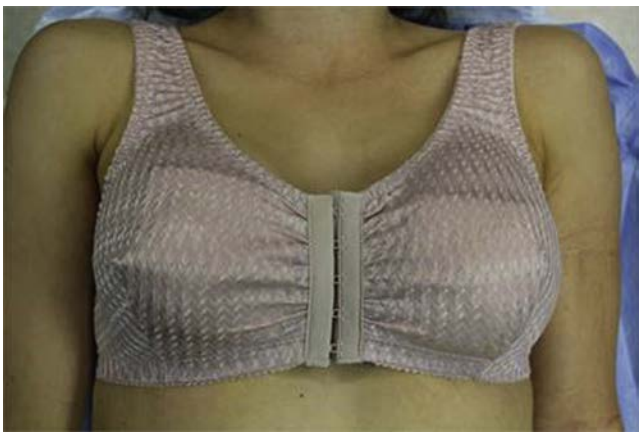
• **Fig. 2.15** Appearance of the periareolar incision after subcuticular closure.



• **Fig. 2.16** Half-inch Steri-Strips are applied to the incision in a chevron fashion.



• **Fig. 2.17** Two- by two-inch gauze dressings are placed over the incision.



• **Fig. 2.18** The patient is placed in a soft front-closure bra at the completion of the breast augmentation surgery.

Postoperative Care and Expected Outcome

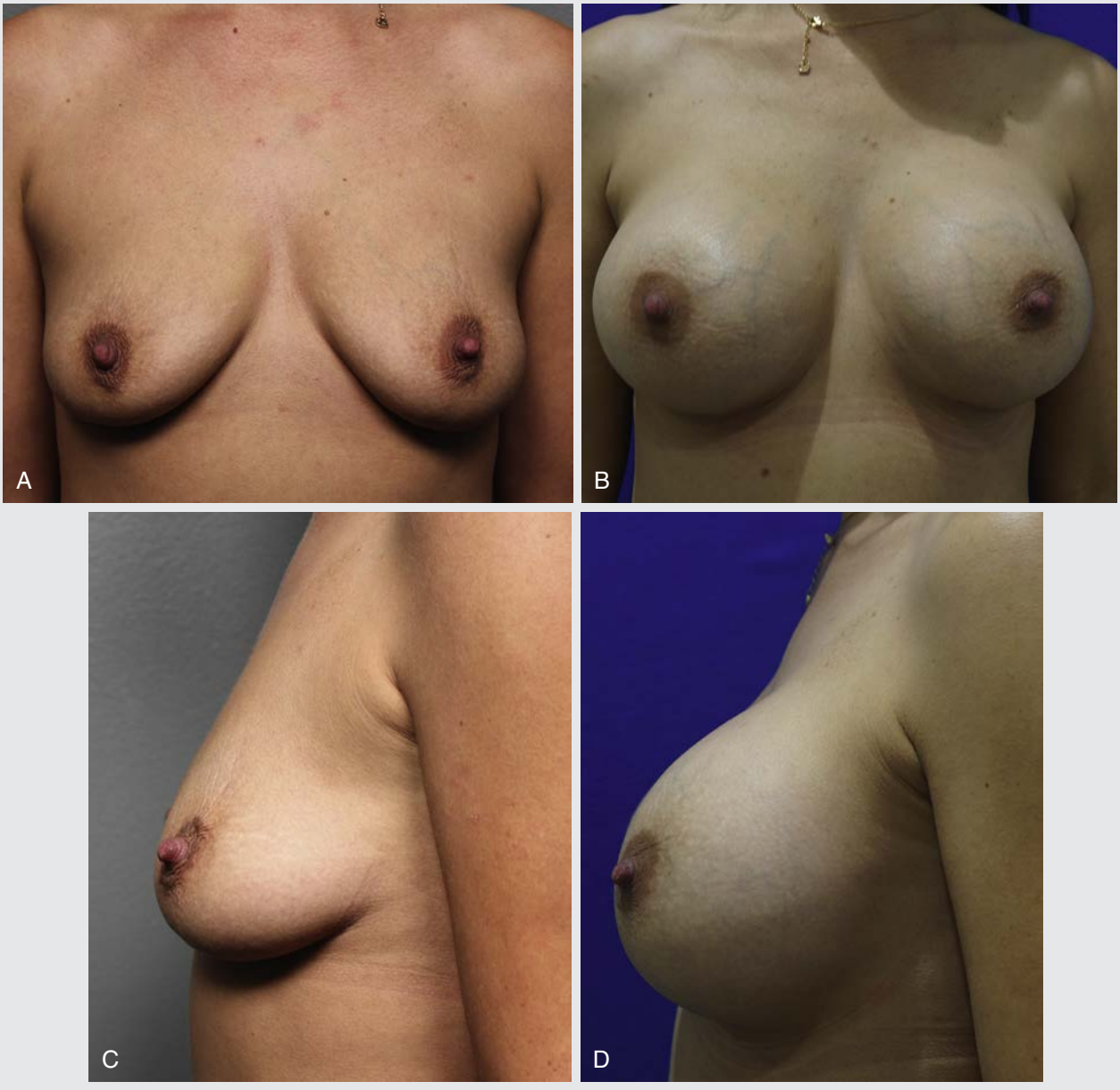
Patients who have undergone augmentation return 2 days later. The bandages and skin strips are removed, and any suture ends are trimmed to skin level. The incision is

cleaned, and ½-inch paper tape is reapplied in a V fashion. My approach for postoperative care involves the patient massaging her implants (in-out, up-down) several times daily. Incisions remain taped for 4 weeks to minimize scarring. Massage continues for 2 months. I prefer that patients do not wear underwire bras for the first month, but thereafter the patient can choose whatever kind of bra she likes. Patients with high-riding implants may be given an elastic band to wrap around the upper breast to incentivize the implants to move toward the IMF.

Patients are examined weekly for 2 weeks, then at 1 month, 2 months, 6 months, and 1 year. They are then asked to return annually (at no charge) for a breast implant check. Patients with silicone implants are recommended to undergo implant imaging to check integrity beginning at 5 years after implantation and every 2 years thereafter. Imaging begins with high-resolution ultrasound and then magnetic resonance imaging if the ultrasound is equivocal. All patients are registered in the National Breast Implant Registry.

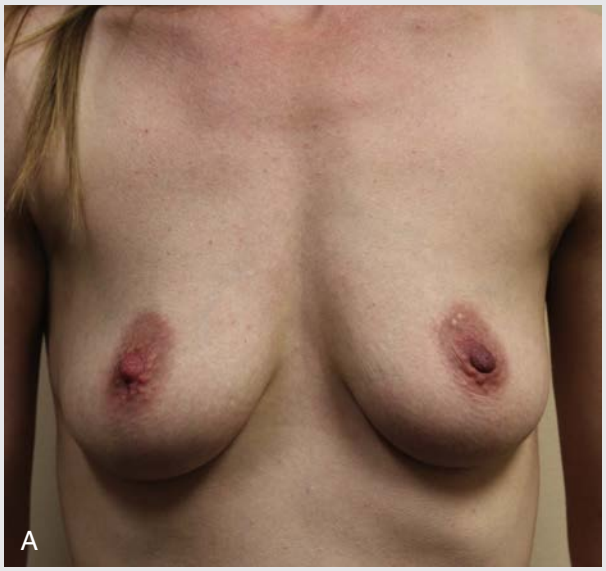
CASE 2.1

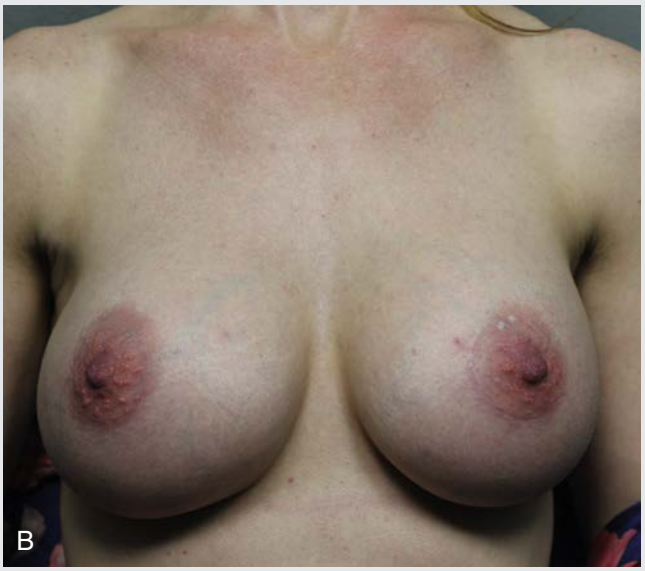
A 29-year-old postpartum woman presented with moderate glandular ptosis and size asymmetry. Submuscular silicone implants were placed by a periareolar approach: 425 moderate plus profile on the right, and 475 moderate plus profile on the left (Case 2.1A–D).

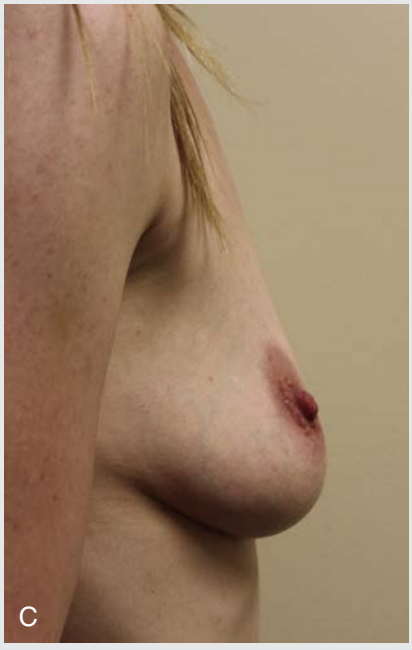


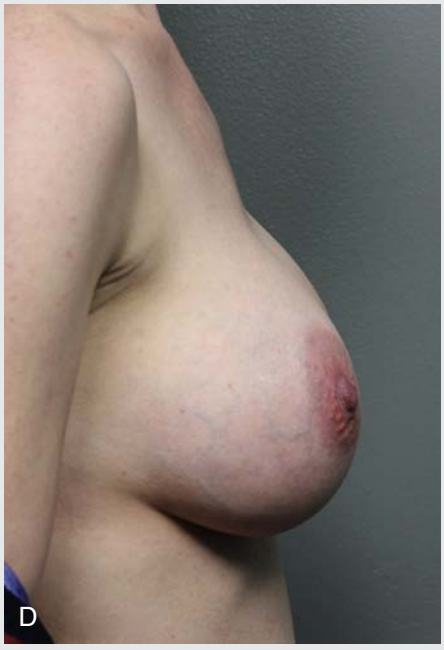
CASE 2.2

A 40-year-old postpartum woman presented with significant glandular ptosis. Dual-plane placement was performed of 355 high-profile silicone implants (Case 2.2A–D).



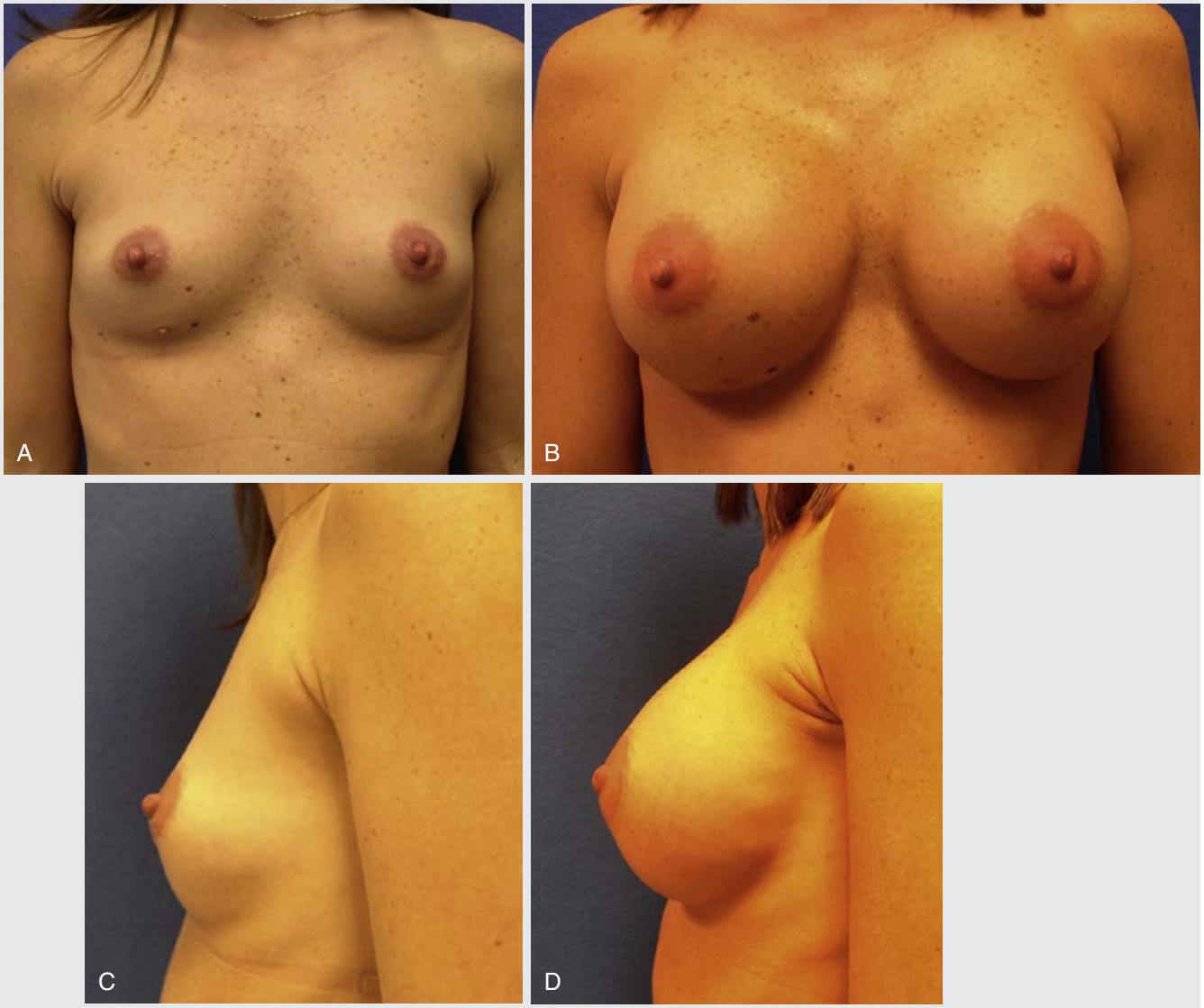






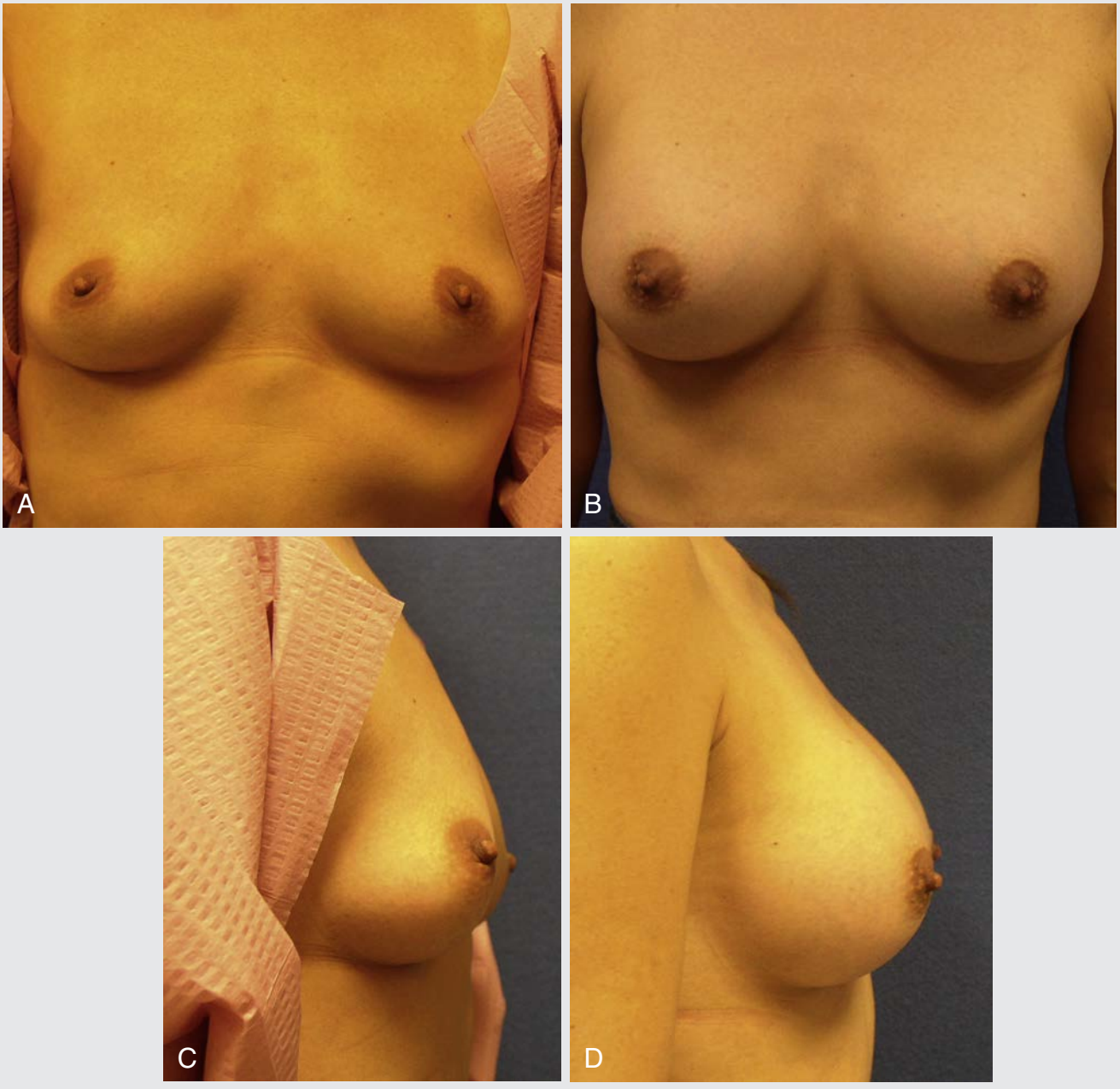
CASE 2.3

A 25-year-old nulliparous woman presented with mild size asymmetry. Periareolar dissection was skived inferiorly to avoid disruption of breast tissue. Submuscular saline implants were placed: 300 standard profile right, and 275 standard profile left (Case 2.3A–D).



CASE 2.4

A 38-year-old postpartum woman presented with good symmetry. Submuscular saline implants were placed by a periareolar incision with a 300-mL standard profile bilaterally (Case 2.4A–D).



Case Examples

Management of Complications

In the case of an early postoperative complication such as **hematoma** or **infection,** the periareolar incision can be reopened, the implant removed, and the pocket washed of any blood or purulence. A lighted retractor allows the entire pocket to be examined for hemostasis. A drain can be inserted into the pocket and can exit through the incision line or through a separate skin stab incision, as desired. If appropriate, the implant can be replaced and then the incision closed.

Occasionally, an implant will be **malpositioned.** The periareolar incision line is readily amenable for visualization of the entire pocket. The incision is reopened and the implant removed and placed in antibiotic solution. **Capsulotomy** or **capsulorraphy** can be performed to adjust the implant pocket as needed. The implant is then replaced and the incision closed.

Secondary Procedures

A patient may return after periareolar breast augmentation wishing for a change in implant volume. Exchanging an implant for an alternative size can be accomplished by the periareolar incision. The capsule may have adequate size to allow for a direct swap to a larger implant, but if pocket adjustment is necessary, it can be easily accommodated by this access. If a smaller implant is desired, capsulorrhaphy can be performed through the same incision to reduce the size of the capsule. Creation of a neo-pocket in the case of implant malposition can be well visualized with the periareolar incision.

Capsulectomy can readily be performed through a periareolar incision. Dissection is carried down to the capsule, and the breast tissue or muscle is elevated from the surface of the capsule using electrocautery dissection. Once an area of 3–4 cm in diameter of capsule is free, the capsule is opened and the implant retrieved. If the implant is ruptured, the skin and breast tissue above the capsule can be protected by covering it with gauze or plastic that is held in place with retractors. The capsule is then opened, and the broken implant shell is grasped with the fingers or an Allis clamp. The implant material is pulled upward quickly, and the free silicone gel can then be pulled hand over hand (like taffy) until the majority is out of the pocket and taken off the field. The interior of the capsule then can be swabbed out with multiple sponge sticks to remove the remaining silicone. Once the interior is reasonably free of silicone, the opening in the capsule can be tacked closed with suture to prevent any further soiling, and capsulectomy can proceed. The periareolar incision allows for relatively short distances of dissection in all directions to free the capsule on both its anterior and posterior surfaces. Once the capsule is removed, if acellular dermal matrix or some other material is desirable in an effort to reduce recurrence of capsular contracture, the material can be inserted through the periareolar incision and sutured to the fascia with excellent visualization.

Tuberous breasts are particularly amenable to a periareolar approach, because the areolar diameter is usually generous and needs to be reduced with a circumareolar mastopexy. The lower pole of the breast tissue can be easily visualized for radial scoring of the parenchyma to expand its capacity. A patient with minimal nipple ptosis or with nipple asymmetry can undergo a circumareolar repositioning of the nipple–areolar complex, and a breast implant can be placed by deepening the dissection in the infraareolar area to reach the subglandular or submuscular plane.

Mastopexy may be desired as a previous periareolar augmentation patient ages and the breast tissue sags. A superiorly based pedicle for the nipple–areolar complex is a reliably safe technique no matter the skin excision pattern.

However, in those patients wishing **breast implant removal without mastopexy,** I will instead remove the implant and capsule through an inframammary approach. In my experience, reusing the periareolar incision for this particular procedure tends to result in an unattractive contour depression and/or skin folding along the periareolar incision line as a result of volume loss.

Conclusion

A periareolar incision provides a safe and effective portal for breast augmentation. The visualization of the implant pocket is superior in comparison to an IMF or transaxillary approach, allowing more precision in pocket creation. The resulting scar is often barely perceptible. Because the incision is below the obliquely traveling sensory nerves to the nipple–areolar complex, the sensibility to the nipple–areolar complex is at no increased risk. The periareolar incision has been abandoned by some because of a perception of increased risk of biofilm contamination and resulting capsular contracture. However, my experience with contracture rates less than 1% has allowed this incision to remain my favorite.

PEARLS FOR SUCCESS

- Areolar diameter should be at least 4 cm for this approach.
- Dissection through the breast tissue should be no wider than the incision.
- Meticulous hemostasis must be performed.
- Finger dissection of the loose areolar tissue to gently elevate the muscle reduces injury.
- Implant diameter should be kept within the base diameter of the breast.

References

1. Li, S., Chen, L., Liu, W., Mu, D., Luan, J., 2018. Capsular contracture rate after breast augmentation with periareolar versus other two (inframammary and transaxillary) incisions: a meta-analysis. Aesthetic. Plast. Surg. 42 (1), 32–37.
2. Adams, W.P., Culbertson, E.J., Deva, A.K., Magnusson, M., Layt, C., Jewell, M.L., Mallucci, P., Hedén, P., 2017. Macrotextured breast implants with defined steps to minimize bacterial contamination around the device: experience in 42,000 implants. Plast. Recon. Surg. 140 (3), 427–431.

3

Breast Augmentation With Implant—Transaxillary Approach

LOUIS L. STROCK

Introduction

Breast augmentation, according to the most recent procedural statistics data from the American Society for Aesthetic Plastic Surgery, continues to have increased popularity as the most common surgical procedure in the United States and was performed in more than 330,000 women in 2017.[1] The most common incision access used is the inframammary approach worldwide, based largely a long-existing bias that this approach is most simple to perform with the best ability to accomplish consistent results.

There is an evolving body of literature, however, that suggests that the transaxillary approach can be performed with results that are comparable in terms of consistent and predictable outcomes, with the advantage of the avoidance of an incision on the breast for primary breast implant placement. In their recent literature review for outcomes-based analysis for breast augmentation, Lista and Ahmad[2] suggest that the transaxillary approach is preferred equally to the inframammary approach for breast implant placement. Numerous additional studies have reported excellent and predictable outcomes using the transaxillary approach with several variations of technique.[3–6]

This chapter discusses the author's preferred technique for transaxillary breast augmentation with the aid of endoscopic assistance.[7,8] This includes a discussion of rationale for this approach and an emphasis on specific aspects of technique that allow for consistent technical control and outcomes that equal the more universally popular inframammary approach.

Indications and Contraindications

The author views any patient who is a candidate for breast augmentation as a candidate for the transaxillary approach. The deciding factor on whether this approach is used becomes an issue of patient choice. An important aspect of this choice by the patient comes down to correct information relative to the transaxillary approach, because many surgeons claim to offer the approach and then criticize it, often based on a lack of experience or just because they do not prefer the approach, to then offer only the inframammary approach with which they may be more comfortable.

After an explanation of the technique, how it works, and that the addition of the endoscope allows for precise technical control in the author's hands that makes the procedure identical to the inframammary approach in terms of the internal cuts made, the patient can then select her preferred approach. The only difference between the axillary approach, in the technique of the author, is the set of instruments used to create the partial subpectoral pocket. The patient selects the transaxillary approach if she prefers that her breast implants be placed with no incisions on the breast.

An issue that can be confusing is whether certain tissue types represent contraindications to the transaxillary approach. The author uses the approach in any patient who is otherwise an appropriate candidate for breast augmentation. This applies to patients with all tissue types and who request any type of breast implant device used by the author in his clinical practice. This also applies to patients who have minimal ptosis, after a detailed explanation and distinction from patients who have significant ptosis and require a breast augmentation with mastopexy.

Preoperative Evaluation and Special Considerations

The main issues for preoperative evaluation include the preference of incision location, accurate education relative to the choice of incision relative to the technique for pocket creation, and an assessment of tissue type with the resultant discussion of whether the patient can achieve the outcome desired should her tissue position be low as a result of mammary ptosis. This issue is emphasized because of the large subgroup of patients in the author's revision practice from outside who had ptosis addressed by breast augmentation with subsequent

dissatisfaction with the position and appearance of the augmented breast because a mastopexy was not pursued.

There are several important issues relative to incision location that should be understood. The transaxillary incision, when properly placed within the hair-bearing skin, will almost always heal in a way that is difficult to see postoperatively. The timing of the incision becoming difficult to see may vary to some degree based on the ethnicity of the patient, with the longest maturation time frames noted in Asian, Hispanic, and red-haired Caucasian patients. The author informs his patients that the incisions usually are difficult to see by 1 year, with distinct improvement seen at 4 months.

The author has performed the transaxillary approach routinely in patients who are avid tennis players, entertainers, and cheerleaders for major conference sporting events who usually have no issues as long as there have been appropriate expectations created through patient education. These patients can elect the inframammary approach or the axillary approach, then, if they prefer to have their implants placed with no incisions on their breasts. The periareolar approach is not currently offered on a routine basis by the author unless requested by a patient.

Surgical Technique

Preoperative Markings

The author has a preferred sequence of preoperative markings. The markings begin with an interrupted line to show the midline of the chest, from the sternal notch to the xiphoid process. It is important that any issues relative to minor or significant asymmetries in ribcage shape are noted. This is important in both preoperative patient education and preoperative markings. The preoperative inframammary fold (IMF) is then marked, along with the mid-breast meridian on each side. The preoperative breast width, desired breast width, and lateral tissue thickness measurements are checked and marked just below the clavicle for reference and documentation (Fig. 3.1A, B).

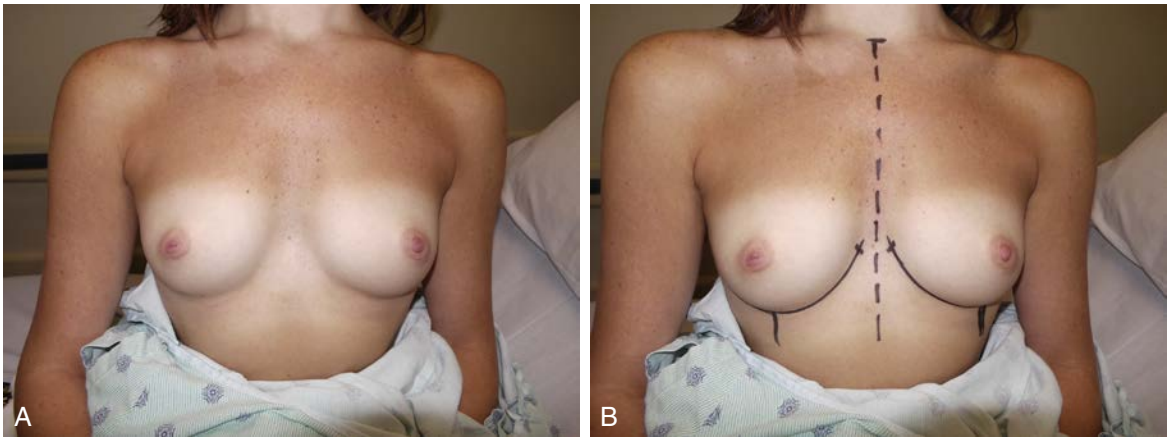
The proposed changes in IMF location and shape are then marked on each side, based on a combination of the tissue type present and the type of implant used. This process for these determinations are based on the nipple-to-IMF distance on strong stretch, which must equal the sum of the height of the implant planned (equal to the diameter of a round implant) and the implant projection divided by 2, plus 0.5–1 cm if the tissue is fairly thick, as described by Caplin as the St. Louis Formula[9] (Fig. 3.2A). This approach is used regardless of incision location in the practice of the author.

The central level markings are checked by a sternal notch to mid-breast meridian at IMF measurement, with confirmation of equal distances present. Allowances are made for meaningful differences of ribcage shape from side to side. The IMF markings are then extended medially and laterally as indicated. The superior aspect of the medial IMF is marked and used as a reference for the superior-most division of the pectoralis major muscle release (Fig. 3.2B).

The next issue for markings is the incision. Regardless of the type of implant to be used, the first mark is in the axillary apex. A dominant skin crease is used for the incision location if present, but mainly for the incision anterior to the axillary apex marking. The posterior aspect of the incision may be directed slightly superiorly to keep the incision within the hair-bearing skin (Fig. 3.3A–D). *The key concept is that the incision must be kept within the hair-bearing skin in all aspects.* The incision designs used routinely by the author in his practice include open V, boomerang, and open S shapes. Photos of markings are then taken in the preoperative holding area that are used for reference as needed during the procedure.

Intraoperative Markings

The preoperative markings are then routinely rechecked at the start of the procedure, with the patient prepped and draped and the arms extended and out 90 degrees



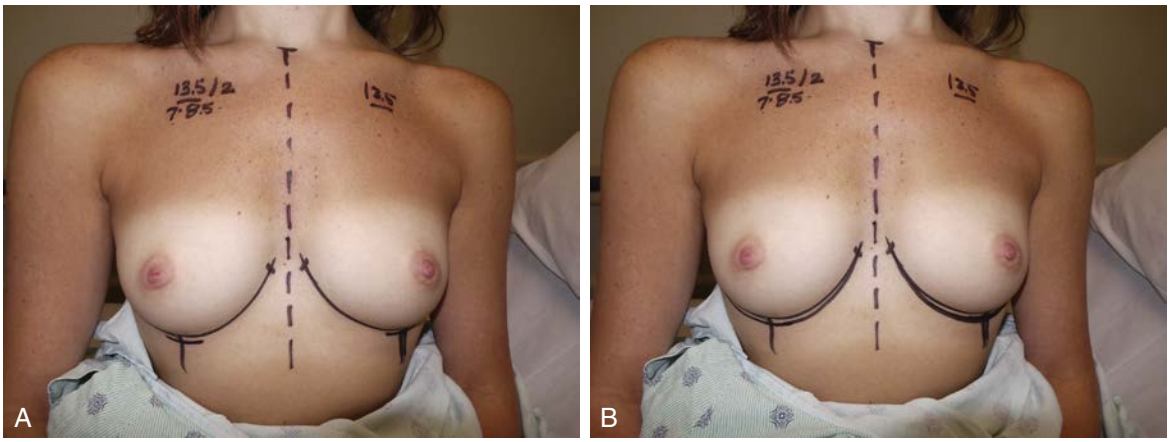
• **Fig. 3.1** (A) Preoperative photo. (B) Preoperative markings of anatomic chest midline and existing inframammary fold.

from the chest. Special attention is given to the nipple-to-IMF distances both at rest and on stretch. The reason for this is because the author then conducts the procedure to release the tissue and create a tissue pocket to the markings in all areas. This is the reason that the preoperative markings are performed with great attention to detail.

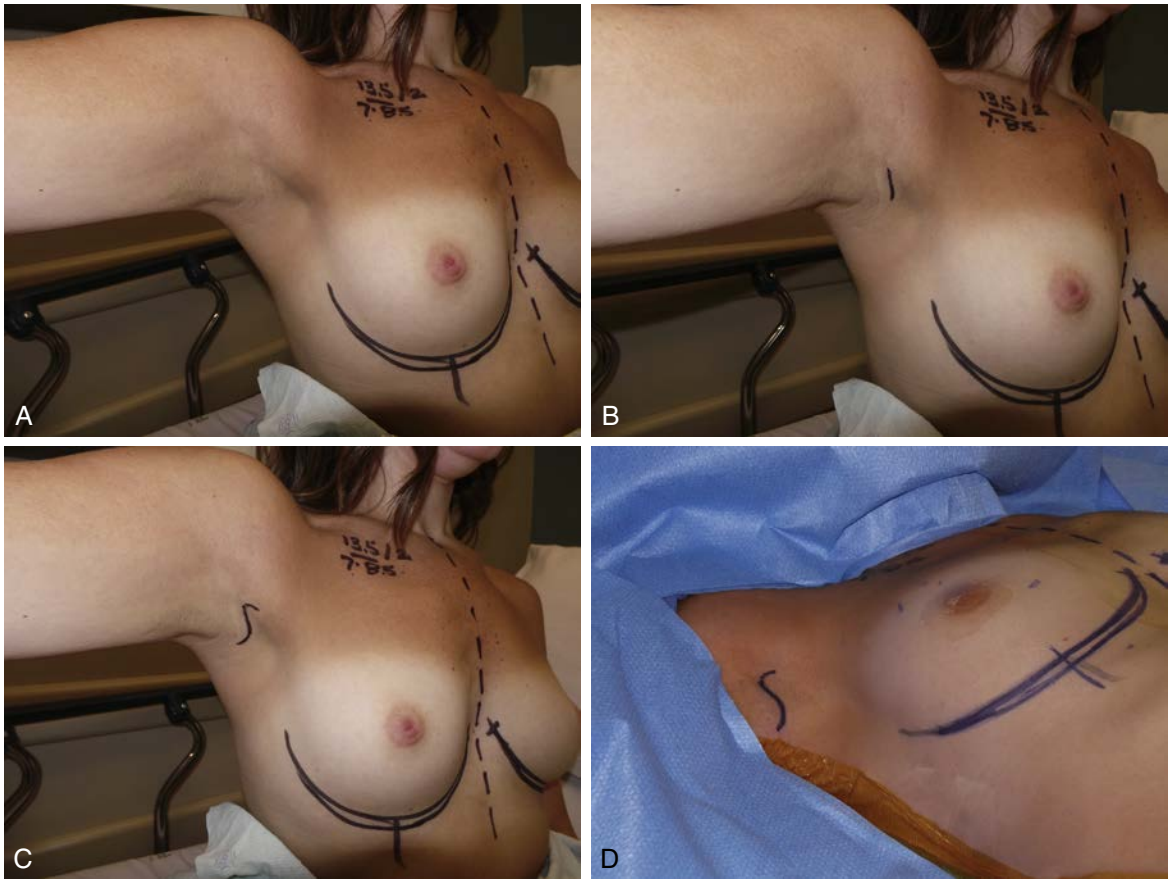
Details of the Procedure

Incision and Tissue Tunnel

A 4-cm incision is placed in the axilla as described earlier. A cross-hatch marking is made in the axillary apex to serve as a reference for alignment during closure. A thin skin flap is then created in an anterior direction, toward the lateral



• **Fig. 3.2** (A) Preoperative markings to lower the level of the IMF, based on a combination of nipple-to-IMF measurement under stretch, added to implant projection, divided by 2 (Caplin formula). (B) Preoperative IMF markings completed to show planned change in IMF both level and shape.



• **Fig. 3.3** (A) Axilla unmarked. All incisions will stay within hair-bearing skin. (B) Axillary marking anterior segment from axillary apex. (C) Completion of incision pattern for this patient, an open S because of skin configuration and large implant size to be used. (D) Intraoperative perspective on incision location and shape before the start of the procedure.

border of the pectoralis major muscle. It is important to note that this dissection avoids entry into the axillary contents and minimizes damage to the intercostobrachial nerve. A four-prong skin flap is helpful to create this flap, with repeated checks to ensure correct thinness of the flap (Fig. 3.4A). A fiber-optic retractor is then used to expose the lateral border of the pectoralis major muscle (Fig. 3.4B). Once identified, the fascia is entered and the lateral border of the muscle is exposed. Using a finger moved right along the undersurface of the pectoralis major muscle, a plane is created between the pectoralis major and pectoralis minor muscle below. A finger-sweep type maneuver is used to develop this tissue plane. This can be developed using the cautery, but the author has not found this approach to be helpful. This is the one area that the author prefers gentle blunt dissection in the transaxillary approach. The tissue tunnel for entry of the implant has been preliminarily created with the technique described to this point.

Optical Cavity and Muscle Release

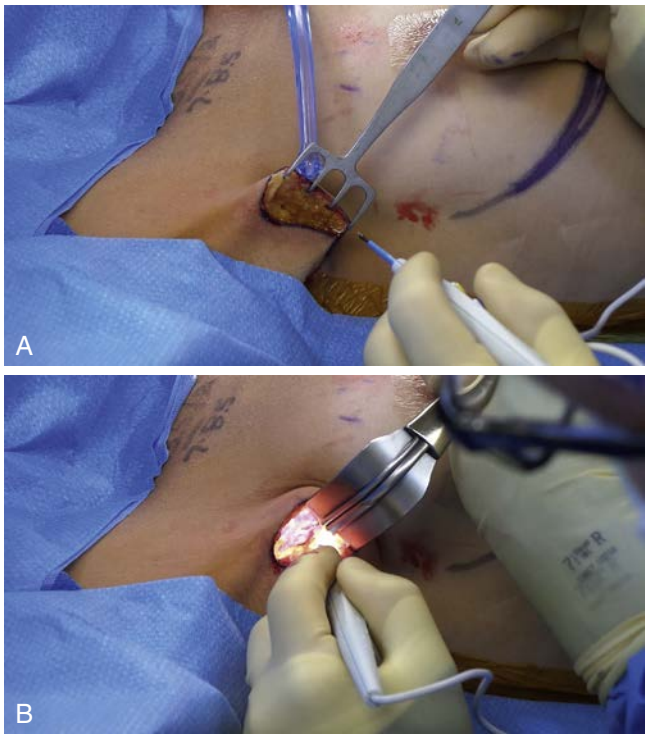
The endoscopic retractor is brought into the surgical field and is placed into the tissue tunnel, pointed to the medial reference mark at the superior IMF (Fig. 3.5A, B). A 10-mm, 30-degree angled endoscope is brought into the operative field and placed into the retractor sheath. An areolar plane that is avascular with minimal to no blood staining is seen on the monitor (Fig. 3.5C). Correct orientation of the endoscope is confirmed. The suction cautery handle with a spatulated tip attached is used to create a uniform optical cavity. This phase of the tissue release is to create uniform exposure of the undersurface of the pectoralis major muscle. *An important technical aspect is to create this plane from the undersurface of the pectoralis major muscle until all ribcage anatomy is identified.* This prevents possible entry into the chest cavity, which can occur if there are any abnormalities of ribcage shape or aberrant ribs. This is performed throughout using the cautery to minimize blood staining. Once this uniform optical cavity has been created, the release of the pectoralis major muscle can now be performed.

The key to technical control of the muscle release and creation of a tissue pocket appropriate for the combination of tissue type and implant type in each patient is to know how and where to divide the pectoralis major muscle relative to the plane for the IMF. This involves *constant correlation of external landmarks, reaffirmed by preoperative markings, with internal anatomy.* For a patient who needs the IMF maintained at the preoperative level, the muscle is released approximately 2 cm above the existing IMF. Alternatively, to lower the IMF, the muscle is divided just above the level of the existing IMF (Fig. 3.5D, E). The fold is then lowered in a plane immediately superficial to the anterior surface of the pectoralis major muscle cuff, to the level of the preoperative markings (Fig. 3.5F). This approach allows for different releases as needed, from patient to patient, or from side to side in a patient with asymmetries.

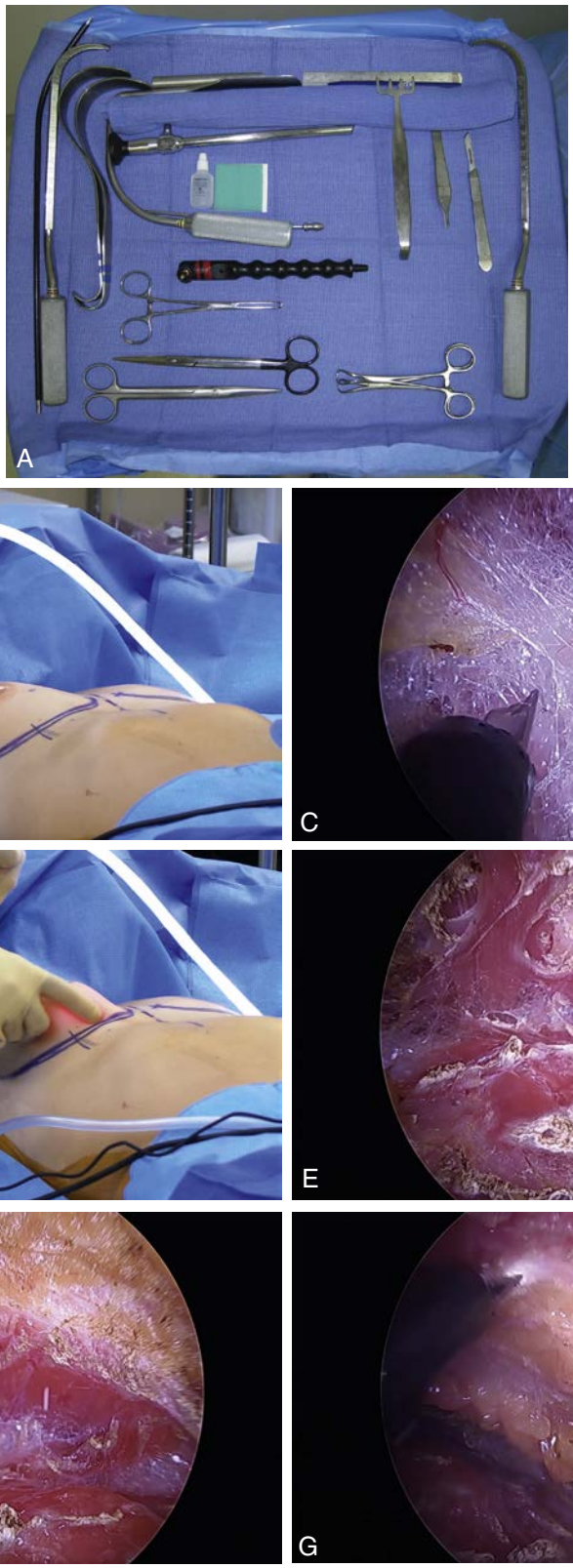
The extent of dual plane release can also be controlled in a precise manner using this technique (Fig. 3.5G). This is especially important in patients with pseudoptosis or minimal ptosis in whom added dual plane muscle tissue separation from the overlying glandular tissue is needed. The difference in the release between the two is that the IMF is also lowered in the minimal ptosis patient but maintained in the patient with pseudoptosis.

After the preliminary tissue release is performed with the IMF level and shape and dual plane separation created, the adequacy of the release is checked with the aid of Agris-Dingman dissectors. Imperfections of the extent of periphery of the tissue pocket are marked and revised after reintroduction of the endoscopic equipment. Hemostasis with particular attention to muscle edges is performed. After refinements, the pocket can be irrigated with saline to confirm absence of significant bleeding. Antibiotic irrigation as preferred can then be used to irrigate the tissue pocket.

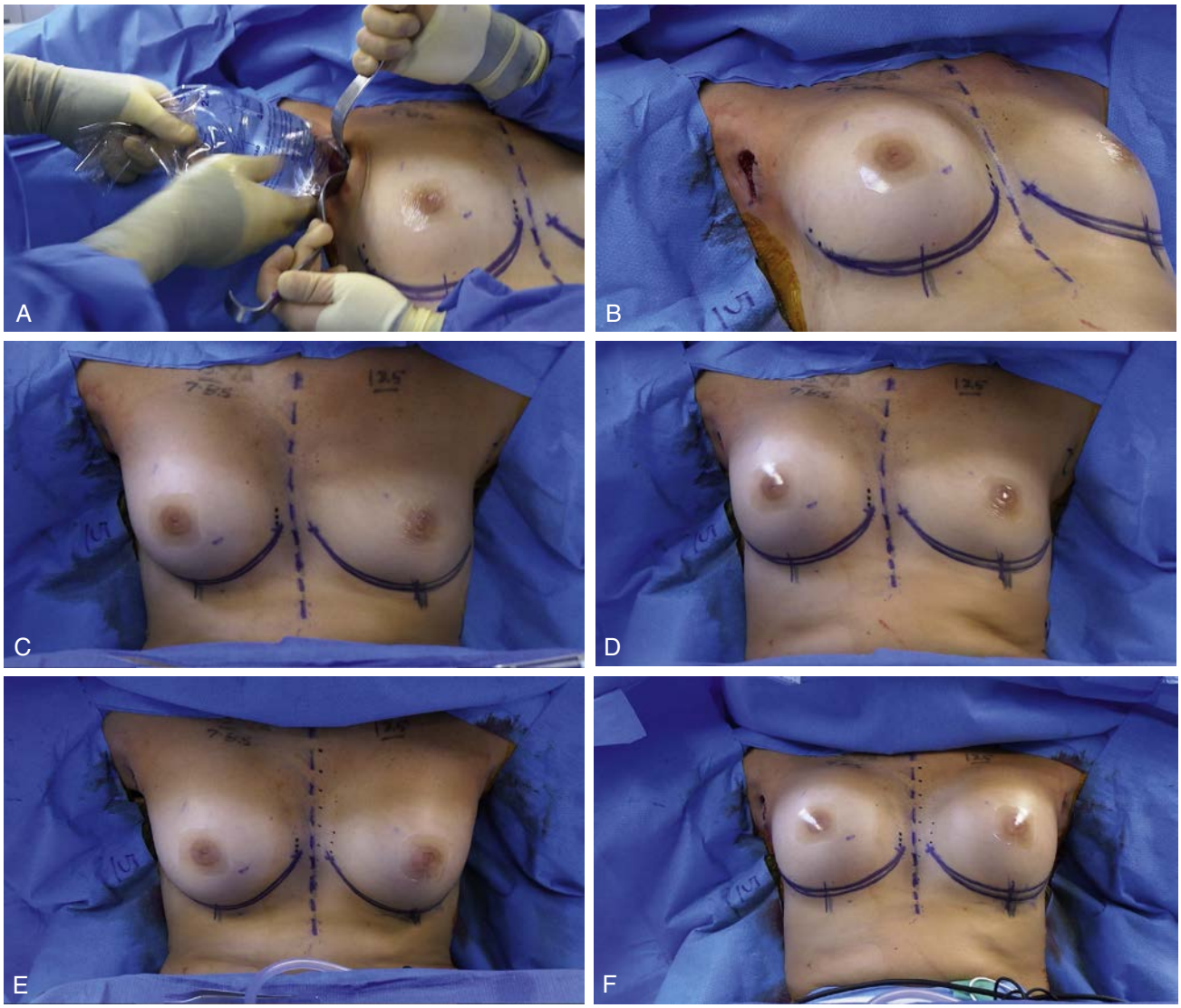
Chest wall width measurements are used to confirm the breast implant choice. The device is handled by the surgeon only with new gloves, placed into antibiotic solution, and then into the tissue pocket with the aid of an insertion sleeve. The insertion sleeve is used to minimize risk of the device coming into contact with the hair follicles and subcutaneous structures present in the transaxillary incision. The incision is held open with the aid of one of two 1-inch



• **Fig. 3.4** (A) A thin skin flap is developed in the subcutaneous plane, in an anterior direction, avoiding dissection into the axillary contents. (B) A fiber-optic retractor is used to identify the lateral border of the pectoralis major muscle. The plane immediately beneath the pectoralis major and above the pectoralis minor is developed to create the entry tunnel for endoscopic dissection of the tissue pocket and eventual placement of the breast implant.



• **Fig. 3.5** (A, B) Endoscopic equipment at start of pocket dissection. (C) Initial endoscopic view of areolar plane used to create optical cavity in preparation for pectoralis major muscle dissection. (D) Correlation of external landmarks with internal anatomy. *This is the key step to allow for control of the level and shape of the IMF.* (E) Start of the right pectoralis major muscle release. For orientation right is lateral, left is medial, ribcage is down. After the release is started, confirmation of external landmarks to internal anatomy is checked to ensure that the muscle cuts are made, in this case, to lower the IMF. (F) The IMF is lowered, after completion of the pectoralis major release, by entering the plane immediately superficial to the pectoralis fascia of the lower pectoralis major muscle cuff. (G) The position of the pectoralis muscle can be controlled directly with endoscopic assistance. This allows for creation of a precise level of dual-plane release.



• **Fig. 3.6** (A) An insertion sleeve is used to facilitate device placement and to minimize contact of the implant with the skin and subcutaneous structures around the incision. (B–D) The patient is placed in 80- and 45-degree sitting positions to confirm correct position of the device into the IMF release. (E, F) The patient is placed in 80- and 45-degree sitting positions after completion of second side to allow confirmation that devices are each sitting in the correct position relative to adjusted IMF and that optimal symmetry is present.

Deaver retractors, used to open the incision and tissue tunnel for placement (Fig. 3.6A).

At the time of device placement, the patient is in a 45-degree sitting position. The device is placed into the pocket and dropped down into the tissue release at the IMF (Fig. 3.6B). Correct placement is confirmed with the patient raised into the 80-degree and 45-degree sitting positions. (Fig. 3.6C, D) This is very important to make sure that the device is low enough and does not sit high or even move superiorly back up into the tissue tunnel. Any irregularities in IMF shape or increased dual plane tissue separation can be addressed using Agris-Dingman dissectors, performed to miniseries any trauma to the ribcage or damage to the breast implant.

An identical procedure is performed on the contralateral side (Fig. 3.6E, F). Once a satisfactory result has been accomplished after placement of the second implant, the pocket is reirrigated and the incisions closed using 2-0 Vicryl in the deep subcutaneous tissue, 3-0 PDS in the deep dermis, and either 5-0 plain gut or 3-0 V-Loc in the superficial dermis. The IMF is stabilized with the aid of 1-inch foam tape placed at the level of the final IMF as described by Maxwell and Falcone.[10] (Fig. 3.7A). A pressure dressing consisting of fluffed gauze and 4-inch foam tape is placed to maintain the device position for 24–48 hours.

Postoperative Care and Expected Outcomes

The pressure dressing placed in the operating room is removed in 24–48 hours. The tape placed along the

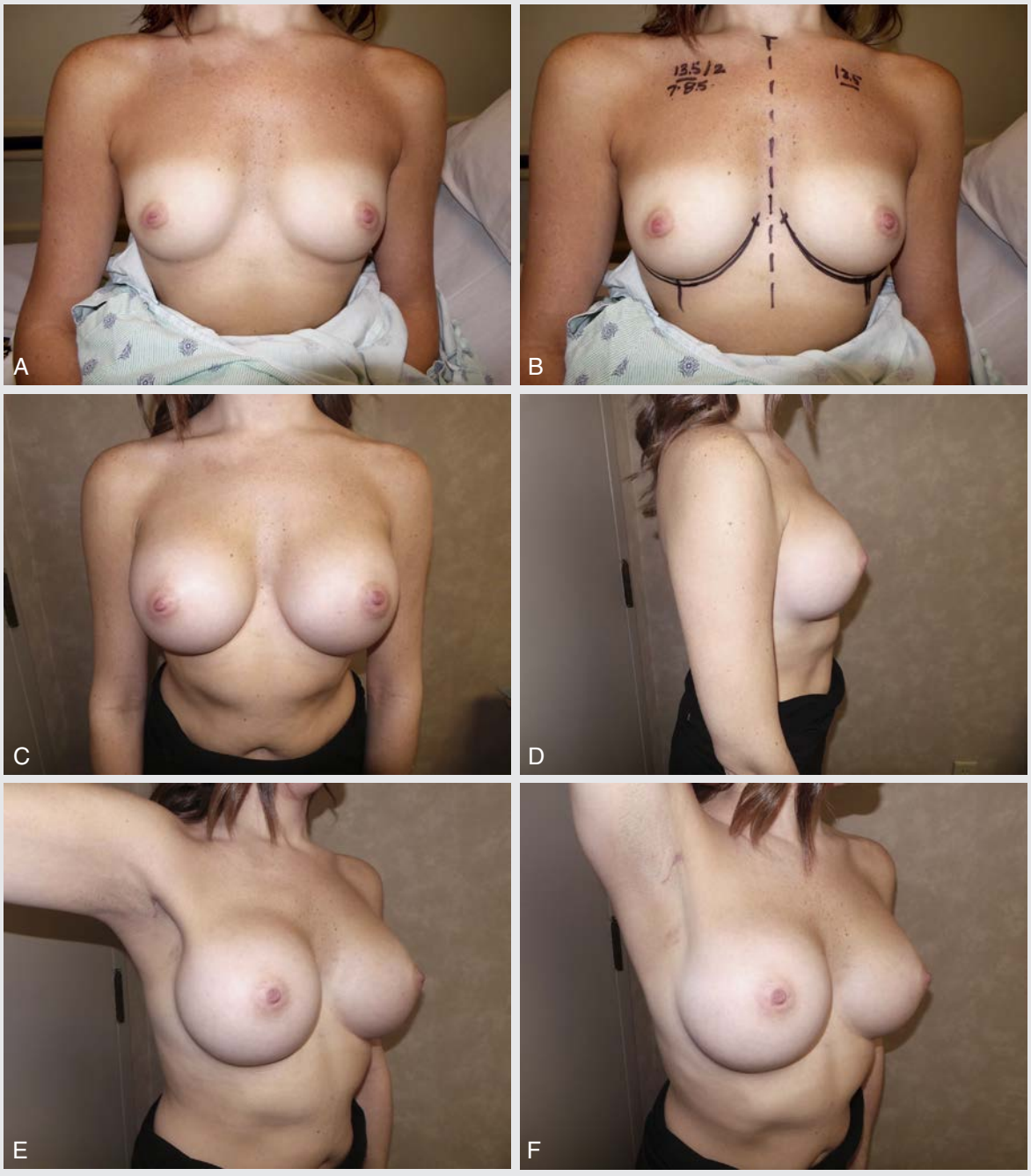
IMF is left intact for 1 week (Fig. 3.7B). This diverts any swelling away from the IMF to enhance shape. The patient is then placed in a specific underwire bra that will be used for 1–4 weeks. An elastic wrap is used with the initial bra for anywhere from 1–6 weeks, usually 1–2 weeks (Fig. 3.7C). A second underwire bra is then used to maintain support until 6–8 weeks postoperatively.

Incision care is minimal in most cases. The incision looks inflamed and visible for the first month and becomes more difficult to see over next several months. Problems with cysts or other issues are minimal. Occasionally patients may have small open areas that are addressed easily, if present, using simple wound care. An important tip to minimize such issues is to encourage use of spray antiperspirant deodorant to keep the axillary areas dry and free of excessive sweating. This can be a challenge in the home area of the author's practice in North Texas.

Case Examples

CASE 3.1

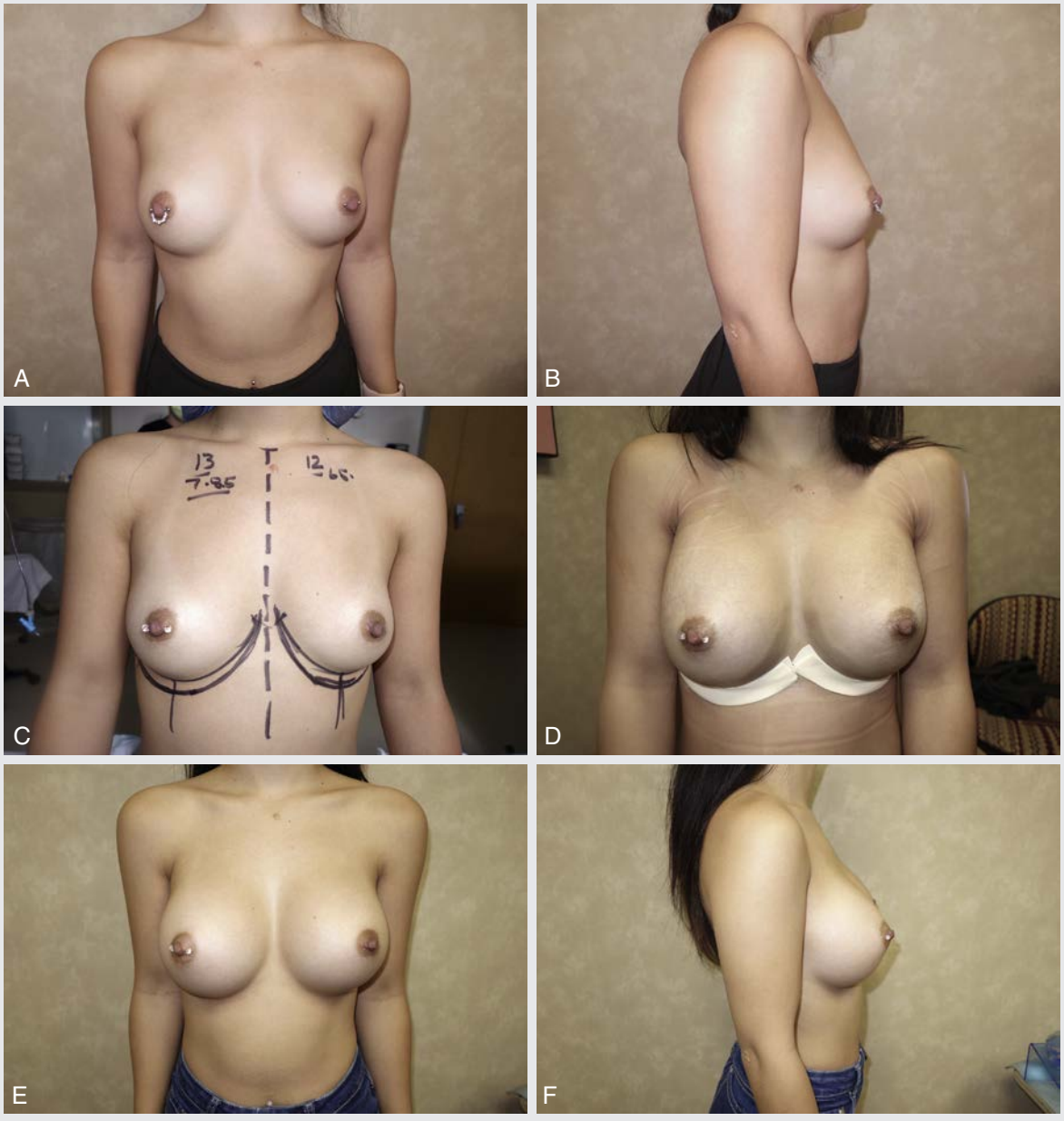
This patient is a 30-year-old woman who requested a two or more cup size increase in breast size if possible. She was noted to have moderate tissue with minimal asymmetry. She stated preference for a high-profile cohesive II device. She underwent augmentation using an Allergan SSF 450-cc high-profile smooth gel device, placed in a partial subpectoral pocket using a transaxillary approach. This patient's procedure is shown in the technique presentation earlier.



• **Case 3.1** (A) Preoperative frontal. (B) Frontal with markings. (C) Postoperative frontal. (D) Lateral views. (E, F) Incisions are shown at 4 months postoperatively.

CASE 3.2

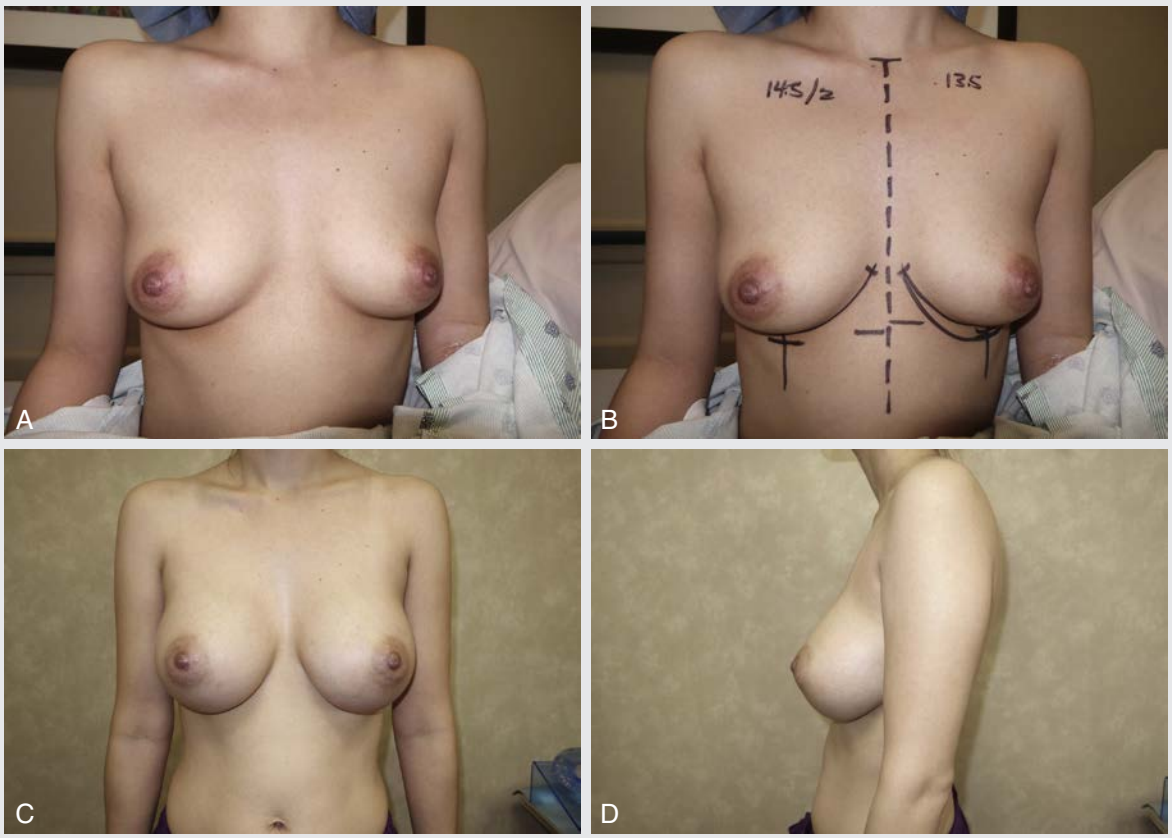
This patient is a 22-year-old woman who requested a two cup size increase in breast size if possible. She was noted to have moderately tight tissue with moderate asymmetry. She underwent augmentation using a 405-cc Mentor MemoryGel Xtra moderate plus smooth wall silicone gel implant, placed in a partial subpectoral pocket using a transaxillary incision.



• **Case 3.2** (A, B) Preoperative frontal and lateral views. (C) Frontal view with markings. (D) Initial postoperative view. (E, F) Postoperative frontal and lateral views.

CASE 3.3

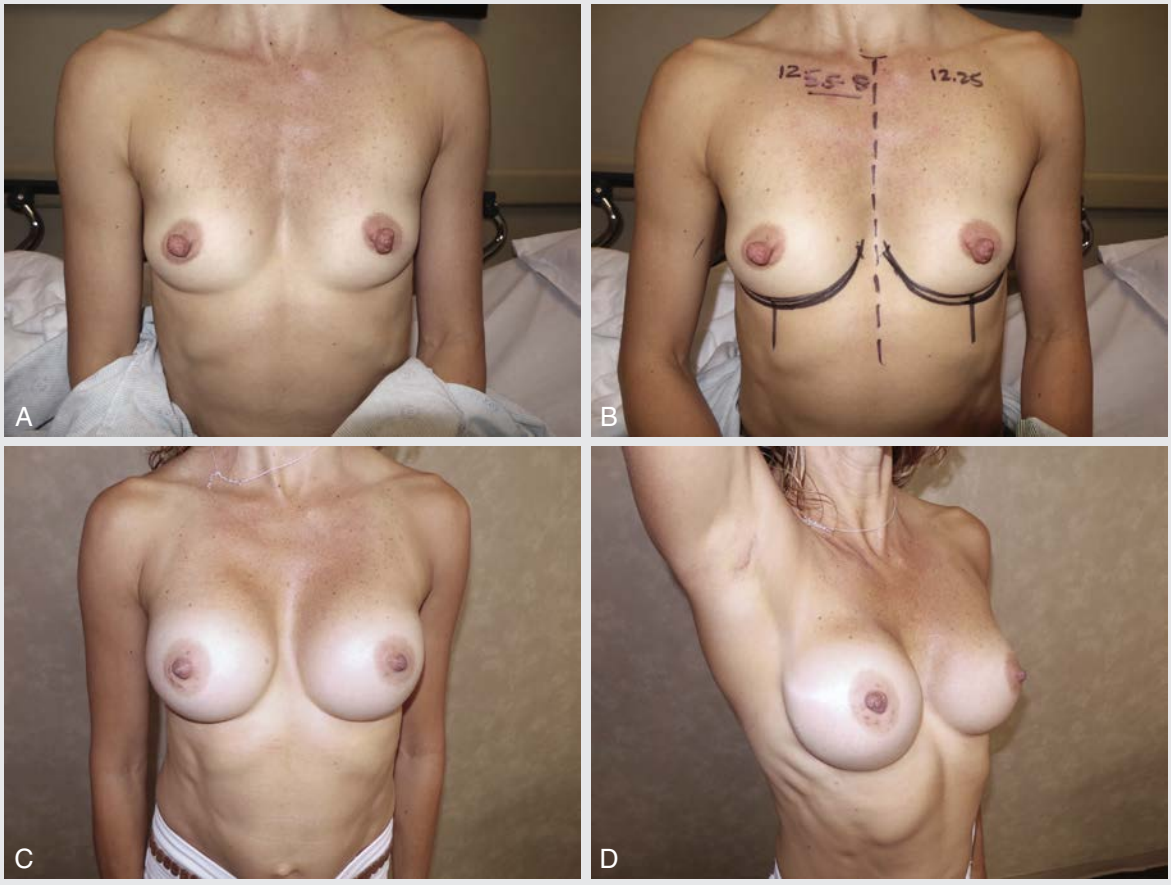
This patient is a 37-year-old woman who also requested a two cup size increase in breast size if possible. She was noted to have moderate to loose tissue, mild asymmetry, with minimal ptosis. She underwent augmentation using a 405-cc Mentor MemoryGel Xtra moderate plus smooth wall silicone gel implant, placed in a partial subpectoral pocket using a transaxillary incision.



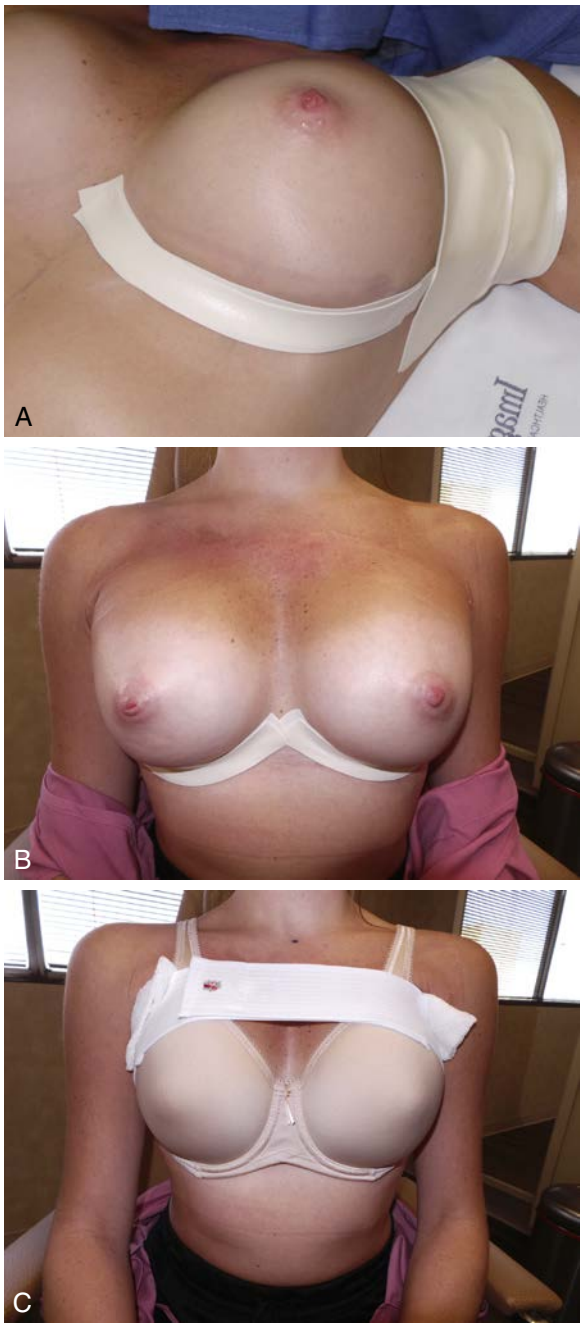
• **Case 3.3** (A, B) Preoperative frontal and frontal markings. (C, D) Postoperative frontal and lateral views.

CASE 3.4

This patient is a 37-year-old woman who also requested a two cup size increase in breast size if possible. She was noted to have moderate to loose tissue and mild asymmetry with minimal ptosis. She underwent augmentation using a 405-cc Mentor MemoryGel Xtra moderate plus smooth wall silicone gel implant, placed in a partial subpectoral pocket using a transaxillary incision.



• **Case 3.4** (A, B) Preoperative frontal and frontal markings. (C, D) Postoperative frontal and incision view.



• **Fig. 3.7** (A) At conclusion of the procedure, tape reinforcement is placed along the modified IMF and to establish pressure over the axillary incision. (B) Postoperative visit on postoperative day 2 with tape reinforcement of IMF release maintained, to be left in place for 1 week. (C) An elastic wrap is used to maintain downward pressure on the breast implants, in conjunction with tape and bra external stabilization of IMF release. The elastic wrap is used on an individualized basis, usually for about 1 week.

Management of Complications

The complications of this procedure are those of breast augmentation. There is some confusion regarding the ability to perform revision procedures after a transaxillary breast augmentation. Postoperative hematoma can be addressed by reopening the axillary incision with the aid of endoscopic visualization to identify any specific bleeding sites.

Secondary Procedures

If a patient requests a size change and the only intervention needed would be refinement and opening of tissue pocket, an axillary incision can be used. Although the author has performed capsulectomy using an axillary incision, this is not the author's preferred approach. This can come into play in the treatment of a patient with capsular contracture, who may be treated by capsulectomy, neopectoral pocket, or, occasionally, capsulotomy, all of which are addressed with an inframammary incision by the author. A ruptured gel implant, which can be a possibility in the treatment of contracture or otherwise thought to be present based on radiologic report, is best addressed using an inframammary incision. Any exchange from saline to gel is performed using an axillary incision, if originally placed using this incision, as long as the pocket is not so large that a capsular tightening or capsulorrhaphy is needed.

Conclusion

The transaxillary approach for breast augmentation can provide consistent and reliable outcomes comparable to those reported for the inframammary approach. The transaxillary approach has joined the inframammary approach as the preferred evidence-based incisions for breast implant placement. The author provides a rationale and technique for endoscopic assistance to provide tissue visualization and technical control when performing transaxillary breast augmentation.

SUMMARY BOX

Pearls for Success

- Endoscopic assistance adds precision to tissue release and pocket creation.
- The procedure is best viewed as a sequence of tissue tunnel creation, optical cavity creation, and pectoralis major muscle release.
- IMF management is possible with correlation of external landmarks and internal anatomy, providing the basis to maintain or lower the IMF as needed, with location planned according to plan for IMF level.
- Tape and bras help stabilize the IMF and dual-plane tissue release.

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4

Breast Augmentation With Implant—Subfascial Placement

RUTH GRAF, PRISCILLA BALBINOT, DANIELE HELENA PACE AND MARIA CECÍLIA CLOSS ONO

Introduction

The pectoral fascia is a thin layer of dense connective tissue, covering the surface of the pectoralis major muscle. It can be easily dissected along the subfascial implant insertion. The pectoral fascia helps support the breast implant, and even in slim patients a smoother transition is achieved in the breast upper pole[1–2] if the fascia is firmly attached to the muscle.

Various approaches can be used to perform a subfascial breast augmentation (transaxillary, inframammary fold [IMF], periareolar, vertical, and short horizontal incisions), which makes this technique more versatile. Capsular contracture seems to be less frequent in subfascial placement compared with the subglandular pocket, probably because of a higher vascularized tissue (pectoralis major muscle).[3]

Subfascial implant placement avoids the negative aspects of a submuscular pocket (animation deformity) and provides a shorter recovery. In this chapter the authors describe their technique on subfascial breast augmentations, including indications, operative techniques, postoperative care and expected outcomes, management of complications, and secondary procedures for revisions.

Indications and Contraindications

Any size and shape of implants can be used in subfascial breast augmentation cases and all kinds of approaches, depending on whether the procedure is only breast augmentation or mastopexy augmentation. There are no contraindications for this technique because of the maneuver of muscle coverage superomedially and fat transfer if necessary to avoid rippling in slim patients.

Patients with tuberous breasts usually present with lower pole hypoplasia and some degree of nipple–areola complex weakness and prolapse. In these cases, a subfascial pocket is created, the fascia is incised radially in lower pole, and fat can be added in this region to allow shape improvement.

Secondary mammaplasty that is primarily subglandular can be performed, removing the anterior capsule and elevating the fascia and posterior capsule to create a new pocket for the new implant. If the implants were submuscular primarily, a new subfascial pocket is created in the secondary procedure.

Preoperative Evaluations and Special Considerations

All patients can be provided a subfascial implant placement, especially thin patients. Ideal primary patients have hypomastia, no ptose, and the presence of a soft tissue envelope to cover the implant. In very slim patients with absence of soft tissue coverage, subglandular placement is difficult.[4] In these cases, a spreader maneuver is done in the muscle fibers at the superomedial pole of the breast and in some cases fat transfer is done, as shown in Figs. 4.1; 4.2A, B; and 4.3. It is also important to measure breast height and base to properly choose the implant volume.

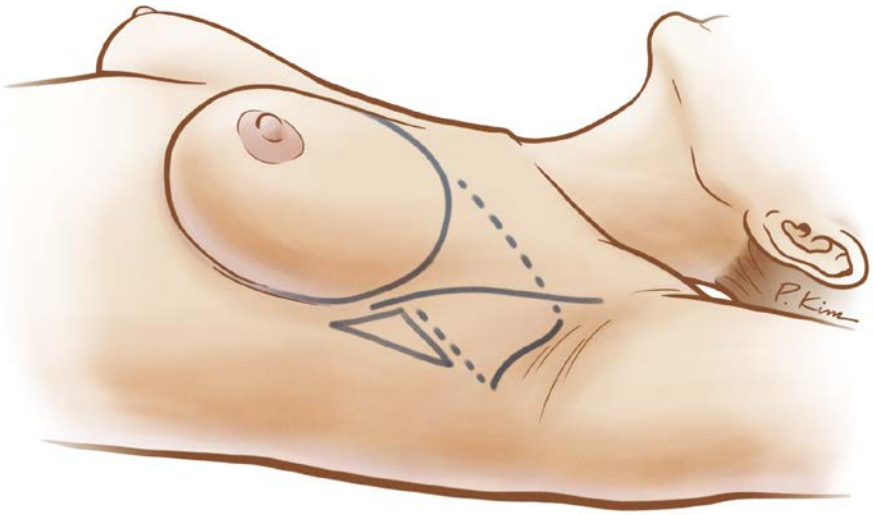
Breast augmentation mammaplasty and breast augmentation mastopexy cases can be performed with a subfascial implant pocket.

Differences in breast sizes usually can be handled by using different implant volumes. Adding fat in the smaller breast at the end of the procedure can be helpful if similar implants are used. When concomitant mastopexy is performed, excessive tissue from a larger breast can be resected and a similar size of implants can be used.

Cases of mild to moderate tuberous breast can be managed properly with a transaxillary or inframammary breast augmentation. However, more severe cases must be treated with mastopexy techniques (e.g., periareolar breast augmentation).

Radial incisions in the fascia should be performed to smooth the fibrous ring and improve breast contour. Fat transfer to the lower pole can be done at the end of the procedure.

Slim patients are very challenging because of the absence of adequate tissue coverage. Some muscle fibers (pectoralis



• **Fig. 4.1** Preoperative drawing of the axillary fold incision, subcutaneous tunnel, and breast pocket for the implant. The *triangle* drawn contains a great concentration of lymphatic vessels.

major muscle) can be elevated with the fascia in the superior part of the pocket to create a smoother transition in the upper pole breast. Fat grafting can be done to camouflage rippling (composite breast augmentation).

Surgical Techniques

Relevant Surgical Anatomy

The pectoral fascia is a dense connective tissue that originates from the clavicle and sternum, covers the pectoralis major muscle, and continues down with rectus abdominis fascia. It can be bluntly dissected along the subfascial plane and has some specific characteristics.

At the second rib level, the pectoral fascia tightly connects with the superficial fascia of the breast, and it is difficult to dissect the pocket. This is usually the upper undermining point, which defines breast limits.[5]

Along the point that corresponds to the fourth intercostal space, a horizontal septum originating from pectoral fascia connects with the nipple.[6] This septum is a guide to dissection, especially in infraareolar and periareolar mammoplasties and mastopexies cases.

The pectoral fascia is a well-defined anatomic structure made of dense and consistent connective tissue. It can be used to minimize implant edge appearance and make the breast implant less noticeable. A subfascial pocket can be used even in slim patients.[7]

Preoperative Markings

Skin markings are done with the patient standing. The pocket footprint (breast limits) is marked. Precise measurements must be taken using the inframammary fold (IMF), the nipple–areola complex, and the suprasternal notch as key landmarks. The midline of the chest and IMF are marked. Lines are drawn first straight down the midline from the suprasternal notch to the xyphoid process and second from a point 5 cm from the suprasternal notch at the clavicle to the nipple–areola complex and then straight down to the areola. The incision is marked depending on incision choice. In breast augmentation mammaplasty (transaxillary, infraareolar, and inframammary incision), the nipple–areola complex placement does not change, different from mastopexies (periareolar, vertical, and inverted T), in which the nipple–areola complex distance is elevated to correct ptosis (Fig. 4.4A–C).

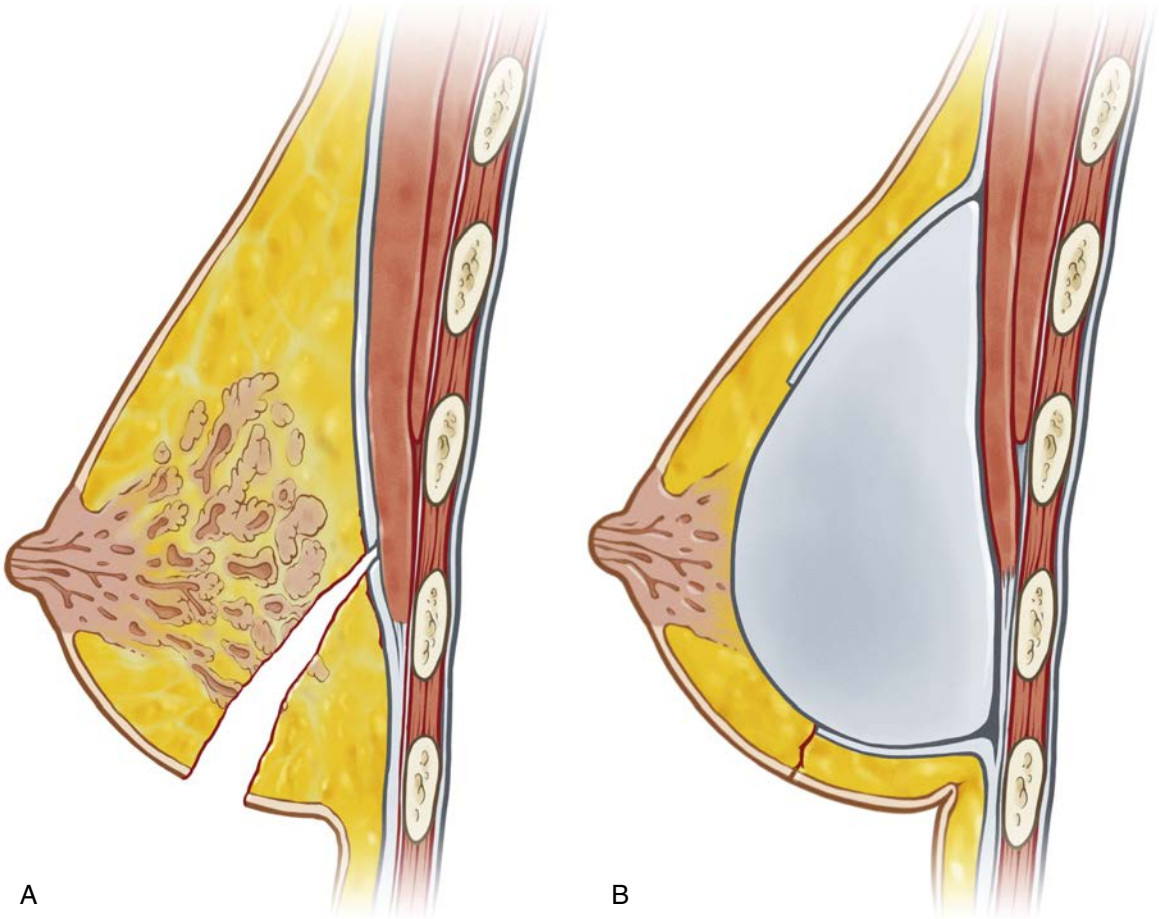
Surgical Techniques

After incision, subfascial pocket undermining should be done very carefully to avoid fascia injury, and, if there is doubt about its limits, some muscle fibers may be lifted up with the fascia. Currently, an electrocautery device with a thin tip is used to undermine the pocket.

Upward traction is necessary to make dissection easier and more precise. Limits for dissection are the second intercostal space superiorly, 1.5–2 cm from midline medially, 5–7 cm below the areola to the new IMF (or the actual IMF, respecting its limits), and to the anterior axillary line laterally.

The distance between pocket implants should not be less than 2–3 cm to prevent symmastia. Lateral undermining is minimal to prevent implant lateralization. Some muscle fibers (pectoralis major muscle) can be elevated with the fascia in the superior part of the pocket, incising between the fibers to create a smoother transition in upper pole breast.

Once dissection is completed, meticulous hemostasis is performed and the implant is inserted into the pocket. Fascia can be sutured with absorbable suture (Video 4.1).



• **Fig. 4.2** (A) The inframammary approach going direct to the fascia and opening it at the level of the areola. (B) The implant in the subfascial plane.

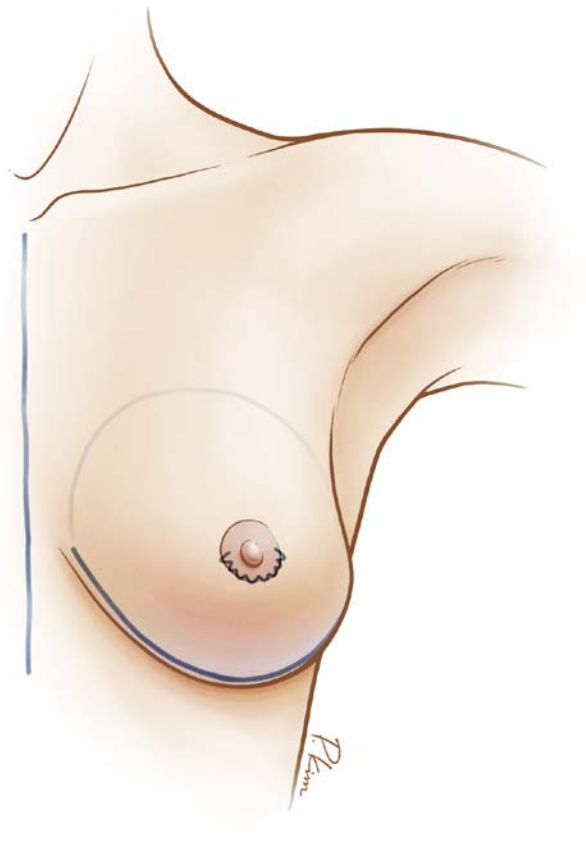
Axillary Approach for Subfascial Augmentation

The axillary incisions are placed in a natural crease. An S-shaped, 4-cm-long incision is made in the main axillary fold 1 cm behind the lateral border of the major pectoralis muscle. It is important never to cross beyond the lateral edge of the pectoralis muscle. A subcutaneous tunnel is dissected up to the superior lateral border of the muscle, preserving an inferior lateral triangle of soft tissue containing most of the lymphatic vessels, as we can observe in Fig. 4.1.

The pectoralis fascia then is incised, and a subfascial breast pocket is dissected with electrocautery. It can be done by an endoscopy retractor or direct view. Transaxillary breast augmentation can damage lymphatic vessels during subcutaneous tunnel dissection for introduction of the implant into the breast pocket. Because of this, dissection of the subcutaneous tunnel has to be performed very carefully superficial and direct to the lateral border of the pectoralis major muscle, to avoid lesion to the lymphatic vessels (Videos 4.1 and 4.2).

Inframammary Approach for Subfascial Augmentation

A 3- to 4-cm incision is made in the proposed inframammary crease, lateral to the medial breast line. After the skin and the subcutaneous tissue are incised, the breast gland is dissected in the superior direction until reaching the pectoral fascia, which is visualized and incised 3 cm above the skin incision, creating the fascial flap inferiorly when the dissection proceeds until the IMF. The subfascial pocket is created with regard to the external skin marks according to the implant size. The inframammary approach offers advantages of providing easy access without disruption of the breast parenchyma, and the possibility of using any size of implant. The disadvantages are the visible scar, especially when the patient is in the lying position, a greater risk of exposure of the implant if the patient presents skin dehiscence, and a higher incidence of Mondor syndrome. Details of the technique can be seen in Fig. 4.2 and Videos 4.3 and 4.4.



• **Fig. 4.3** Zig-zag skin marks.

Zig-Zag Infraareolar Approach Subfascial Augmentation

Zig-zag incision is done inside the areolar skin between 3 o'clock and 9 o'clock, starting and finishing in the nipple direction with no. 11 blades (see Fig. 4.3). After that, for the incision of the dermis into the subcutaneous tissue, a glandular tunnel is dissected directly to the fascia without disturbing the lactiferous ducts or mammary gland. At this point, the fascia is opened in the direction of the muscle fibers and the subfascial pocket is undermined in all directions, as described previously. After adequate hemostasis and implant insertion, the internal layers are approximated to the glandular tissue, subcutaneous tissue, and dermis with absorbable sutures. The skin is then sutured with matrix stitches in each small flap of the zig-zag incision, as shown in Video 4.5.

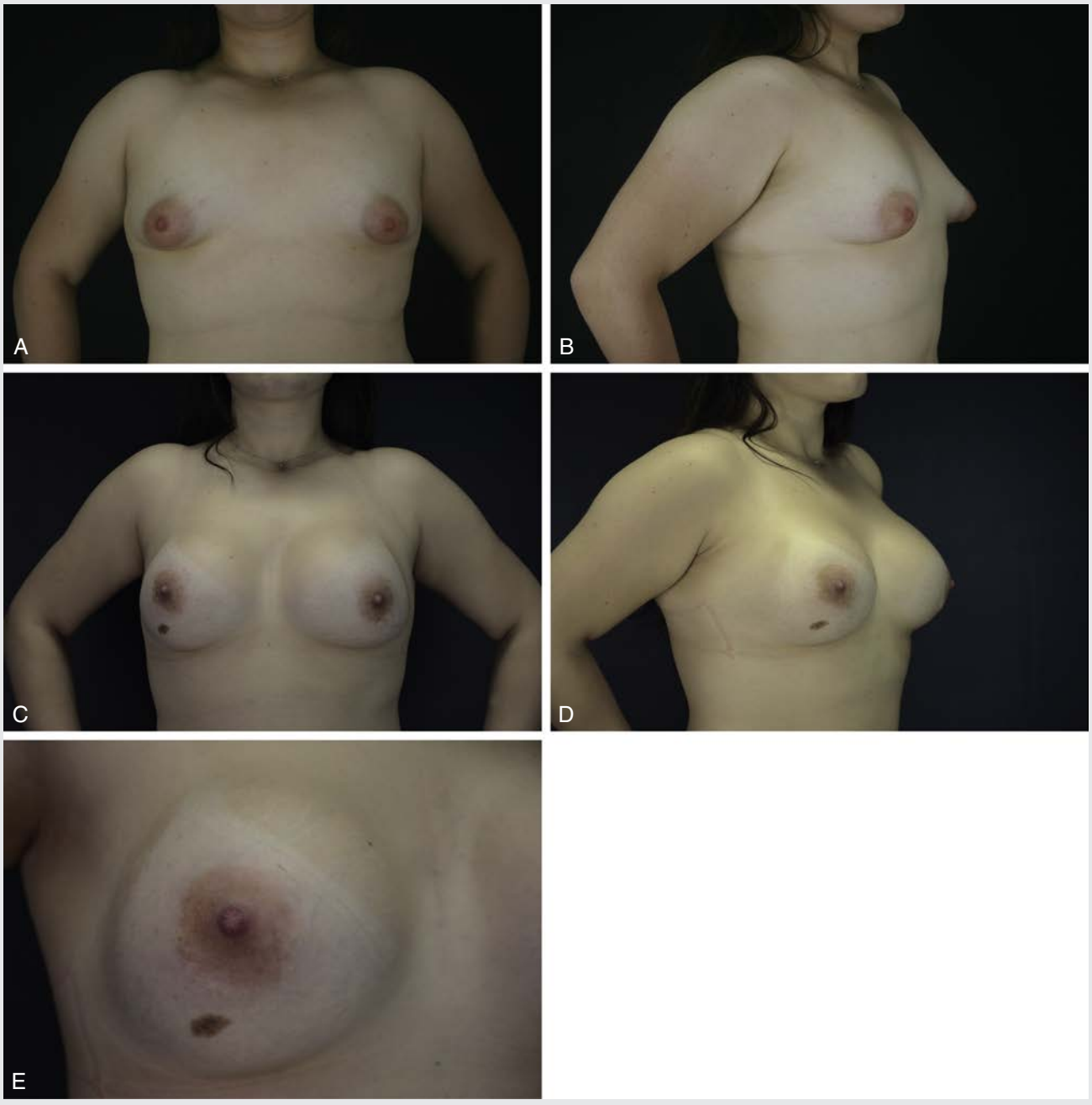
Periareolar Approach

The periareolar approach for augmentation mammaplasty was first described in the 1970s. It is used for mastopexy augmentation. Once the periareolar incision is made respecting measurements—the superior skin mark 17 cm from the sternal notch, the medial skin mark 9 cm from the midline, and the inferior skin mark 4.5 cm from the inframammary fold—the de-epithelialization is performed with respect to the 4.2-cm areolar diameter, and the gland is divided perpendicularly to the thorax, until reaching the fascia. At this point, subfascial dissection is carried superiorly and inferiorly, making the same pocket described in Fig. 4.5. The periareolar augmentation gives the option of a central point of access for creation of the implant pocket, which allows easy and accurate dissection in all directions[3] (Video 4.6).

Case Examples

CASE 4.1

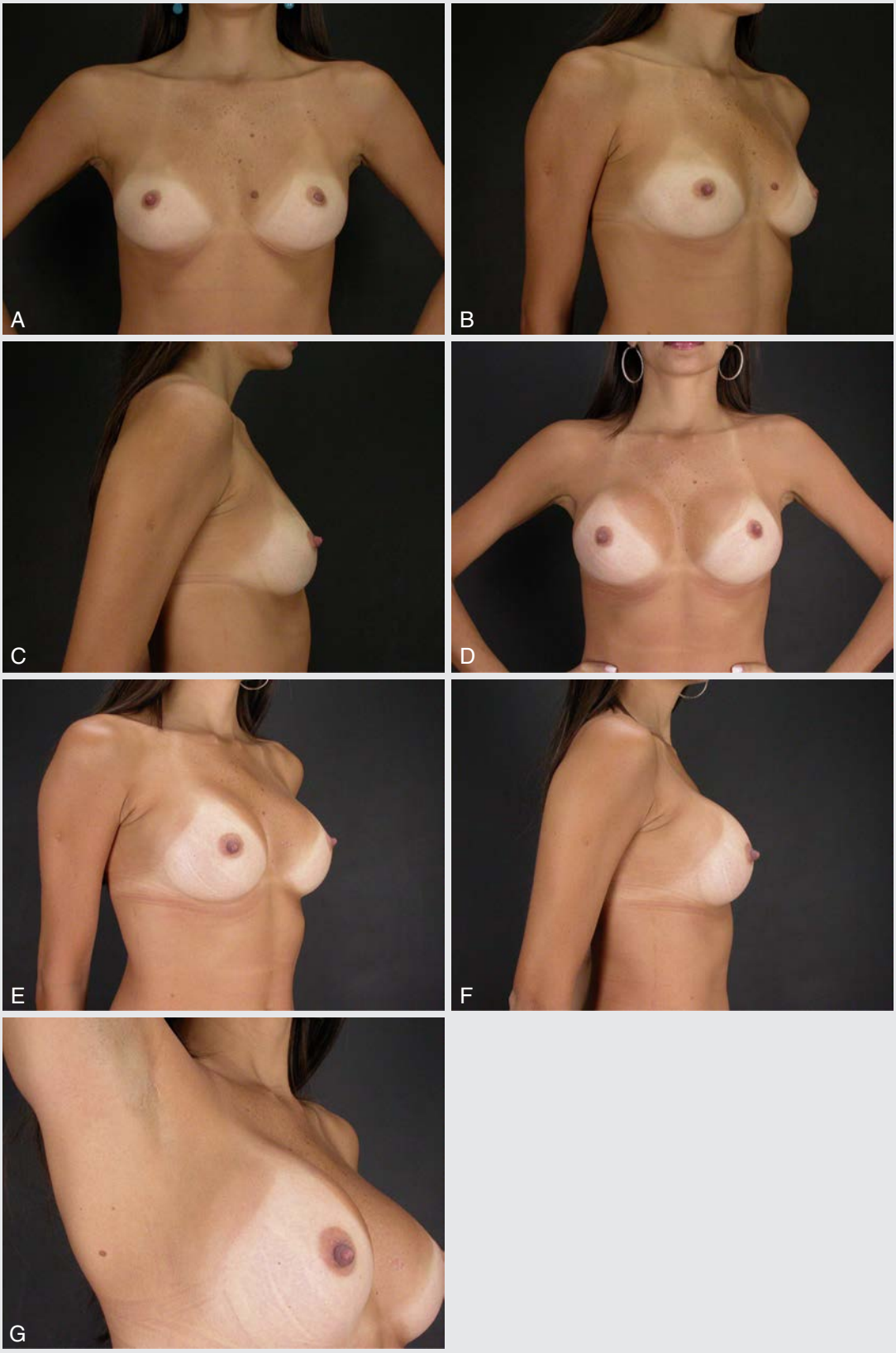
A 26-year-old female patient presented with tuberous breasts. Case 4.1A, B presents preoperative photographs. Case 4.1C–E are postoperative photographs taken 30 months after subfascial breast augmentation infraareolar zig-zag mammaplasty with a 330-cc anatomic high-profile implant.



• **Case 4.1** Infraareolar breast augmentation. Female patient, 26 years old, with tuberous breasts. (A, B) Preoperative photographs. (C, D) Postoperative pictures 30 months after subfascial breast augmentation with infraareolar zig-zag mammaplasty and 330-cc anatomic high-profile implant. (E) Final scar aspect with good camouflage.

CASE 4.2

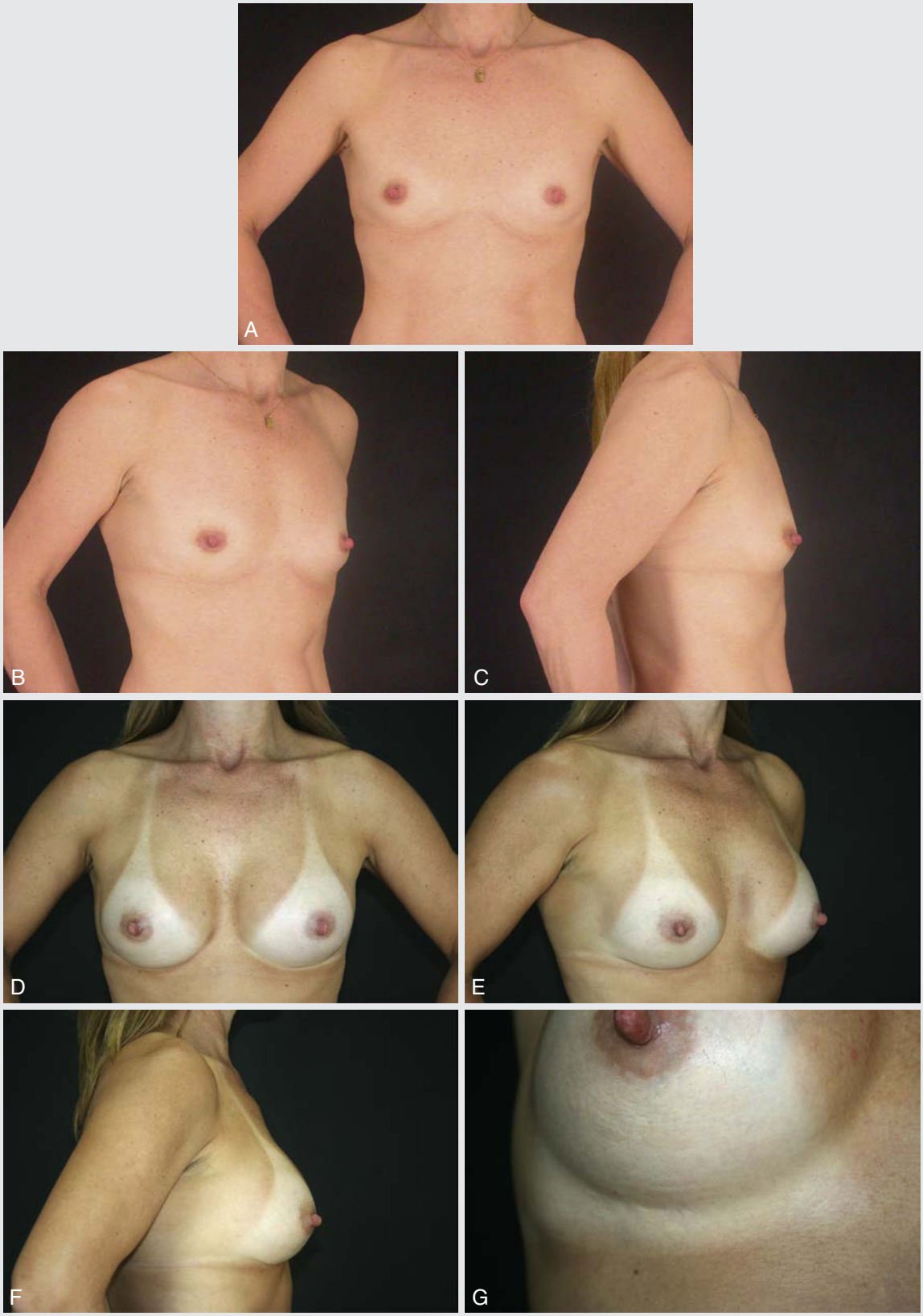
A 23-year-old female patient with hypomastia presented for axillary subfascial breast augmentation (Case 4.2A–C). Case 4.2D–F show the patient 2 years after transaxillary breast mammaplasty with a 300-cc round, high-profile breast implant. Case 4.2G provides a close view of the axillary scar.



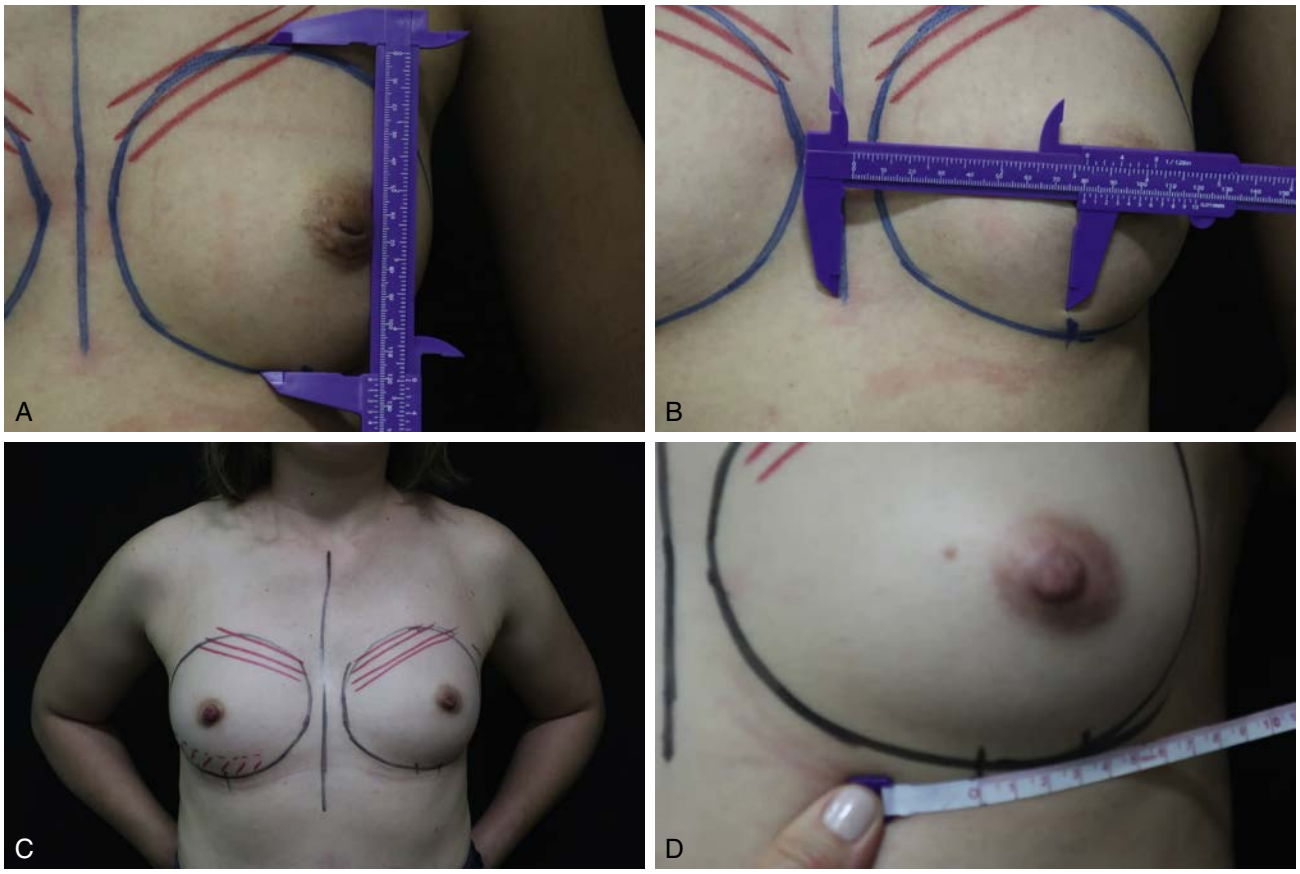
• **Case 4.2** Axillary breast augmentation. (A–C) Preoperative view of a female patient, 23 years old, with hypomastia. (D–F) Two years after transaxillary breast mammaplasty with a 300-cc round, high-profile breast implant. (G) Close view of axillary scar.

CASE 4.3

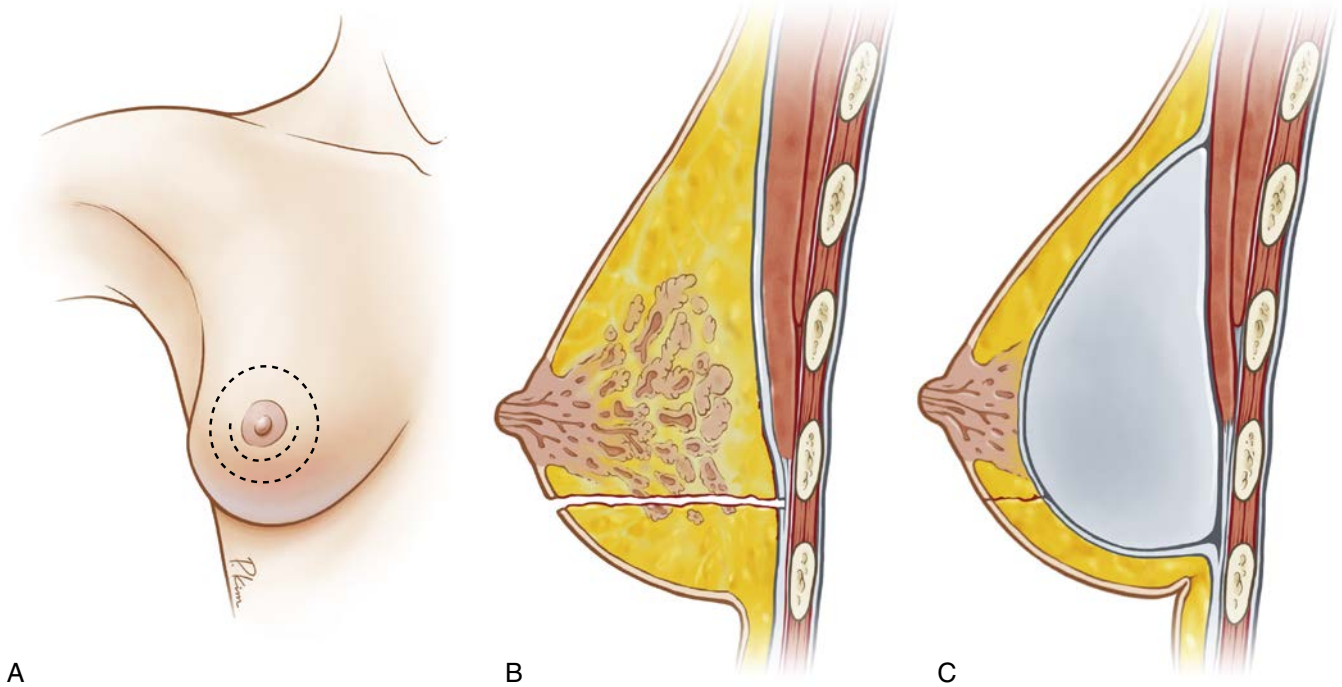
A 32-year-old patient with severe hypomastia underwent inframammary subfascial breast augmentation. Case 4.3A–C presents a preoperative view. Case 4.3D–F shows results 18 months after mammaplasty through the IMF with a 300-cc round, high-profile implant. Case 4.5G shows the final scar.



• **Case 4.3** Inframammary breast augmentation. (A–C) Preoperative view of a female patient, 32 years old, with a severe hypomastia. (D–F) Eighteen months after mammaplasty through the IMF with 300-cc round, high-profile implant. (G) Final scar aspect.



• **Fig. 4.4** Breast measurement.



• **Fig. 4.5** (A, B) The periareolar approach going direct to the fascia and opening it. (C) Breast implant in the subfascial plane.

Postoperative Care and Expected Outcomes

Dressings with wound care are done postoperatively from day 1 to day 10, until the incision is clean and without scabs.

Patients are usually discharged the same day of surgery on only anti-inflammatory medications. It is recommended to use a compressive bra and an elastic band in transaxillary cases.

An antiseptic chlorhexidine soap is used when showering and some gauze pads protect the wound while wearing bra and elastic band. In general, regular movements of arms are allowed after 2 weeks, driving after 3 weeks, aerobic exercises such as jogging after 1 month and lifting weight after 2 months.

Subfascial implant placement avoids the negative aspects of a submuscular pocket such as implant displacement and animation deformities. It also avoids negative aspects of the subglandular pocket such as implant visibility because of the better coverage with the fascia tissue. More comfortable recovery is achieved in subfascial cases compared with submuscular breast augmentation.

Management of Complications

If the patient develops a hematoma during the first days after the procedure, it has to be evacuated and hemostasis performed carefully in the operating room. The management of infection is essential. The patient showers 1 hour before the surgery with chlorhexidine soap and appropriate antisepsis during the procedure. Use of a funnel prevents implant exposition to the skin, and the "no touch" technique prevents infection.

If an infection occurs that compromises the implants, they have to be removed, antibiotic administered, and reimplantation performed 4 months later. It the infection occurs only at the skin incision, local management is necessary.

Secondary Procedures

Implant displacement is a relatively common cause of postoperative asymmetries. It can be caused by mistakes and differences in pocket dissection and early excessive movements. Anatomic implants result in asymmetries when initially placed rotated or when they rotate inside the pocket as a result of seroma formation. Mild cases of displacement can be managed conservatively using a modeling bra and elastic bands. More severe and long-term cases need reoperation to reshape the breast pocket with extra dissections or sutures. Sometimes, a subclinical seroma and double capsule can cause anatomic implant rotation.

If the patient presents preoperative asymmetry it is important to discuss the better option with the patient at the first consultation. Some cases need different implant sizes; some need fat added to make the breast shape more symmetric; and others need different approaches for removing more or less skin in both breasts, using, for example, a periareolar approach on one side and a vertical or short horizontal scar technique on the other side. In some cases, when the asymmetry is quite evident, breast tissue needs to be removed from one side and a small implant placed, with a large implant placed on the other side to compensate and achieve better symmetry.

For patients who have rippling and implant visibility, instead of using a subfascial pocket and pearls during the procedure, adding fat secondarily is a technique that does not require touching an implant that is in perfect condition.

Capsular contracture is one of the most difficult complications to manage. In Baker II, following the patient clinically is the better option, but in Baker III and IV, the secondary procedure is mandatory. If the patient develops a seroma associated with the capsular contracture, needle aspiration with ultrasound of the entire liquid is required and the sample must be sent to the laboratory to examine for breast implant–associated anaplastic large-cell lymphoma (BIA-ALCL). If the result is negative for BIA-ALCL, the implant exchange is performed by removing the anterior capsule and the implant. The posterior capsule is maintained and is opened inferiorly. A new implant pocket is undermined below the posterior capsule, keeping some pectoralis major muscle fibers attached to it, and reaches the breast footprints made before surgery, going far past the capsular contracture limits. The implant is placed into the pocket after rigorous hemostasis and antibiotic solution instillation. The pocket is closed, removing the capsule tissue and the inferior breast tissue. It is sutured to breast tissue to obtain coverage and avoid subglandular implant migration. Breast incisions are closed with sutures just as in primary cases.

Conclusion

Subfascial breast augmentation is a reproducible technique with advantages of subglandular and submuscular implant placement. Supplementary soft tissue upper pole coverage, with an improved upper pole contour and a smooth transition between thorax and breast is achieved without submuscular complications. Muscular dynamics and consequential asymmetry seen in submuscular breast augmentation are remote with the subfascial technique. A better recovery is achieved with subfascial placement, with less pain and downtime.

PEARLS FOR SUCCESS

- Pectoral fascia is easily recognized in surgery and should be kept whole. An accurate dissection with electrocautery provides better results.
- Elevation of superior muscle fibers at the medial breast upper pole improves implant cover.
- Accurate hemostasis should be performed. Bleeding can occur because of muscle exposition when fascia is elevated.
- No muscular dynamics and asymmetry over the implant because the implant is anterior to pectoralis major muscle.
- Fascial flap performed inferiorly to the IMF incision avoids implant exposition if the patient experiences difficult wound healing, and the fascial flap helps maintain the implant in the original position so it does not slide down over time.

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5

Breast Augmentation in the Asian Patient

HONG-KI LEE AND QIONG LI

Introduction

Breast augmentation is one of the most popular aesthetic procedures worldwide, including in Asia. The unique Asian cultural background, which is more conservative, influences various options for Asian breast augmentation. Many Asian women prefer an axillary incision to inframammary fold (IMF) incision because they do not want others to notice any scar on their breasts when they are in a public bath, swimming pool, or any other public places. From the ethnic perspective, Asian skin is darker than Caucasian skin and has a higher risk of hypertrophic and hyperpigmentation scarring.

The axillary approach has been questioned because of the blind, inaccurate, and bloody dissection. However, with the help of endoscopy, the axillary approach can have clear visualization and precise dissection, ensuring much better results than blind dissection. It has been demonstrated that axillary approach breast augmentation is a safe technique that has no impact on sentinel lymph node detection.[1] If the dissection is appropriately performed, there is minimal chance of damaging the nerves and vessels. The periareolar incision is infrequently used, mainly because of the risk of changes in nipple–areolar sensibility, interference with milk ducts, and therefore possible bacterial contamination of implants.[2]

In this chapter we discuss two dominant primary implant breast augmentation techniques in an Asian population: silicone implant subpectoral breast augmentation via IMF incision and endoscopy-assisted axillary incision.

Indications and Contraindications

IMF incision is suitable for almost all cases, especially for the difficult ones such as those involving ptosis, low pole constriction, and complicated revision surgery.

Axillary incision is preferred for patients who wish to hide the scar away from the breast. There are some limitations for this incision, so the relative contraindications are as follows:

- Severe breast ptosis needing mastopexy
- Lower pole constriction/short nipple-to-fold distance and need to stabilize new IMF
- Tubular breast
- Snoopy nose deformity
- Complicated breast revision cases (IMF approach needed)

Preoperative Evaluation and Special Considerations

Patients who seek breast augmentation have an extended consideration period and have collected much information on the internet. Sometimes, the more information they have, the more unrealistic their expectation can be, and the more confused they are due to "Dr. Google." Patients should be informed about all the surgical procedures and details, including all the possible complications and risks. The formal consent form should be signed after all consultations.

A careful history and physical examination should be applied when approaching prospective breast augmentation patients. Meticulous attention should be given to the following:

- In evaluating breast development, the surgeon should inspect both breasts for symmetry, checking contour, fullness, nipple–areola position, the relationship between the position of the areola complex and the IMF, the relative relationship between breast and chest wall, and the distance to cleavage; and examine for musculoskeletal abnormalities such as scoliosis and soft tissue abnormalities (mass or nodule).
- Either obvious or subtle, asymmetries should be noted and explained to patients, ensuring that they are aware of all the details about their breast and chest wall beneath it.
- Pregnancy and breastfeeding history and breast mammogram history should be recorded.

Preoperative Measurement and Markings

Detailed measurements are necessary for both patients' communication and making a surgical plan. Most importantly, dimensions of the breast can give surgeons guidance

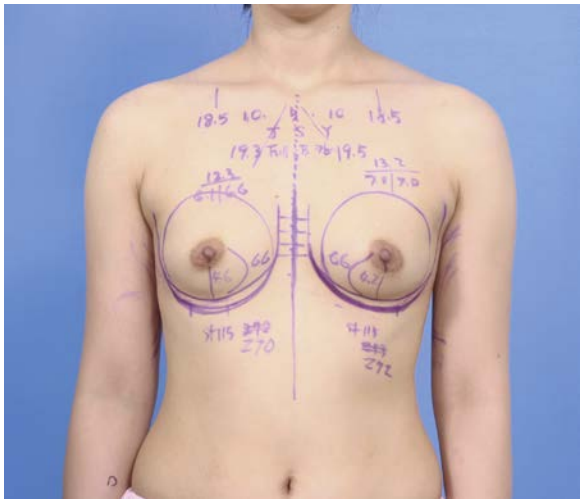
TABLE 5.1 Preoperative Measurements

Measurement for Education	Measurement for Surgical Planning
BW	BW
SN-N	SN-N
C-N	MSS
N-IMF	C-N
N-N	PT
N-M	N-IMF
DAC	
PT	
MSS	
D-NS	
D-IMFS	

BW, Breast width: first, draw a vertical line 1.5 cm away from the midline; horizontal distance between this line and the homolateral anterior axial line is the breast width; *C-N,* distance from the midpoint of the clavicle to the nipple; *DAC,* diameter of the areola complex; *D-NS,* vertical distance of two nipples, which means the difference level of both nipples; *D-IMFS,* the vertical distance of two inframammary folds, which can present the asymmetry on both sides; *MSS,* maximum stretch of tissue envelope; *N-IMF,* vertical distance from the nipple to the inframammary fold in the mid-meridian; *N-M,* nipple to midline; *N-N,* nipple-to-nipple distance; *PT,* soft tissue pinch test—thickness of soft tissue in upper pole; *SN-N,* distance from the supra-notch to nipple on each side.

to choose the right implants for optimal results. Here we classify all the essential dimensions into two groups: measurement for education (aims to help patients to know more about their breast and understand the results) and measurement for surgical planning (Table 5.1).

All those measurements should be informed to patients and recorded in the medical chart. Based on the individual breast dimensions, proper implants should be selected to match the patient's expectation and to ensure the safety of the long-term follow-up. The measurement and marking should be performed in a standing position, and all the essential measures can be placed on patients' breasts before the surgery (Fig. 5.1).



• **Fig. 5.1** All the measurement and marking should be performed in a standing position, and all the essential measurements can be marked on the patient's body before the surgery.

Surgical Technique

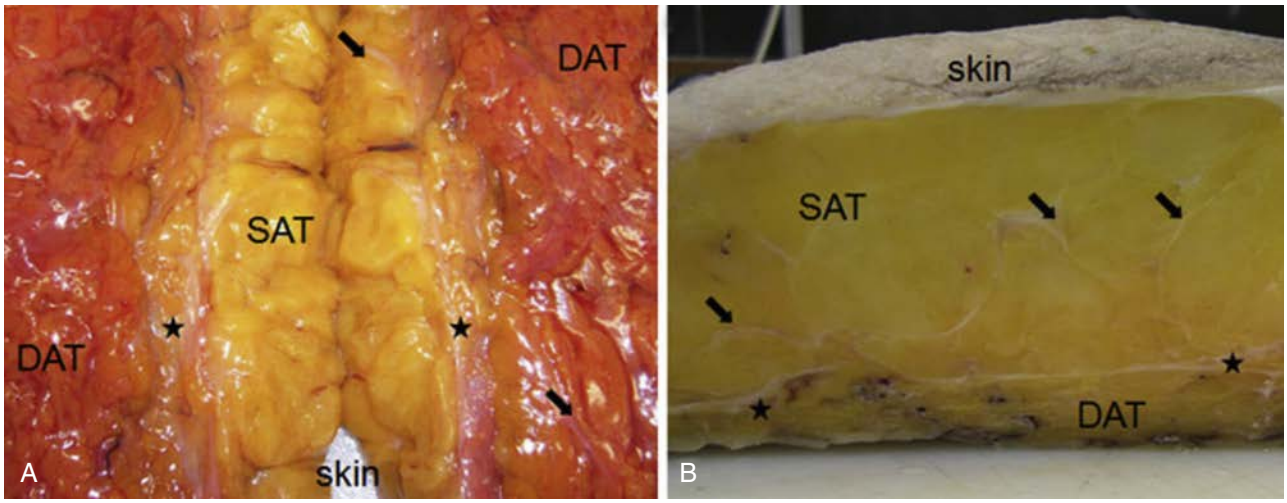
Subpectoral Breast Augmentation via Inframammary Fold

Relevant Surgical Anatomy

Lancerotto et al[3] have described that there are three layers of abdominal subcutaneous adipose tissue: a superficial adipose tissue (SAT), a membranous layer (ML), and a deep adipose tissue (DAT) (Fig. 5.2). The SAT is made of large fat lobes encased in fibrous septa in a honeycomb-like structure and has nearly constant characteristics throughout (Fig. 5.3). These septa (retinacula cutis superficialis) appeared well defined, mostly oriented perpendicular to the surface, and mechanically strong, anchoring the dermis to the deeper planes. The DAT is flatter, less well defined, and has smaller fat lobes, and the fibrous septa (reticular cutis profunda) were less consistent and mostly obliquely oriented. These septa permit lateral displacement readily, the mechanical strength of these septa is weak, and they permit lateral sliding. The breast gland is an ectodermal origin structure contained in a superficial adipose tissue, in which strong reticular cutis superficialis hold up the breast gland between the ML and the dermis at the IMF level without herniation. Without the fixation of the ML and SAT to deep fascia, the DAT layer can be separated easily with the loosening of the reticular cutis profunda by weight of the implant in a wedge-like fashion, in which case, there is a possibility of bottoming out of the implant. It is the main reason why new IMF line should be reconstructed with a fixation method in breast augmentation with implant regardless of incision choice. Without the fixation, the chance of inferior malposition of implant always exists, especially with smooth-surfaced implants and even microtextured implants (Fig. 5.4A–C).

Preoperative Markings

Placement of the incision location precisely in the new IMF is the key factor to better aesthetic outcome. Thus labeling the new IMF and identifying the incision location is vital before undergoing surgery. The breast width, the type of breast implant selected, the pocket location, the strength of the fibrous connections around the existing IMF, and the degree of the breast ptosis should all be considered when redefining the new IMF and incision. The author's personal preference is to use Charles Randquist's formula because it is simpler and easier to follow and practice than others, which mainly based only one crucial factor: the breast implant width (Table 5.2). The IMF incision should be placed in



• **Fig. 5.2** (A) "Surgical" description of abdominal subcutaneous tissue. A fresh full-thickness specimen, reversed and cut perpendicularly to the skin. (B) Slice of the formalin-fixed specimen. *Arrows,* Retinacula cutis; *DAT,* deep adipose tissue; *SAT,* superficial adipose tissue; *stars,* membranous layer.[3] (Courtesy Dr. Luca Lancerotto.)

the darkest area under the shadow of the breast mound on standing position. The length of the incision will be 4–5cm, depending on the implant size.[4–8]

Surgical Procedure

After the surgical preparation, two critical steps should be performed to prevent contamination: use of nipple shields and use of an incision shield with sterile transparent film. Because the breast is of ectodermal origin, the nipple can be a continuous bacterial dissemination focus during the operation even with bactericidal skin preparation. Use of an incision shield on the IMF incision can protect incision margin skin injury and minimize the risk of implant contamination during the insertion process.

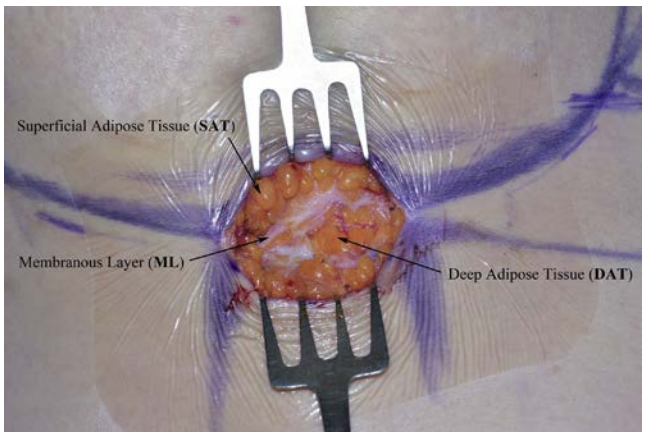
1. *Skin incision*

The incision should be made deep to superficial dermis along the new IMF with a scalpel and shift to monopolar needle electrocautery to avoid unnecessary bleeding.

2. *Dissection through subcutaneous fat to expose the pectoralis major muscle*

The surgeon should continue to dissect through the dermis and subcutaneous fat, straight down to the muscle layer. Make sure that all the dissections are quick, neat, and vertical to the skin surface. For this purpose, retraction of both chest flap and abdominal flap with retractor should be without traction, in order not to deviate up or down. Once the musculature is visible, the surgeon should check, locate, and identify the pectoralis major muscle carefully. The muscles at this level are the pectoralis major muscle, rectus abdominis muscle, external oblique muscle, serratus anterior muscle, and intercostal muscles.

Check the direction of muscle fibers, and then use the retractor to grasp the mammary gland and subcutaneous tissue and to elevate pectoralis major musculature anteriorly, which will be very helpful to identify the lower lateral origin

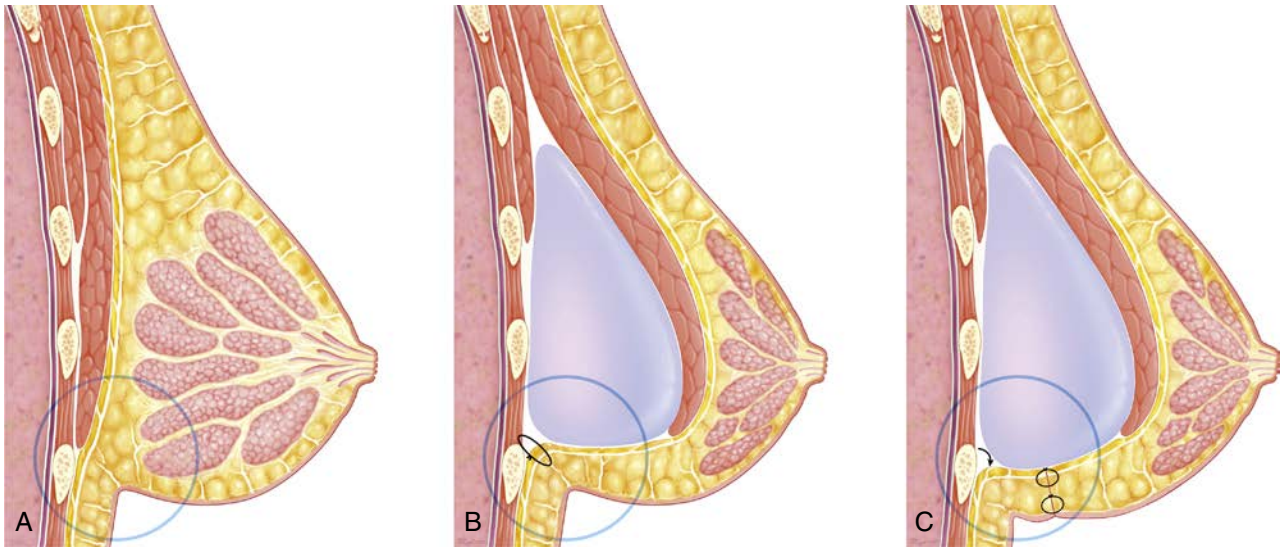


• **Fig. 5.3** Three layers of abdominal subcutaneous adipose tissue: a superficial adipose tissue *(SAT),* a membranous layer *(ML),* and deep adipose tissue *(DAT)* at the IMF level.

of the pectoralis major muscle (Fig. 5.5). Differentiation of pectoralis major muscle from intercostal muscles is critical not to produce a pneumothorax, which comes from penetrating the intercostal muscles. The surgeon separates the pectoralis major muscle fibers from rib and its costal origin, leaving a 5-mm length of the stump at the origin to prevent inadvertent cutting of perforator, which may retract to the intercostal space, making bleeding difficult to control.

3. *Creation of implant pocket*

When the lower and lateral costal origin of pectoralis major muscle has been divided laterally, the subpectoral space, a loose areolar space, can be found easily. Use the monopolar needle or forceps electrocautery to cut through the muscle fibers attached to the chest wall and to create a precise pocket. The width of the pocket is from the parasternal line, which follows appearance points of a medial cutaneous branch of the intercostal nerves to the anterior axillary line, which usually follows the line of appearance



• **Fig. 5.4** (A) Strong reticular cutis superficialis holds up the breast gland between the membranous layer and the dermis at the IMF level. (B) The loose reticular cutis profunda should hold up the breast implant between the membranous layer (superficial fascia) and deep fascia of the chest or abdomen with suture fixation, at the new IMF level. (C) Without the fixation of the superficial fascia to deep fascia, the deep adipose tissue layer can be separated easily with the loosening of the reticular cutis profunda by weight of the implant in a wedge-like fashion. © Hong-Ki Lee.

points of a lateral cutaneous branch of intercostal nerves. The horizontal dimension of dissection should just fit; should this be excessive, this may cause injury of the lateral cutaneous branch of the fourth, fifth or sixth intercostal nerve and widening of intermammary distance with the supine position.

The dissection plane will follow Tebbetts' "dual-plane principle."[9] The general sequence should begin in a cranial direction, continue medially, and finish laterally. When the dissection continues cranially into the upper pole, surgeons should pay special attention to make sure not to deviate under the serratus anterior or pectoralis minor. The medial dissection also should be cautious and precise. The release of the pectoralis major muscle's sternocostal origins in the medial border should be very cautious; the dissection should stop at about 4 o'clock on the right side and about 8 o'clock on the left side. Cranially from 4 and 8 o'clock level to 3 o'clock level, decreasing the cutting amount of pectoral sternal origin with gradual tapering can leave intact attachment of pectoralis major to the sternal origin. Leaving the sternal origin of the pectoralis major muscle is very important to prevent complications or unpleasant results, such as synmastia, neurovascular bundle injury, and future implant edge visibility and animation deformity. The dissection continues upward in a cranial direction, releasing the uppermost parts of the pocket just as needed with implant height. The last dissection will be the lateral part where the tissue should be released appropriately to create a fit and sufficient pocket for the selected implant.[10]

A sizer can be a more accurate option to precisely check the dimensions of the pockets.

4. *Implant insertion*

Soak the implants in an antibiotic solution or povidone-iodine (Betadine). The surgeon should change into a new pair of powderless gloves and be careful not to touch anything except the implants during insertion. Insertion of the implant into the pocket should be carried out carefully and consistently. There should be no rough force, nor a sharp instrument to insert. An insertion sleeve can be very helpful to squeeze the implant into the pocket. An insertion sleeve can avoid potential implant shell and gel injury and prevent any contamination of the implant from surgeons' hands or surrounding tissue surface.

Once the implant has been inserted, the surgeon should check the right orientation and position of the implant, especially the anatomic implant. The surgeon can look at the line or markings on the anterior surface of the implant to make sure there is no upside down or rotation. Usually, no drain is needed for primary breast augmentation through IMF incision.

5. *Wound closure*

Wound closure is another basic procedure in IMF incision breast augmentation. A multilayered wound closure technique can anchor the incision wound to the chest wall right at the new IMF, without any shift upward or downward.

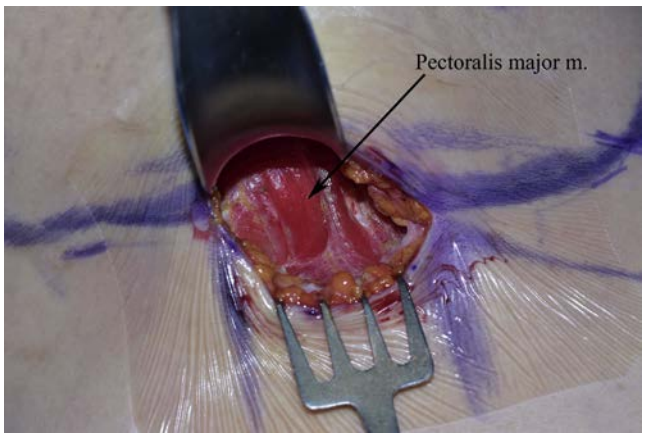
The wound is closed in three layers as follows. The first layer of sutures is three deep layer sutures with 2-0 Vicryl.

Three deep layer sutures are made at the central, medial, and lateral end of incision opening. The central deep layer suture is not tied at the beginning. For enhancing the medial and lateral deep sutures visualization, the central suture can be knotted tightly after medial and lateral suture knot formation. It is crucial to grip the fascial structure firmly so that the suture does not cut through the soft tissue. However, the surgeon must be careful not to go too deep to avoid pleura injury. The tension becomes minimal, and the edges

TABLE 5.2 How to Redefine the New IMF

Breast Width (BW)	11.0 cm	11.5 cm	12.0 cm	12.5 cm	13.0 cm
New N-IMF	7.5 cm ± 0.5 cm	8.0 cm ± 0.5 cm	8.5 cm ± 0.5 cm	9.0 cm ± 0.5 cm	9.5 cm ± 0.5 cm
Fine Adjustment	+0.5 cm	Tight skin > 2–4 cm pinch test > Lower pole fullness			
	–0.5 cm	Loose skin > upper pole fullness			

IMF, Inframammary fold; *N-IMF,* vertical distance from nipple to inframammary fold in the mid-meridian.
Courtesy Charles Randquist. From Tebbetts, J.B., 2006. Dual plane breast augmentation: optimizing implant-soft-tissue relationships in a wide range of breast types. Plast. Reconstr. Surg. 118, 84.



• **Fig. 5.5** Differentiation of pectoralis major muscle from the intercostal muscles. Use the retractor to grasp the mammary gland and subcutaneous tissue and to elevate pectoralis anteriorly, which will be very helpful to identify the lower lateral origin of the pectoralis major muscle.

of the wound can approximate each other with everting manner after first deep layer closing is adequately and firmly performed.

The second layer of sutures is superficial fat and dermal layer suturing, aiming to approximate the wound edges further and to bring tissue into a crest on both sides of the wound. Inverted sutures with long absorbable monofilament thread, like 3-0 PDS thread, which can last longer, can be used to reduce the dermal layer tension (Fig. 5.6A–F).

The third layer is skin suturing. Either a straight running suture with non-absorbable suture or paper skin tape can be used, depending on surgeon's preference. This layer closing aims to approximate the superficial dermis and epidermis adequately.

6. *Bandaging*

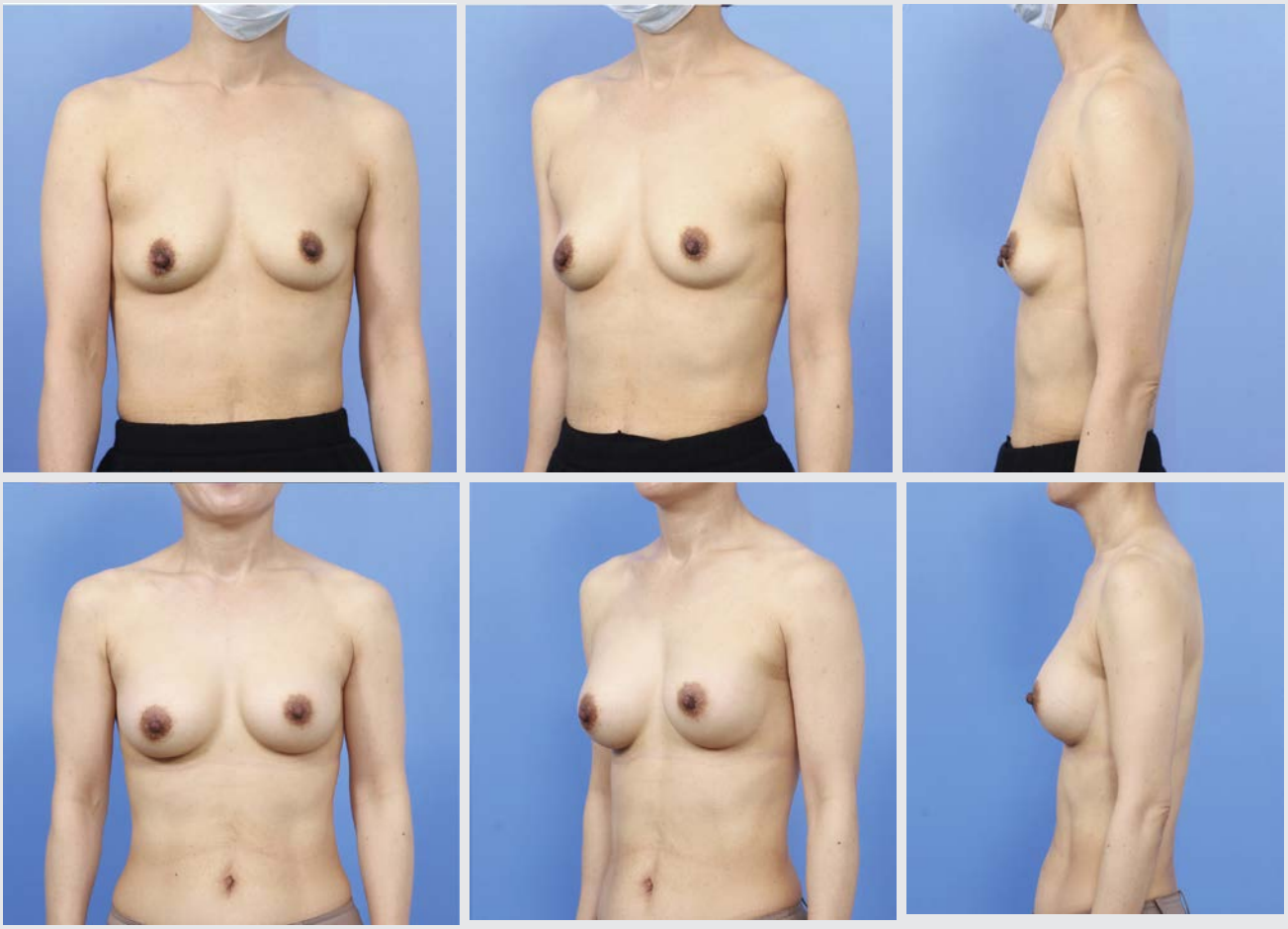
Strip bandaging is placed on the upper pole to compress upper part of the breast and limit the unnecessary early movement of pectoralis major muscle. Upper pole bandaging can also help implant–tissue integration if textured implants are used and improve lower pole tissue expansion in constricted cases as soon as possible. Sometimes, suggest the patient wear the upper pole strip bandage for 1 month.

Postoperative Care and Expected Outcomes

Patients can be discharged after recovering from anesthesia, or stay in the hospital for one night. After removal of skin sutures, paper skin tape or silicone sheet can be applied for several months to minimize the scar hypertrophy, and bleaching cream can be recommended on the wound to prevent postinflammatory hyperpigmentation.

CASE 5.1

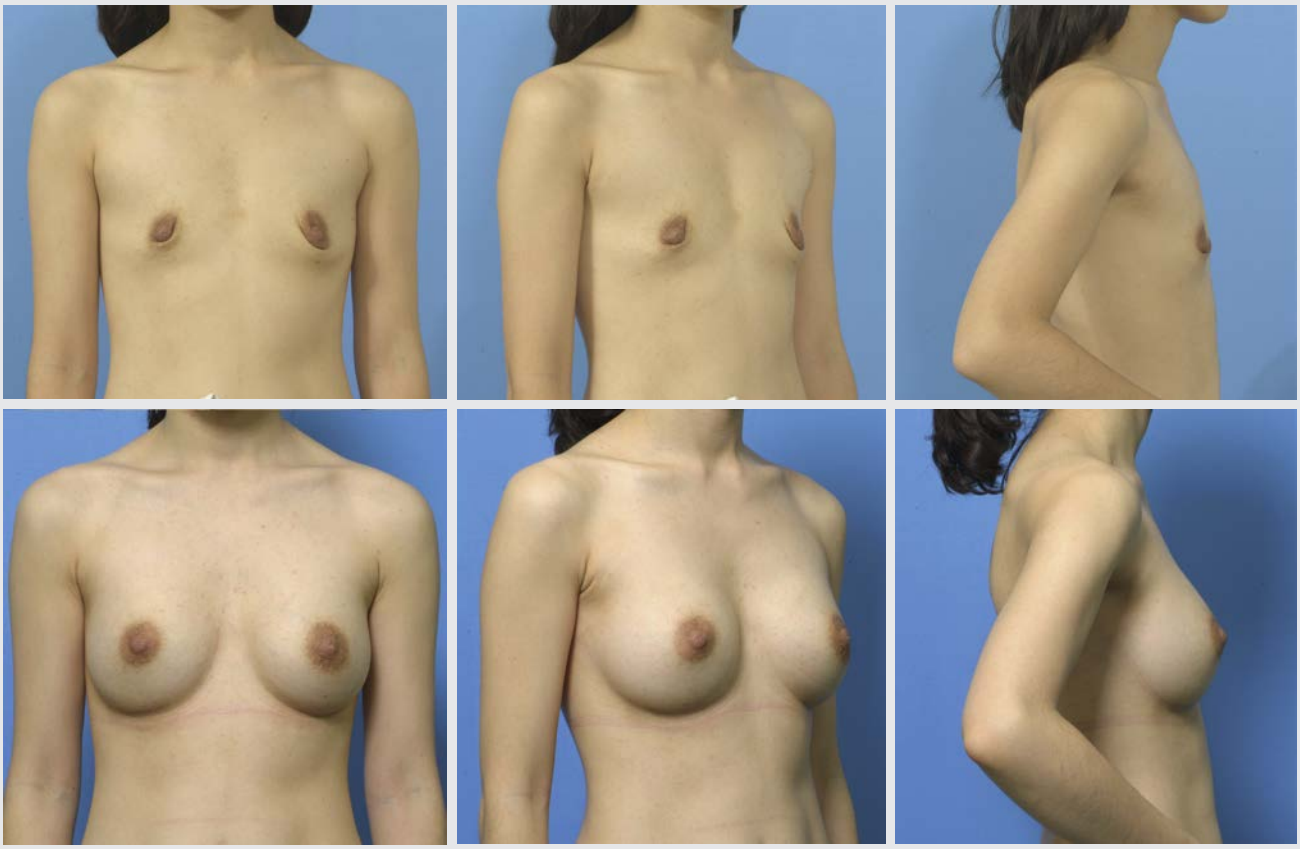
One-year follow-up in a 32-year-old woman after an IMF incision approach. The incision scar has a definite position under the shadow breast mound on new IMF.



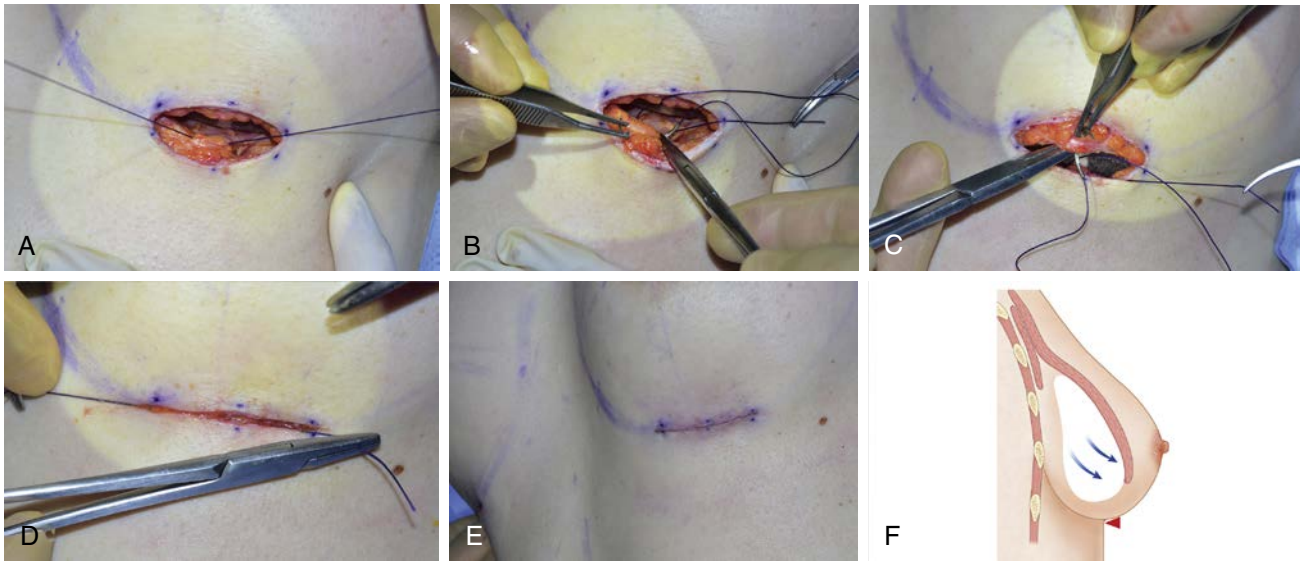
• **Case 5.1** One-year follow-up in a 32-year-old woman after an IMF incision approach. Frontal view, three-quarters view, and lateral view. The patient has a definite IMF line *(top).* Round, textured, 290-cc implants were used on both sides. The incision scar has a definite position under the shadow breast mound on the new IMF *(bottom row*).

CASE 5.2

One-year follow-up in a 42-year-old woman after an IMF incision approach. The incision scar has mild pigmentation.



• **Case 5.2** One-year follow-up in a 42-year-old woman after an IMF incision approach. *(Top)* Frontal view, three-quarters view, and lateral view. The patient does not have a definite IMF line, has breast ptosis, and has very loose skin envelope after breastfeeding. Round, textured, 272-cc bilateral implants were used. The incision scar has a definite position under the shadow breast mound on the new IMF with very mild pigmentation similar to her nipple–areola complex.

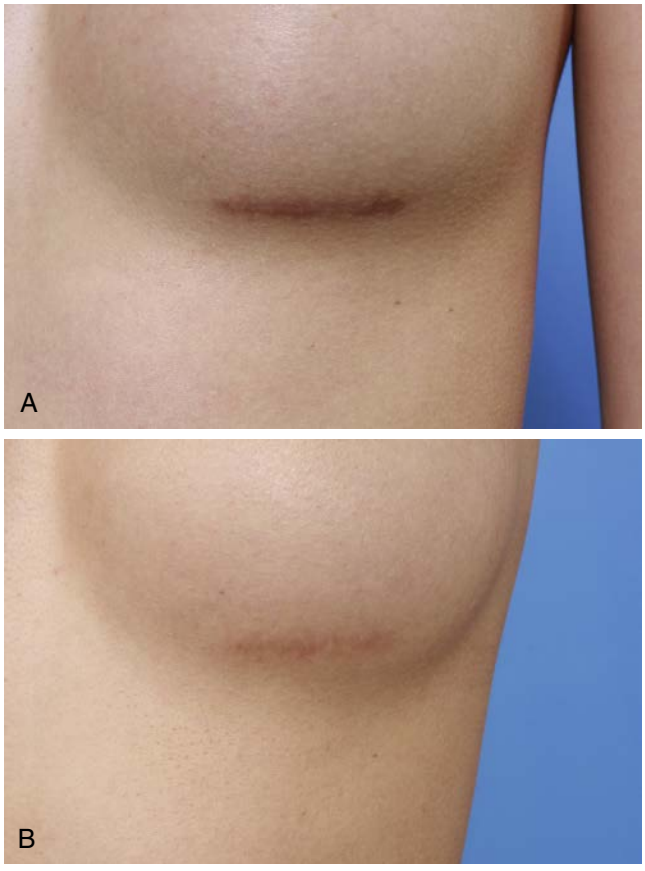


• **Fig. 5.6** IMF wound closure in three layers. (A) Bite deep with needle in fascia. (B) Superficial fascia of the abdominal flap bite from deep to superficial. (C) Superficial fascia of the breast flap bite from deep to superficial. (D) Knot tightening to relieve enough tension. (E) IMF fixation is important to prevent implant bottoming out and to promote the controlled expansion of the lower pole. (F) IMF fixation allows the controlled expansion of the lower pole without bottoming out of the implant. © Hong-Ki Lee

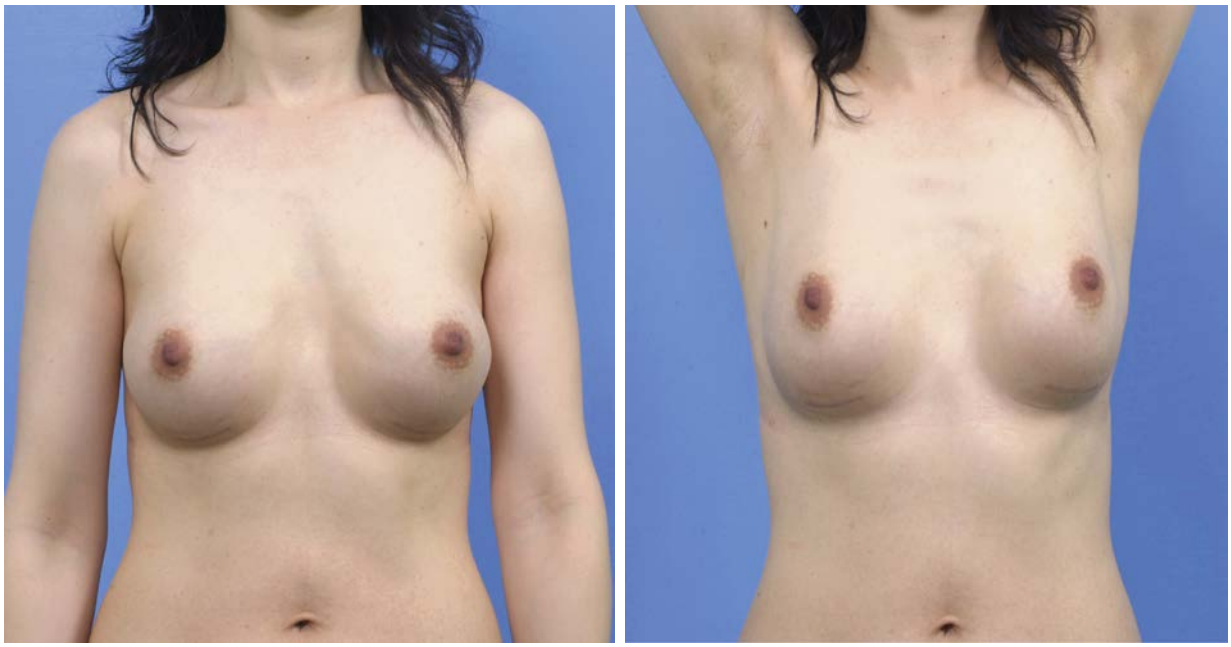
Management of Complications

The common complications with IMF incisions are noticeable IMF scarring: hyperpigmentation and hypertrophy (Fig. 5.7A, B). Postinflammatory hyperpigmentation (PIH) comes from an inflammatory process that triggers melanocytes to release excessive melanosome in the basement membrane—the boundary between dermis and epidermis. It has been my experience that the patient who has dark nipple–areola complex or pigmented scar on other parts of the body can be at high risk for hyperpigmentation. In those cases, an incision other than IMF can be recommended or full precaution of a chance of pigmentation with informed consent is an essential part of patient education before surgery. Hypertrophy of scarring comes from trauma to the skin and excessive tension across the incision. When there is hyperpigmentation or to prevent PIH, a combination of steroid and hydroquinone can be applied at least for 3–4 months from 1 month after operation. When there is hypertrophic scar formation, or to avoid hypertrophic scarring, silicone gel sheet can be applied after 1 month for a year. Early injection of long-acting steroid, administered less than 6 months after surgery, may result in depressed scar atrophy at long-term follow-up. I prefer that the injection of steroid be delayed at least 1 year postoperatively.

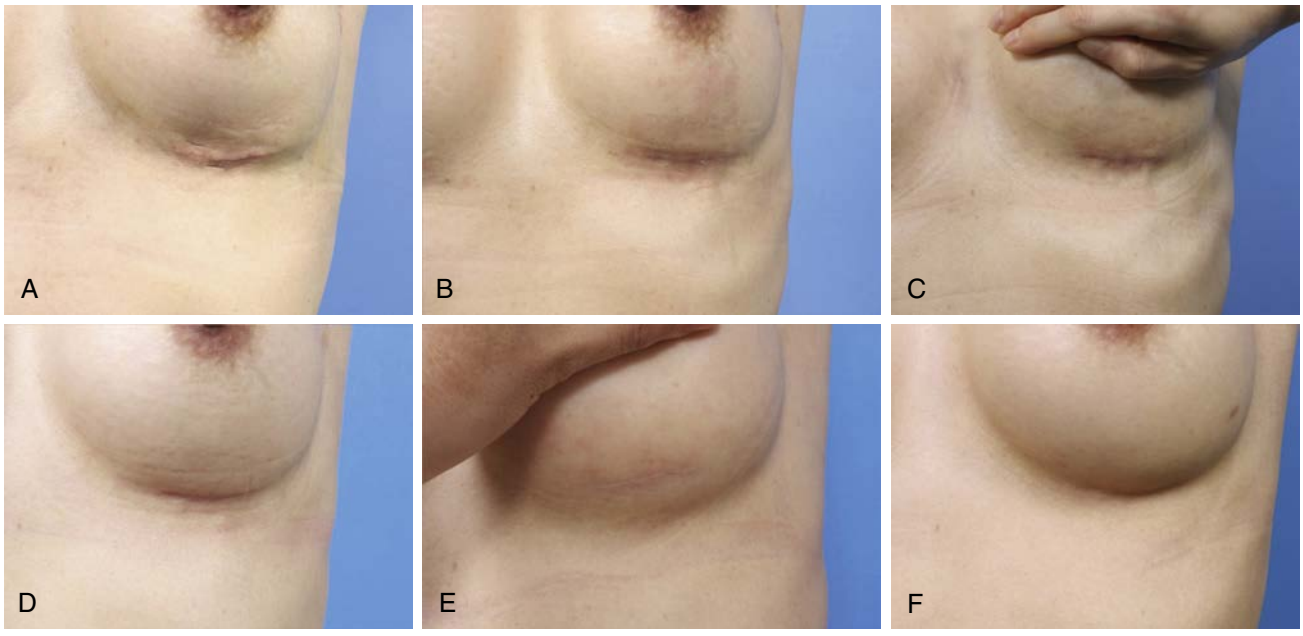
Other complications with IMF incision are an inappropriate scar location that is not hidden along the new IMF line. This can be upward on the breast mound or inferior to the incision on the upper abdominal wall (Fig. 5.8). Chest wall scarring inferior to the incision comes with incomplete dissection on the inferior part of pocket or too much inferior direction suture of the superficial fascia to the deep fascia. The proper fixation of the superficial fascia



• **Fig. 5.7** Hyperpigmentation and hypertrophy of the IMF incision scar. Traction maceration injury during the operation induced dark pigmentation and hypertrophy of the incision scar. (A) 1 year postoperatively; (B) 3 years postoperatively.



• **Fig. 5.8** Inappropriate location of the incision scar on the breast mound not hidden in the IMF may come from a failure to fix the superficial fascia to the deep fascia on the chest wall, especially with the smooth-surfaced implant and microtextured implant. Pictures show the scar 1 year postoperatively.

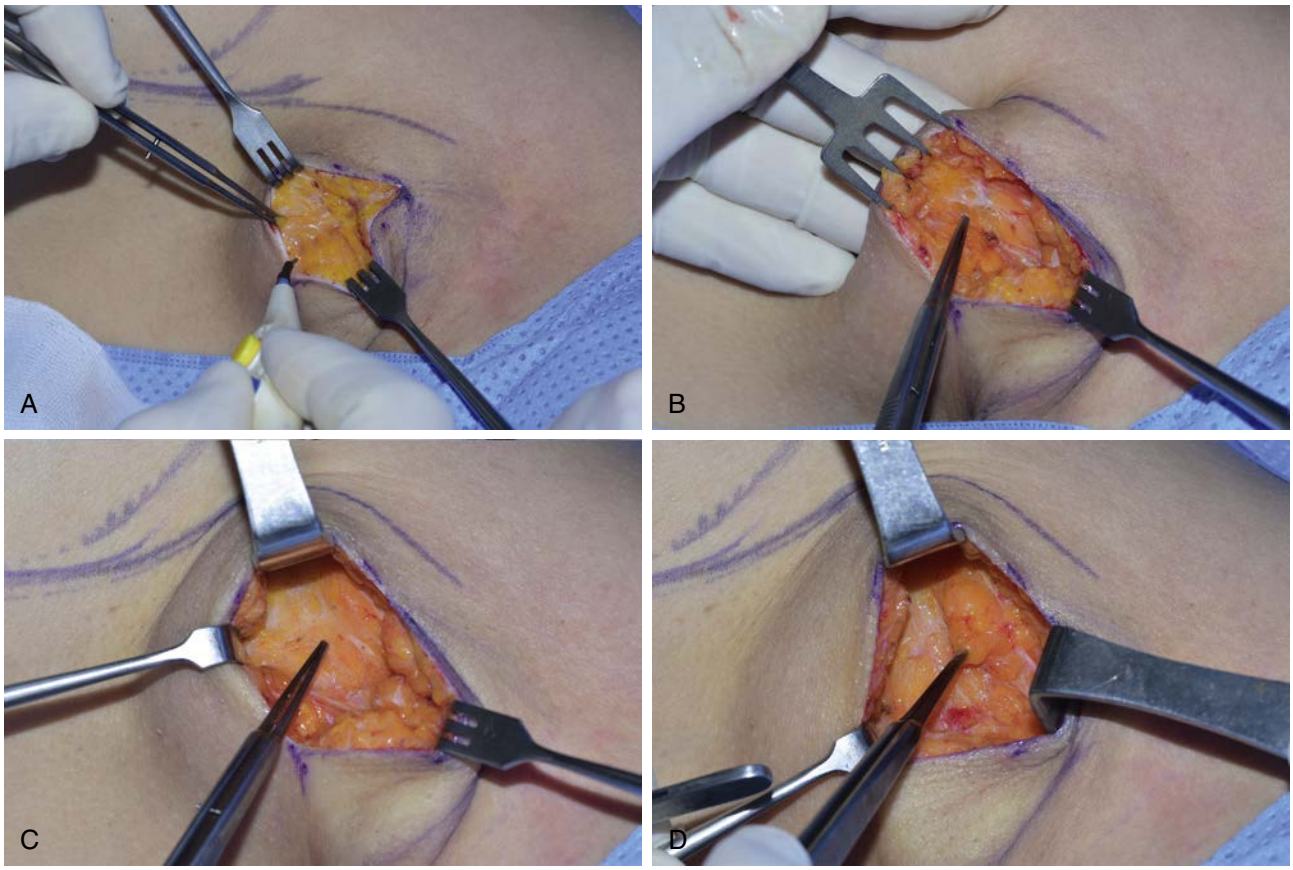


• **Fig. 5.9** Properly managed IMF incision scar during follow-up. Follow-up at (A) 1 week; (B) 1 month; (C) 3 months; (D) 6 months; (E) 9 months; and (F) 1 year.

to deep intercostal fascia or costal cartilage is mandatory not to make inadvertent separation of the abdominal flap from the deep fascia, which may result in inferior migration of a smooth surface implant. Depressed scar adhesion at the incision comes from the adherence of the dermis to the deep fascia. Only the superficial fascia and deep fat, but not the dermis, should be grasped to fix the superficial fascia to the deep fascia. With that method, intervening subcutaneous superficial fat tissue can give a smooth contour without the formation of deeply depressed fixation (Fig. 5.9A–F).

Subpectoral Plane Breast Augmentation via Axillary Incision With Endoscopy

The development and refinement of endoscopic instrumentation and techniques allowed surgeons to dramatically



• **Fig. 5.10** In the axilla region the subcutaneous fat can be recognized as skin, superficial adipose tissue, membranous layer, and deep adipose tissue. (A) Superficial adipose tissue has a firm and cuboidal appearance. (B) Reticular cutis superficialis. (C) Membranous layer. (D) The deep adipose tissue has a loose, flatter appearance and can be easily displaced.

improve the accuracy of transaxillary augmentation by providing direct visualization during pocket dissection and providing a control that enables more precise modification of pectoralis origins. Most importantly, the scar is off the breast mound, keeping the integrity of the mammary parenchyma and of course the axillary lymphatic channels.[1] This approach avoids the blunt, bloody, and imprecise nonendoscopic technique of axillary breast augmentation.

Relevant Surgical Anatomy

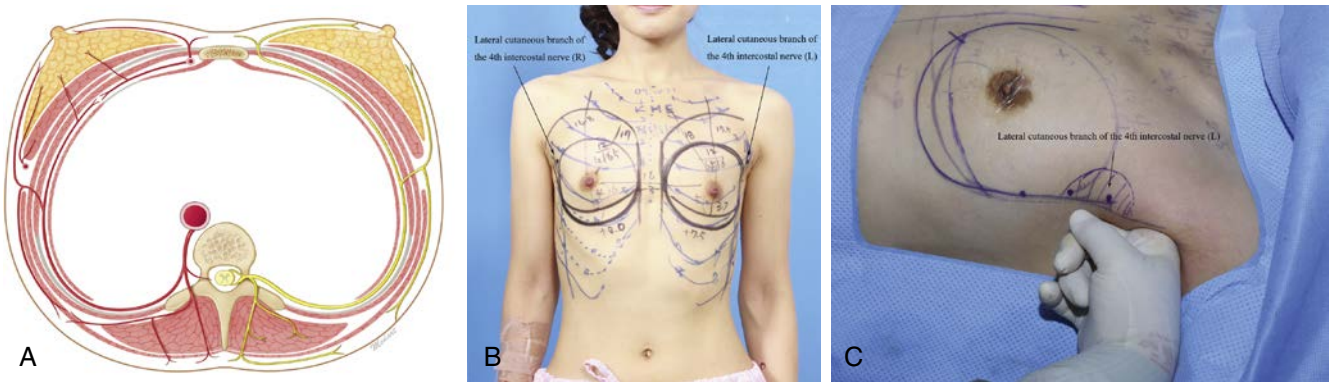
The breast is an ectodermal structure contained in a superficial adipose layer. Axillary fascia is a part of deep subcutaneous fascia, extending to the pectoralis muscle fascia and the brachial fascia, which covers the vital structures like the brachial plexus and axillary artery and veins. Therefore, in the axilla region the soft tissue could be recognized as skin, SAT, ML, DAT, and axillary fascia from superficial to the deep direction (Fig. 5.10A–D). If the dissection in axilla stays on the ML (superficial fascia) until the lateral border of the pectoralis major, the chance of damaging the brachial plexus, axillary vessels, intercostobrachial and medial brachial cutaneous nerve branches, and lymphatic channel is very rare because they are located deep to the dissection plane beneath the axillary fascia.

TABLE 5.3 Sensory Innervation of the Nipple–Areola Complex in 28 Cadaver Dissections

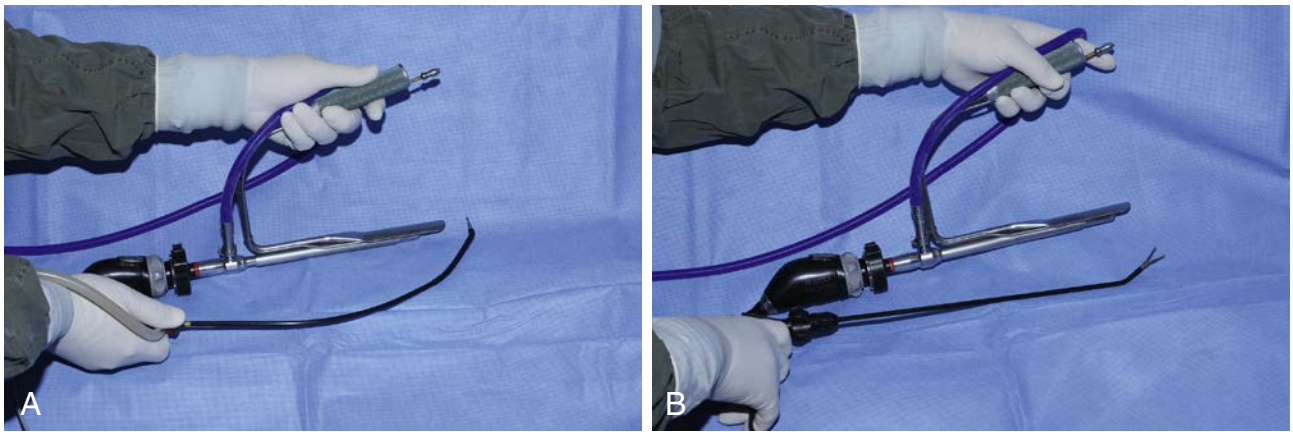
Lateral Cutaneous Branches of the Intercostal Nerve (LCB)		Medial Cutaneous Branches of the Intercostal Nerve (MCB)	
Third	3.6% (1/28)	Third	21.4% (6/28)
Fourth	79.0% (20/28)	Fourth	7.1% (2/28)
Fifth	3.6% (1/28)	Third and fourth	57.1% (16/28)
Third and fourth	7.1% (2/28)	Fourth and fifth	10.7% (3/28)
Fourth and fifth	7.1% (2/28)	Third, fourth, and fifth	3.5% (1/28)

Data from Schlenz, I., Kuzbari, R., Gruber, H., Holle, J., 2000. The sensitivity of the nipple-areola complex: an anatomic study. Plast. Reconstr. Surg. 105 (3), 905-909.

Another notable structure is the lateral cutaneous branches of fourth intercostal nerve, which is the most important sensory nerve branch for nipple–areola complex.[11] Table 5.3 summarizes the sensory innervation of



• **Fig. 5.11** Superolateral pocket dissection to save the lateral cutaneous branch of the fourth intercostal nerve. (A) Medial and lateral cutaneous branches innervate the nipple–areola complex along the dermatome. (B) Marking on the rib and costal cartilage in a standing position can identify the location of the medial and lateral intercostal nerves. (C) The lateral cutaneous branch of the fourth intercostal nerve has a location very near to the axillary incision, just inferior to the lateral pectoral fascia opening in the supine position with arm abduction. To protect the nerve, the shadow area where the fourth intercostal nerve might pass by should not be dissected.



• **Fig. 5.12** Endoscopic instruments. (A) An endoscope, retractor, and curved electrocautery dissector. (B) Monopolar electrocautery curved grasper.

the nipple–areola complex. This nerve appears just inferior to the opening of the lateral pectoral fascia at the lateral border of pectoralis minor muscle when the patient is lying down with the arm in the abduction position. This nerve usually accompanies the perforators of the lateral thoracic artery, which runs beneath and along the lateral border of pectoralis minor muscle, so dissection to the lateral pocket just after the pectoral fascia opening should not go directly inferior. The superolateral pocket dissection should save and detour around the appearing point of the lateral cutaneous branches of the fourth intercostal nerve at the lateral border of pectoralis minor muscle to prevent paresthesia or numbness of the nipple–areola complex (Fig. 5.11A–C).

Endoscopy Instrument

Endoscopic equipment for an axillary approach should include several essential tools: an endoscope, retractor, curved electrocautery dissector, and monopolar curved grasper. Notably, the curved electrocautery grasper is very useful to control the bleeding from the perforators just inferior to the medial and lateral intercostal sensory nerves without damaging the nerves and the intercostal perforators, which appear just inferior to the convex ribs and costal cartilages (Fig. 5.12A, B).

Preoperative Markings

Preoperative marking for the axillary approach is the same as for the IMF approach, except for adding axillary incision location marking. Axillary incision location is critically important to minimize scar visibility. Optimal incision location is in the hair-bearing skin of the deepest apical portion of the axillary hollow, with the anterior-most extent of the incision posterior to the lateral border of the pectoralis. Incision length can vary from 4–6 cm to accommodate diverse instrumentation and the size of implants. Axillary scar quality and minimizing damage to implants during insertion are far more critical than incision length.

Surgical Procedure

1. *Patient position*

Optimal patient positioning is essential for optimal axillary exposure while minimizing risks of arm hyperextension, which can produce brachial plexus and sensory nerve injury. At all times, the arm should never be raised to a position higher than 90 degrees to the torso.

2. *Skin incision*

Injection of a vasoconstrictive agent (e.g., lidocaine with epinephrine) along the incision line may reduce dermal bleeding. Tattoo-marking with Gentian violet ink on both sides of the incision before incision can help precise realignment of skin edges at closure. The skin incision deep into the midlevel dermis with a blade is followed by monopolar needle electrocautery cut through the deep dermis and superficial fat to the superficial fascia perpendicularly.

3. *Dissection along the superficial fascia plane toward the lateral border of the pectoralis major muscle*

After reaching the superficial fascia, which is a membrane structure between superficial fat tissue and deep fat tissue and is usually less than 1 cm in depth, the dissection should follow the fascial plane, parallel to the breast skin surface, medially and anteriorly, not posteriorly toward the lateral border of the pectoralis major muscle. The dissection performed along the superficial fascia layer to the lateral border of the pectoralis major muscle, cutting into the deep loose fat layer on the border of the pectoralis major muscle, and the confirmation of the space between the pectoralis major and minor can minimize all those risks (Fig. 5.13A, B).

4. *Entry into the subpectoral space*

After careful identification of the lateral border of the pectoralis major muscle, the surgeon makes a 4-cm-long incision with Metzenbaum scissors through the deep subcutaneous fat and the superficial pectoral fascia overlying the lateral border of the pectoralis in a superior-inferior direction along the muscle fiber to enter the subpectoral space. Check the pectoralis minor on the bottom and confirm the space between pectoral major and minor muscles. Entering the subpectoral plane you will find a loose areolar tissue, which can be dissected easily with fingers. But only the space for insertion of the endoscopic retractor should be prepared with the index finger, without any bleeding (Fig. 5.14A–E).

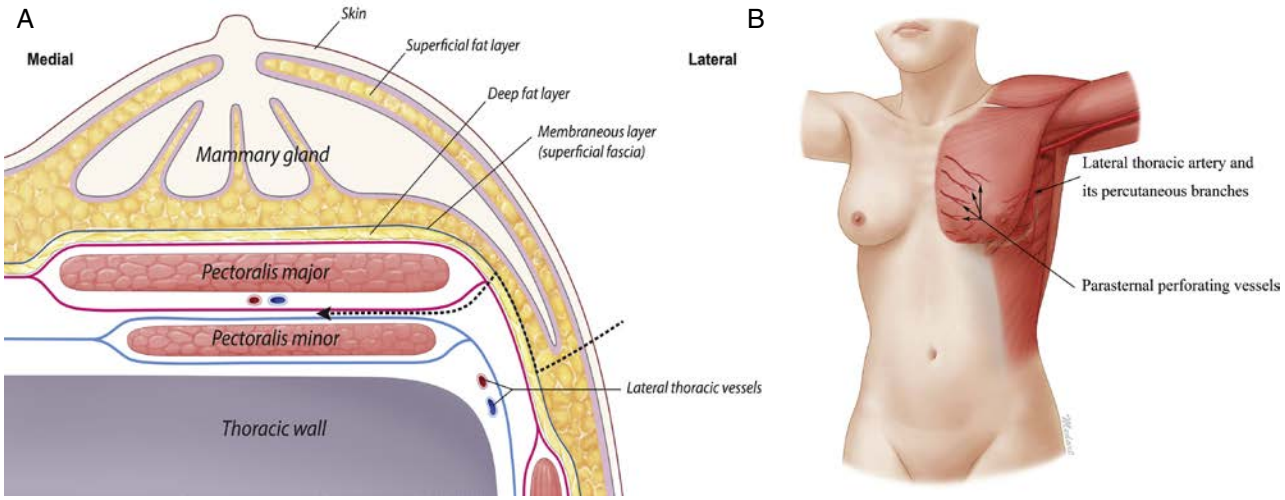
5. *Insert the endoscopy instruments*

Once the endoscopy retractor is in position, all the dissection must be carried out under direct vision using an endoscopic control, never with a finger or blunt instrument dissection.

6. *Create the subpectoral implant pocket*

In the lateral and superior part of the subpectoral pocket, there is only loose areolar tissue and few muscle fibers attached to the ribcage, whereas in the medial and inferior part, muscular origin attachments exist from sternum down to ribs, which looks like many strips attached from ceiling to floor. The retractor can lift the pectoralis major up to create enough of an optical cavity for the endoscopic coagulation dissector to detach those muscular strips, and the suction tube can evacuate the smoke simultaneously. With the retractor stretching the muscle fibers, the surgeon can easily find and coagulate the vessels before cutting them. This is called *prospective hemostasis,* and it will prevent blood staining of tissue, produce much less inflammation, and lead to less pain postoperatively.

As discussed earlier, the lateral cutaneous branch of fourth intercostal nerve should be protected with the detour dissection; go slightly medially first and then inferiorly, instead of going directly inferiorly. (Video 5.1)



• **Fig. 5.13** Axillary dissection pathway and relationship of important structures in the axilla area. (A, *arrow*) Dissection along the membranous layer to reach the lateral border of the superficial pectoral fascia can enter the space between the pectoralis major and minor muscle. (B) The lateral thoracic artery runs beneath and lateral border of pectoralis minor muscle. The dissection beneath the pectoralis minor can have a high risk of damaging the lateral thoracic artery and its percutaneous perforating branches, which can produce huge bleeding and hematomas.

The sequence of dissection can be from up to down and from medial to lateral or reverse, depending on the surgeon's preference. Defining an intermammary distance that is never narrower than 3 cm and avoiding any dissection medial to 1.5 cm lateral to the midline prevents the inadvertent division of medial perforators, as well as medial intercostal nerves. A large vein is usually present 1.5–2.5 cm lateral to the midline at the second intercostal space, and surgeons can avoid damaging it by limiting superomedial pocket dissection in this area.

In the medial pocket, surgeons should never perform any division of pectoralis origins along the sternum, because even the slightest division of these origins can sacrifice critical soft tissue coverage in the intermammary space medially, increasing risks of implant edge visibility, visible traction rippling, and synmastia. The surgeon should only separate pinnate origins of the pectoralis that arise lateral to the main body of muscle origins along the sternum, carefully avoiding dissection into the body of the muscle medially.

In the inferior pocket, the costal origins of the pectoralis are divided, and some large perforating arteries and veins are controlled along the IMF. The depth of division of pectoralis origins proceeds until the surgeon sees superficial pectoral fascia or subcutaneous fat. Especially lateral border of the pectoralis major muscle which has long strip should be divided completely to have enough lateral expansion of lower pole.

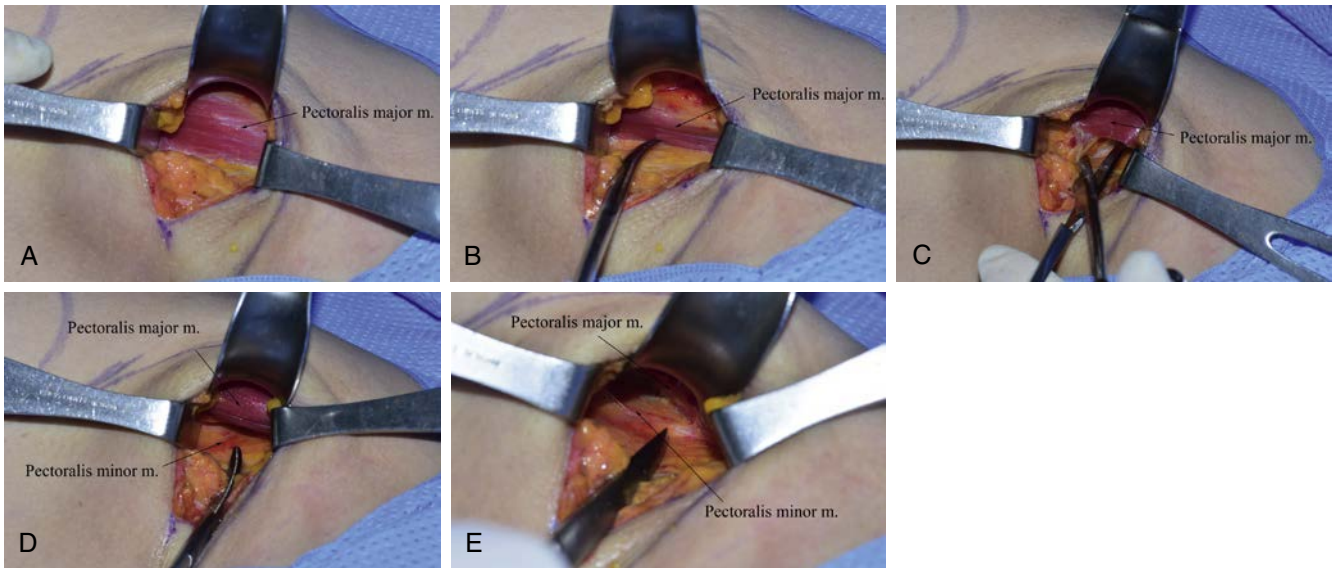
In the lateral pocket the surgeon should define the junction of subcutaneous tissue with serratus anterior and pectoralis minor along the lateral pocket and prevent inadvertent dissection into these muscles.

The surgeon can decide the amount of glandulomuscular dissection according to the indications of the patient after complete release of the pectoralis origin from medial to lateral pocket. With the endoscopic retractor holding the divided muscle fibers under tension, an endoscopic coagulation dissector can separate divided pectoralis muscle from the glandular tissue in gradual increments from an inferior to superior direction. In this way the dual plane can be created. If the lower pole of the breast is tightly constricted, the pectoralis muscle and gland tissue should be pulled up with a retractor. The surgeon should carefully dissect between the glandular tissue and muscle to make sure the muscle can contract upward more as needed and let the lower pole glandular tissue be expanded by implants, which is quite similar to the dual plane type II or III by Dr. Tebbetts' description.

Along the anterior axilla line lower than nipple level, fewer muscle fibers can be seen, and the lateral cutaneous branch of the fifth to sixth intercostal nerve can pass through this area, which innervates the lower pole of the breast. The surgeon should protect all the sensory nerves as much as possible. But in some cases these nerves appear too medially, and this prevents enough lateral dissection to accept the implant at the lower and lateral pole of the breast. In those cases the surgeon should skeletonize the nerve from surrounding tissue or sacrifice and bury the nerves into the muscle, to prevent irritation from the implant in the future. There would be some numbness just after the operation, which can be restored over time in some cases.

7. *Check the bilateral pockets*

At the end of pocket dissection, the surgeon should meticulously reinspect all areas of the pocket and eliminate even the minor bleeding points, and carefully recheck the entire IMF for accuracy and lack of focal restrictions caused by



• **Fig. 5.14** (A–E) Dissection to the lateral border of pectoral fascia and creation of an opening to the subpectoral space. After careful identification of the lateral border of pectoralis major muscle, the surgeon makes a 4-cm-long incision with Metzenbaum scissors through the deep subcutaneous fat and the superficial pectoral fascia to enter the subpectoral space. Check the pectoralis minor on the bottom and confirm the space between the pectoral major and minor.

the incomplete division of muscle origins or incomplete dissection. A sizer can be an option to check the appropriate dissection pocket, according to the dimensions of the permanent implant.

8. *Leave the drains and irrigation*

After checking both pockets carefully and making sure there is no bleeding at all, the author prefers to leave one negative suction drain tube in each pocket. And then irrigate the pockets with a diluted antibiotic solution or Betadine until the irrigation liquid becomes clear.

9. *Implant insertion*

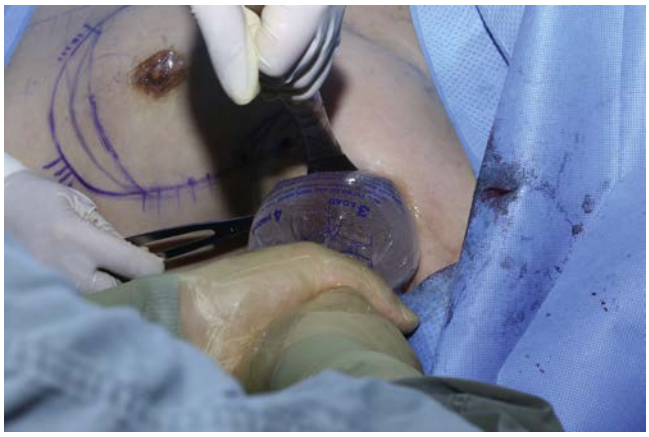
Implant insertion is performed with the same procedure as in an IMF incision approach; a "no touch" technique with powderless gloves and insertion sleeve are mandatory steps (Fig. 5.15). Once the implant has been inserted, the surgeon should check the proper orientation of the implant with the index fingertip, especially the anatomic implant. Marking dots at the back surface of the implant can be palpated to make sure there is no rotation or implant flip over.

10. *Wound closure*

After confirmation of the orientation of the implant, a two-layer wound closure should be performed. Subcutaneous fascial layer suturing with 5-0 absorbable sutures should be made to prevent depression scar formation at incision site. Placement of 5-0 Vicryl sutures in the deep dermis reduces tension and reapproximates the skin edges exactly. The final skin closure can be made with skin glue without suturing.

11. *Dressing and bandaging*

In the axillary approach it is impossible to anchor the new IMF to the chest wall like with an IMF incision. Thus some other methods to fix the superficial fascia to deep fascia are needed to prevent inferior malposition of the implant. Instead of internal suture fixation, an external chest circumferential compression garment can induce fixation of the superficial fascia to deep fascia for 1–2 months. The garment can help the early and controlled expansion of low



• **Fig. 5.15** Insertion of the implant with protecting insertion sleeve into the axillary pocket.

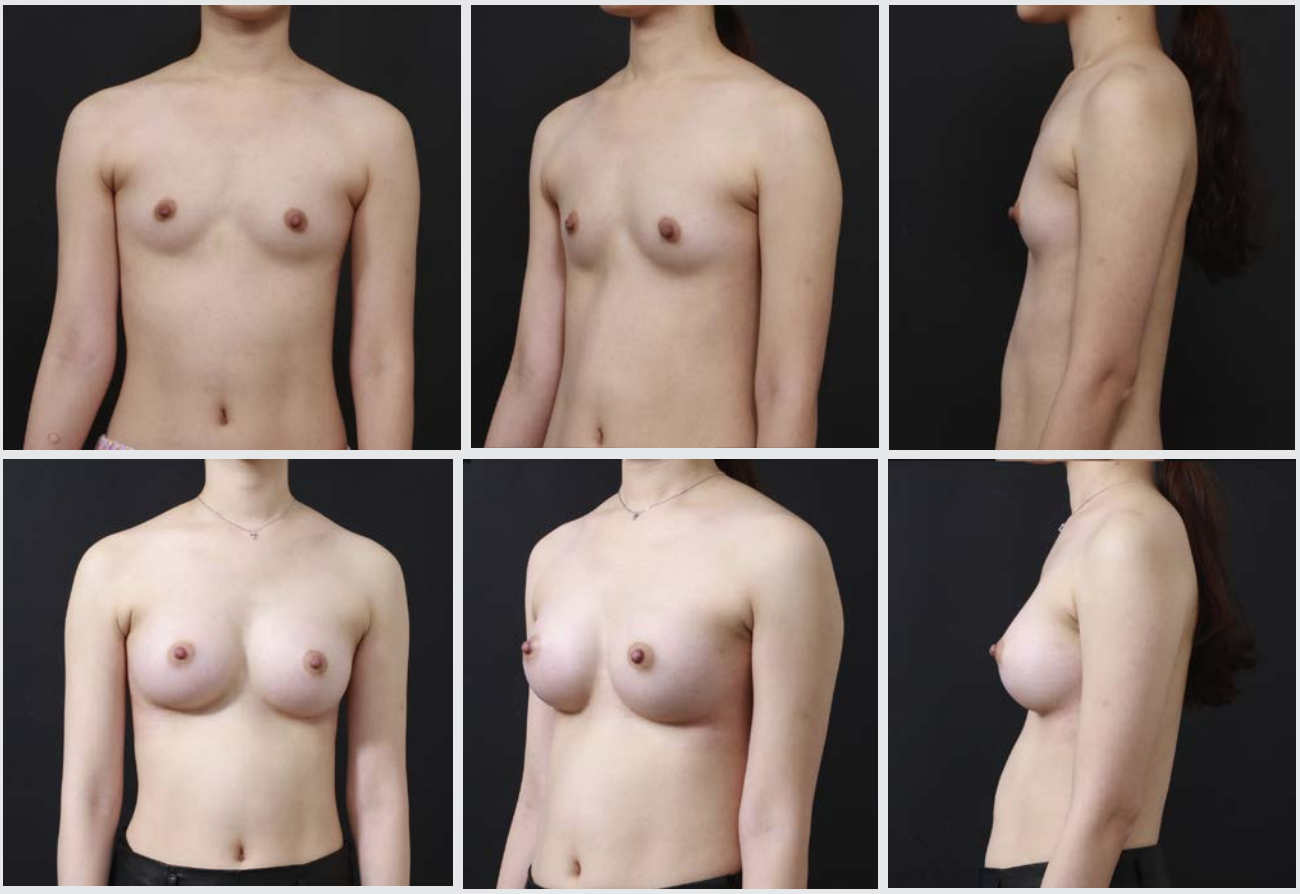
pole while supporting the lower edge of the implant in the correct location (Fig. 5.16). Otherwise, in an axillary incision approach, dissection can be made 5–7 mm less at the IMF line than that of IMF incision approach. This process is recommended to take into consideration the separation of the superficial fascia from the deep fascia of the chest wall without fixation, to some degree depending on the weight and surface of the implant.

Postoperative Care and Expected Outcomes

Patients stay in the hospital for 1 day for drain control and to limit arm motion. The drains can usually be removed the next day when the exudation is less than 30 mL/day per side. After acute wound healing at the incision, bleaching cream or silicon sheet can be administrated on the wound to minimize scar hypertrophy and hyperpigmentation.

CASE 5.3

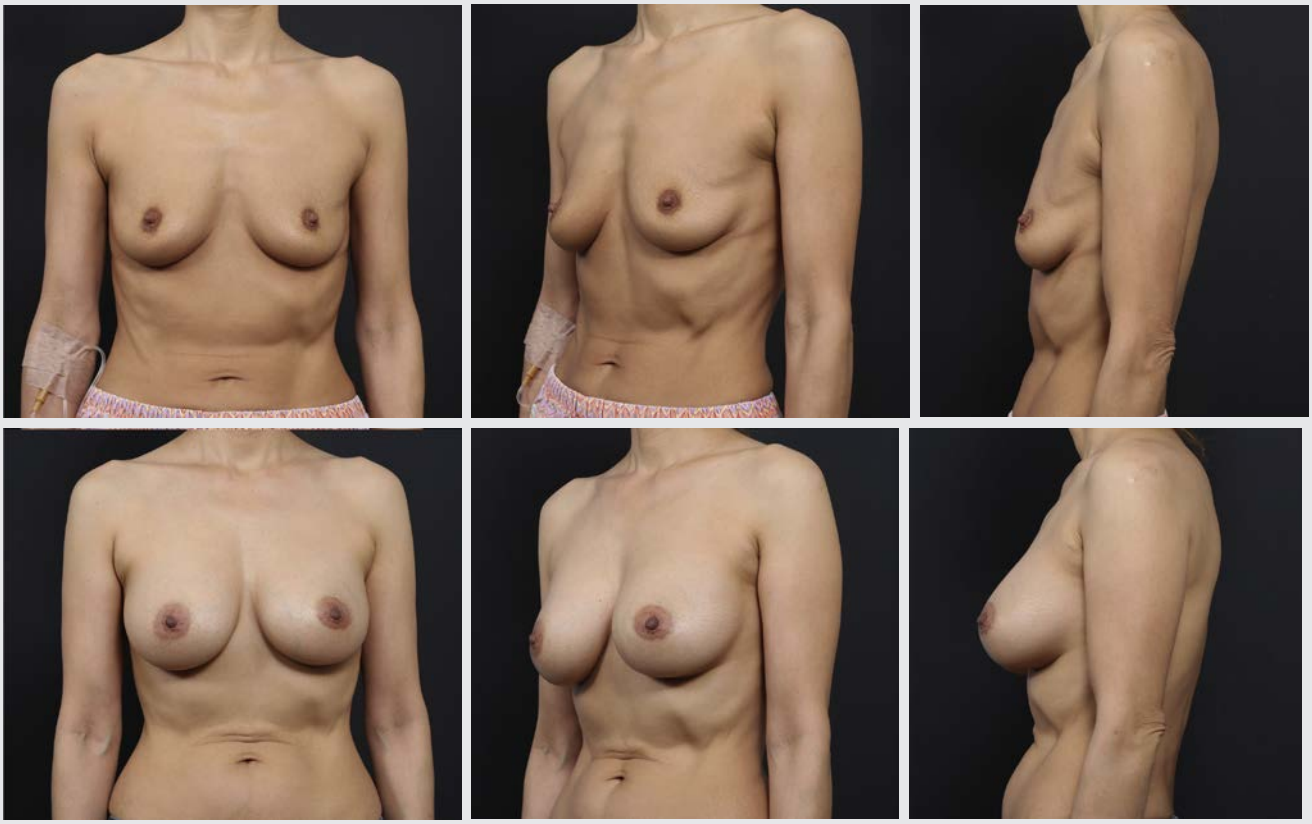
One-year follow-up in a 23-year-old woman after an axillary incision approach. Frontal view, three-quarters view, and lateral view. The patient had asymmetry of chest wall depression and a slightly high positioned nipple. She had no definite IMF line and wanted a scar off the breast. Implant: anatomic textured implant, R: MF295, L: FM270.



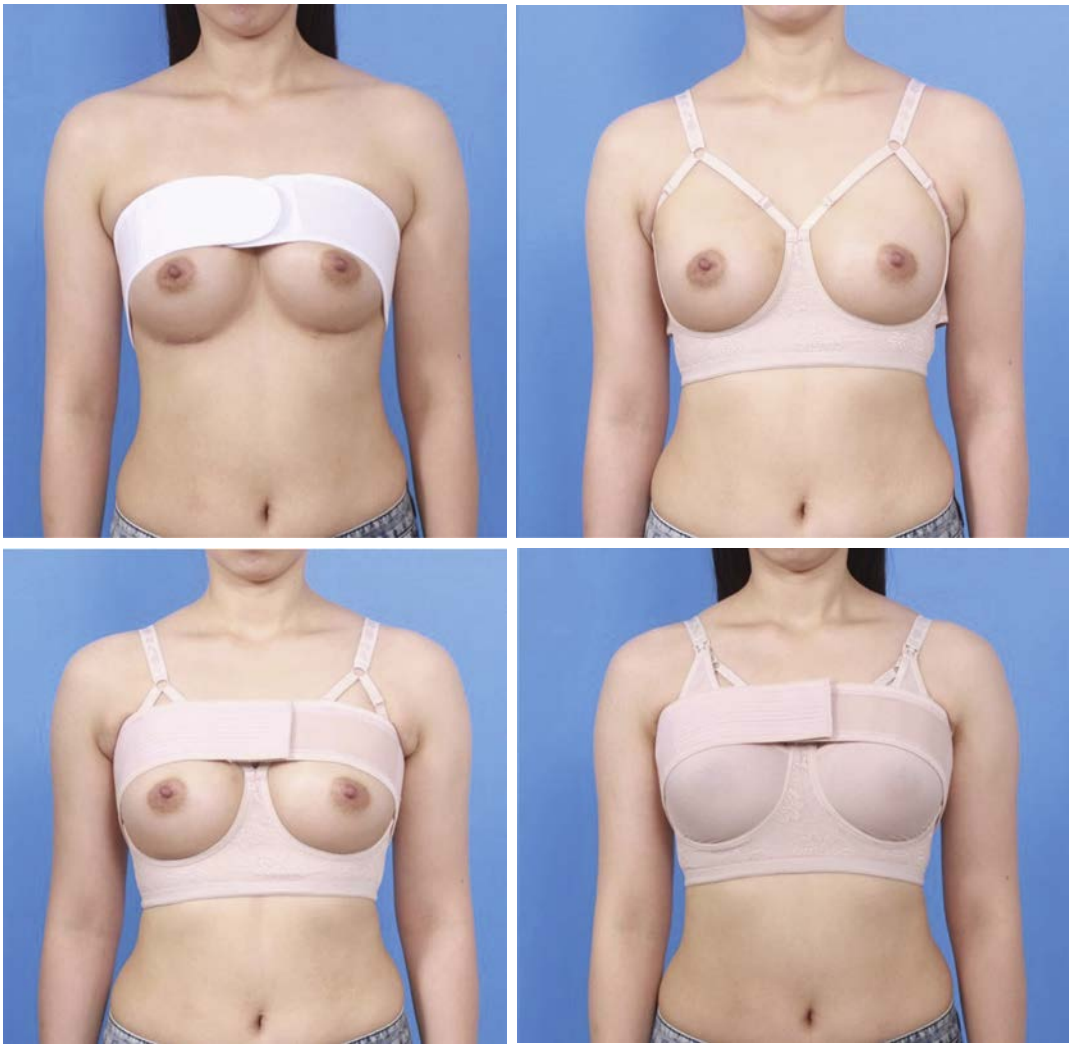
• **Case 5.3** One-year follow-up in a 23-year-old woman after an axillary incision approach. The patient had asymmetry of chest wall depression.

CASE 5.4

One-year follow-up in a 49-year-old woman after an axillary incision approach. Frontal view, three-quarters view, and lateral view. The patient had mild asymmetric breast volume, upper pole deficiency, and glandular ptosis. She wanted a scar off the breast. Implant: anatomic textured implant, R: FM310, L: FM335 (Allergan Style 410).



• **Case 5.4** One-year follow-up in a 49-year-old woman after an axillary incision approach. The patient had upper pole deficiency and glandular ptosis.



• **Fig. 5.16** Various shapes of the garment to fix the superficial fascia to deep fascia of the chest wall with external circumferential compression.

Management of Complications

A common complication with axillary incision is imprecise implant position without IMF fixation. In some cases it involves the high riding of the implant with capsular contracture or inadequate dissection to the inferior direction. In other cases it comes with bottoming out of implant below the proper IMF line. The high position of the implant has been relatively rare with endoscopic visualization, but low positioning of the implant has been occurring more often than before because of the aggressive division of the pectoralis major.

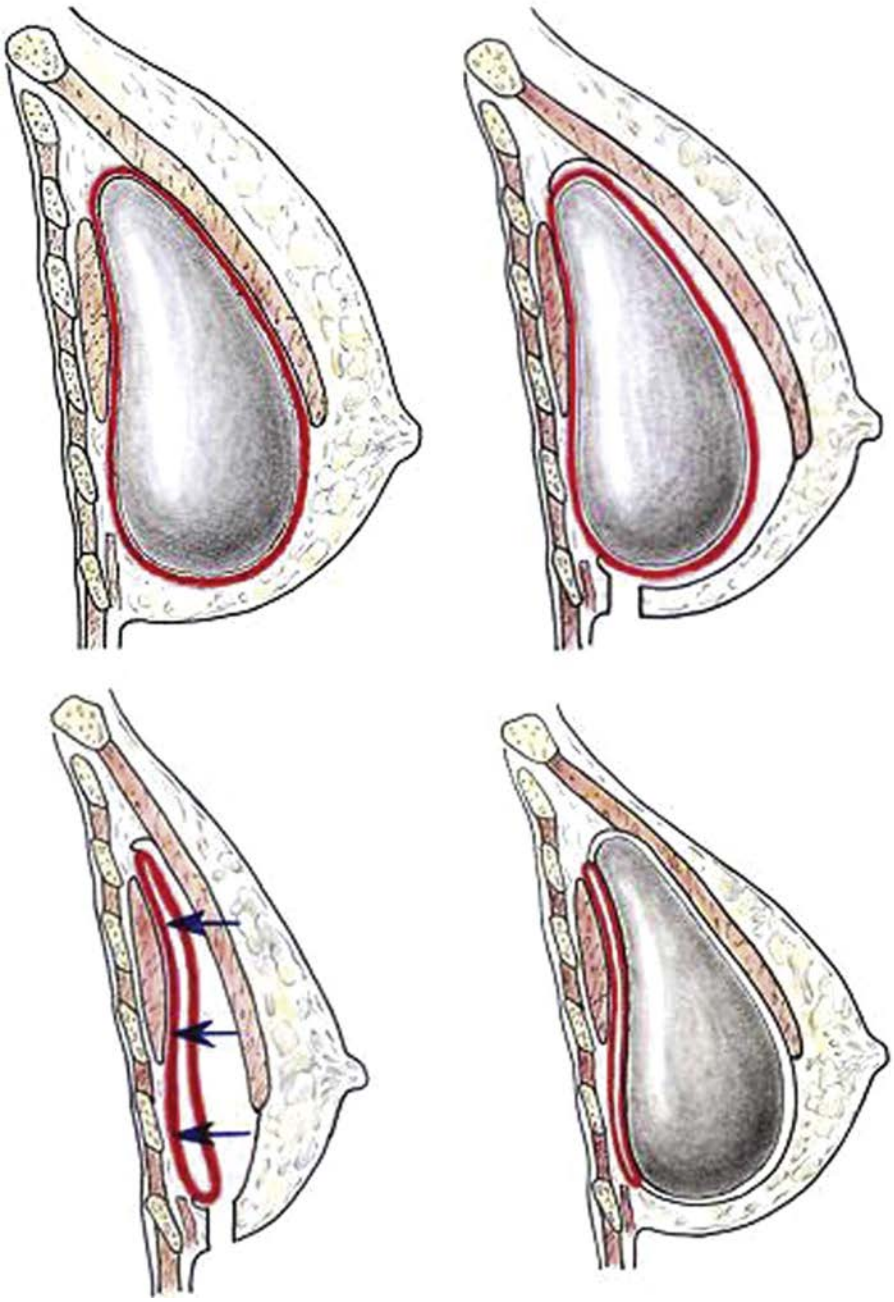
Endoscopic dissection should be done cautiously and should match the operative design pocket without overdissection. To promote the adhesion of superficial fascia to deep fascia of the chest wall, a postoperative garment, which can make a circumferential compression along the exact new IMF for 1 or 2 months, can be an option, in addition to meticulous dissection. This garment is often used to overcome the disadvantage of axillary approach, which cannot use internal IMF suture fixation.

I always use high-quality powderless gloves and change them before handling the implants. To reduce tissue trauma, direct vision, endoscopic visualization dissection is essential. I do not use postoperative displacement exercises. They are not necessary with either smooth or textured implants.

Secondary Procedure

The patient who has capsular contracture can be managed with total capsulectomy and implant exchange through the IMF approach. But in case of the posterior capsule being too thin or adhered to rib and costal cartilage, subpectoral and neopocket implant reposition technique can be a solution to treat capsular contracture and implant malposition[12] (Fig. 5.17).

When tissue envelope deficiency is accompanied with malposition, acellular dermal matrix patching in intracapsule or newly created precapsular space can manage the implant malposition with tissue coverage deficiency.



• **Fig. 5.17** Subpectoral and precapsular implant reposition technique can be an answer to fix capsular contracture and implant malposition.

In case of inferior and lateral malposition of the implant with thin but adequate quality of the capsule, bipolar coagulation under endoscopic assistance in a controlled manner can shrink the overexpanded capsule ("popcorn capsulorrhaphy"). This technique can be a remedy in case of mild inferior or lateral malposition of implant and implant size reduction with capsular pocket reduction.

Conclusion

Incision location in breast augmentation in Asian patients is not as important to optimal long-term outcomes.

The development and refinement of endoscopic instrumentation and techniques has enabled surgeons to dramatically improve the accuracy of transaxillary augmentation.

Both the IMF incision approach and endoscopy-assisted axillary incision approach are excellent techniques for patients who require breast augmentation. Both methods can deliver safe, stable, predictable, and satisfying results to the Asian population. Neither one is inferior to the other; both approaches are good alternatives for a patient who is asking for the specific and unique demands described here.

PEARLS FOR SUCCESS

- The definite preoperative plan is the first step to having an appropriate scar location at exactly the level of the IMF.
- In the IMF incision approach, appropriate incision location without hyperpigmentation, hypertrophic scarring, and adhered depressed scarring is one of the most critical aspects in the Asian population.
- Gentle handling of incision margin and tension reduction across the incision are the keys to preventing hyperpigmentation and hypertrophic scarring.
- With the IMF approach, it is necessary to appropriate lize its location with sutures of the superficial fascia to deep fascia. This is the key to placing an incision scar in a hidden location and without an adhered depressed scar.
- The endoscopy-assisted axillary approach is an excellent alternative for patients who prioritize locating the incision off the breast.
- Keeping the dissection in the axilla region along the superficial fascia can avoid injury to the critical structures underneath the axillary fascia.
- To protect the sensory nerves of the nipple–areola complex, dissection just below the pectoral fascia opening should detour the appearance point of the lateral cutaneous branch of the fourth intercostal nerves.
- New IMF determination is also crucial in the axillary incision approach as well as the IMF incision approach. Garment-supported compression fixation of the superficial fascia to deep fascia can be a good option together with meticulous dissection control.

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6

Breast Augmentation With Primary Fat Grafting

JENG-YEE LIN AND LEE L.Q. PU

Introduction

Breast augmentation with primary fat grafting has gained increasing popularity in the past decade. It has several advantages over implant-based breast augmentation, including avoidance of foreign body implantation and related capsular contracture, which are appealing to people who want breast augmentation using autologous tissues. Initially, the safety and efficacy of fat grafting to the breasts had been questioned. However, a position paper from the American Society of Plastic Surgery Fat Grafting Task Force in 2009 concluded that fat grafting may be considered for breast augmentation and correction of defects associated with medical conditions and previous breast surgeries.[1]

Several authors have also advocated the safety and efficacy of fat grafting to the breasts,[2–4] and limited data on the radiologic impact of fat grafting to the breasts suggest that there is minimal interference with breast cancer screening. In addition, recent advancement in the concept and techniques of fat grafting has also added incentives to the popularity of this procedure. Proper patient selection is of utmost importance for a satisfactory outcome of breast augmentation with primary fat grafting.

In this chapter, the authors describe their preferred technique for breast augmentation with fat grafting, including patient selection, preoperative consultation, and several techniques to ensure an optimal outcome. In addition, a rationalized approach to fat necrosis after fat grafting for breast augmentation and an algorithm for management of fat necrosis are also introduced.

Indications and Contraindications

A good candidate for breast augmentation with fat grafting would be the one who has an abundance of body fat to be harvested from liposuction and sufficient skin pocket dimension or pliability for accommodation of adequate volume of graft. In addition, patients who desire a volume increase of 120–150 cc are good candidates because this procedure has limitations in possible volume increase after each session of fat grafting. There is no absolute contraindication for this procedure. However, patients who do not have sufficient fat to be harvested and those who have tight, small breast skin envelopes (Fig. 6.1) and are reluctant to undergo either internal or external tissue expansion are not good candidates for this procedure. Box 6.1 summarizes the considerations for a good candidate for breast augmentation with primary fat grafting.

Preoperative Evaluations and Special Considerations

Patients with a family history of breast cancer should be informed that the long-term safety of primary fat grafting to breasts has not been established in this group of patients and an extra effort in breast cancer surveillance may be needed after this procedure because of the possibility of calcification as a result of fat necrosis in the breast tissue. Fat necrosis may cause physical or psychological discomfort and potentially complicate breast cancer surveillance and should be communicated to the patient as a risk.

The volume of available fat is an important step for preoperative consultation and planning to ensure adequate volume to be harvested for single or multiple sessions of fat grafting depending on the patient's expectation. Estimation of the volume of body fat is conveniently achieved by palm measurement in which one palm size is about 180–200 cm^2 depending on the surgeon's palm size. The thickness of fat can be determined by a pinch test.[5] The volume of fat to be collected is calculated by the area multiplied by the estimated thickness of fat that can be suctioned (volume = palm size 200 cm^2 × thickness of fat to be suctioned). In general, a total of 700–1000 cc of lipoaspirates (not including the infranatant) can be harvested from both thighs, which is enough for most patients.

The skin can be tested by finger stretching to see if it can be pulled off from the body with little resistance. Note especially the skin pliability in the lower pole, where it is most needed

• **Fig. 6.1** A patient with typically small breast tissue and tight skin who has undergone the external volume expansion for 6 weeks. The pre-expansion procedure before fat grafting is not effective, as shown.

• BOX 6.1 Good Candidates for Breast Augmentation With Primary Fat Grafting

- A good abundance of fat in the body to be liposuctioned
- Good pliability and elasticity of skin in the breast
- Good volume of original breast tissue and pocket

to be expanded for an anesthetic lower pole breast contour. If the skin envelope is tight and the original breast mound is small, then tissue expansion is necessary to overcome the skin tension to achieve the desired breast volume and shape. Tissue expansion can be either external or internal.

Patients who desire more than a two breast cup size increase should be informed of the necessity of more than one or multiple sessions of fat grafting. In patients who request breast augmentation by replacing previous breast implants with fat grafts, any breast deformity or asymmetry (e.g., capsular contracture) should be identified. If capsular contracture has developed, concomitant capsulotomy (Baker I–II) or capsulectomy (Baker III–IV) should be performed to achieve a smooth contour of the breasts (Box 6.2).

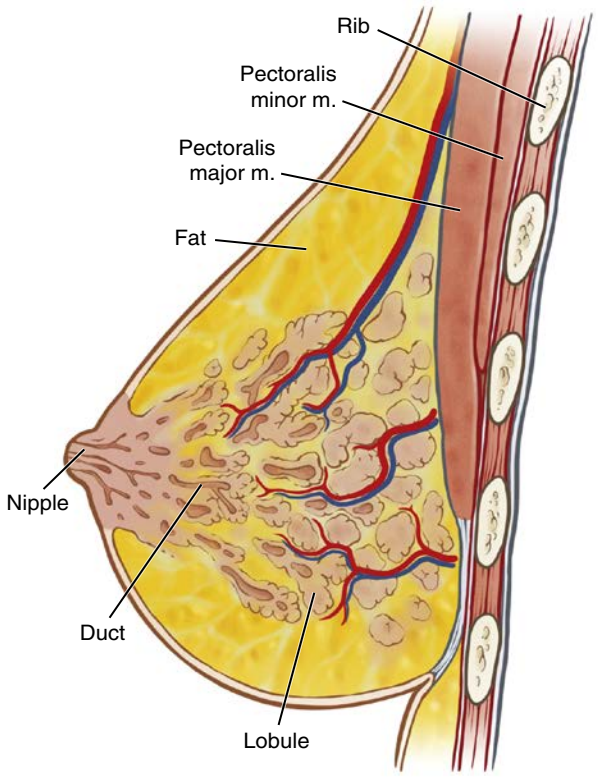
Surgical Techniques

Relevant Surgical Anatomy

Injection of fat grafts to the breast requires an understanding of the relevant anatomy in this area for safety and efficacy of this operation. Fat grafts are injected in different depths of the breast mound: subcutaneous, breast tissue, under breast tissue, intra–pectoralis muscles, and subpectoral levels. Deeper to the subpectoral level lies the ribcage and intercostal muscles, and thus injection should not point down toward the thorax once the cannula is deep to subpectoral level because pneumothorax may occur once the cannula penetrates the pleura (Fig. 6.2). The breasts are well-vascularized tissues and receive multiple blood supplies from several directions but mainly from perforating branches of the internal mammary artery. Therefore, gentle injection with a blunt-tipped cannula can minimize vessel injury and avoid major hematoma in the breast tissue.

• BOX 6.2 Preoperative Evaluations for Breast Augmentation With Primary Fat Grafting

- Assess the availability of fat volume in the body by palm test and skin pinch test.
- Check the pliability of the skin envelope of the breast by stretching the skin in the lower pole of the breast.
- Perform pre-expansion of the tight skin pocket of the breast using internal or external volume expansion before fat grafting.
- Subsequent grafting is necessary if more than a two breast cup size increase is expected.
- Capsulotomy or capsulectomy should be performed for capsule contracture in cases where fat grafting to breast is performed after implant removal.



• **Fig. 6.2** The schematic diagram showing the breast anatomy. Note the anatomy of the breast in layers.

Donor Site Selection

A variety of body areas that uniformly have abundant or excess fat are suitable as donor sites for harvest of fat grafts, such as the abdomen, flanks, buttocks, medial and lateral thighs, and knee. As a general rule, donor sites are selected that enhance body contour and are easily accessible in the supine position. Although the viability of adipocytes within the fat grafts from different donor sites may be considered equal, a higher concentration of adipose-derived stem cells (ADSCs) is found in the lower abdomen and inner thigh,[6] which should therefore be chosen as the preferred donor sites for fat transplantation.[7,8]

Anesthesia

The procedure is performed under general anesthesia or intravenous sedation. Intravenous sedation is routinely used in conjunction with regional or local anesthesia in the donor site of graft harvesting. The tumescent solution used for donor site analgesia or hemostasis should contain the lowest concentration of lidocaine because its high concentration may have a detrimental effect on adipocyte function and viability.[7] In general, we often use 0.01%–0.02% of lidocaine in Ringer's lactate if the fat grafting procedure is performed under general anesthesia. The tumescent solution also contains epinephrine with a concentration of 1:200,000. Epinephrine can precipitate vasoconstriction in the donor sites as well as the recipient sites, which may decrease blood loss, bruising, hematoma, and the possibility of intraarterial injection of the transplanted fat.

Fat Graft Harvesting

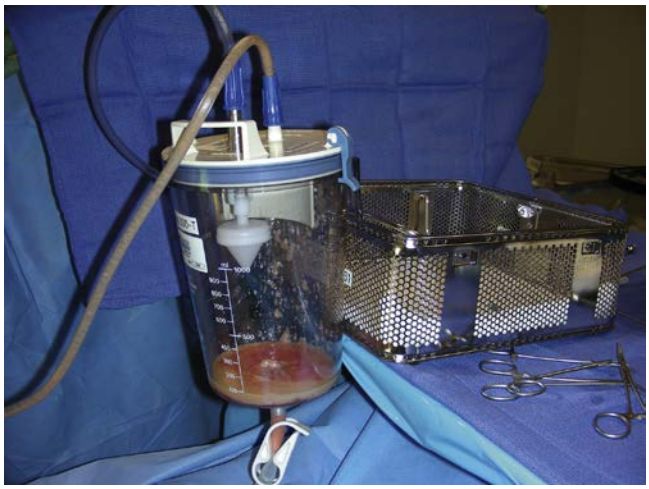
Placement of incisions can be done with a no. 11 blade in the locations where the future scar can be easily concealed. Fat grafts can be harvested through the same incision made for infiltration of anesthetic solution. The size of incision is about 3 mm. A tenotomy scissor is used to dilate the underlying subcutaneous tissue through the incision to allow insertion of the harvesting cannula with ease. The anesthetic solution is then infiltrated to the donor site 10–15 minutes before fat extraction, which makes harvesting of the fat graft easier and less traumatic. The ratio of aspirated fat to tumescent solution should be about 1:1 so that each pass of fat extraction can be more efficient. Vacuum-assisted liposuction with a machine is set to a pressure of –60 to –70 cm H_2O. Lipoaspirates are collected into a 2-L canister that has a drainpipe with a lock attached to its bottom (Fig. 6.3). The infranatant portion at the bottom of the canister is drained out through the pipe after lipoaspirate is allowed to settle for a while by gravity. The fat portion of the lipoaspirate is then collected easily through the pipeline into syringes of variable sizes of surgeons' preferences for convenience of centrifugation.

Fat Graft Processing

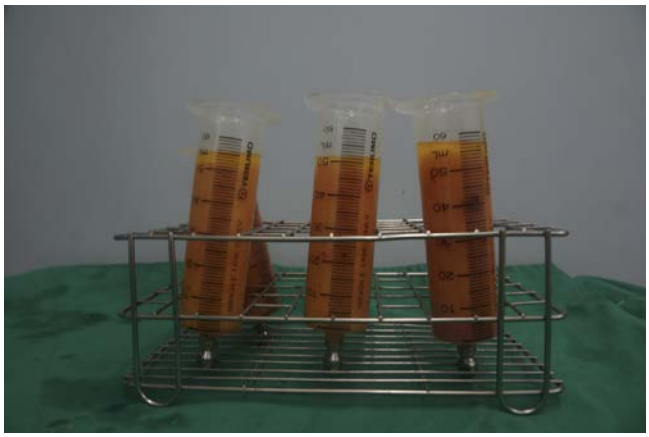
To effectively remove the infiltrated solution and cell debris within the lipoaspirates and to obtain more concentrated fat grafts, centrifugation is our preferred method to process fat grafts. Recent studies have shown that proper centrifugation can concentrate not only adipocytes and ADSCs but also several angiogenic growth factors within the processed fat grafts.[9–11]

The authors choose a 50-cc Luer-Lok syringe for more efficient fat graft processing in mega-volume fat grafting. The fat portion of the lipoaspirates can be easily transferred to the 50-cc Luer-Lok syringe, which is snugly attached to the flexible hosepipe that drains out the lipoaspirates. The Luer-Lok aperture of the 50-cc syringe is then locked with a plug (Fig. 6.4). After careful removal of the plunger, all lipoaspirate-filled 50-cc syringes are then centrifuged with 3000 rpm (about 1200 *g*) for 3 minutes (Fig. 6.5). A greater *g* force or longer duration of centrifugation may be harmful to adipocytes and is therefore not recommended.

In the authors' experience, centrifuged lipoaspirate can be concentrated into 60% of its original volume. Therefore, about 700–1000 cc of lipoaspirate is needed at the completion of harvest because it can be concentrated into 400–600



• **Fig. 6.3** The canister designed for collection of mega-volume (2–3 L) lipoaspirates. A drain is at the bottom of the canister for convenience of fat collection.



• **Fig. 6.4** Collection of fat portion of the lipoaspirate into 50-cc syringes from the canister after allowing the lipoaspirates to settle into layers.

• **Fig. 6.5** The centrifugation of the lipoaspirates for mega-volume fat grafting.

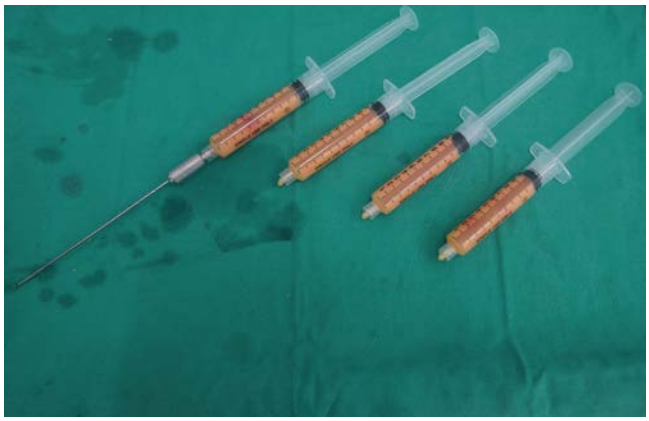
• **Fig. 6.6** The lipoaspirate in the 50-cc syringes are layered into three portions after centrifugation, with the three levels being oil, fat, and water.

cc fat for injection after centrifugation. The "no touch" method is preferred for fat graft processing because exposure of fat grafts to air and contamination can be avoided. After being centrifuged, lipoaspirates with the syringe are divided into three layers: the oil content in the upper layer, fatty tissue in the middle layer, and the fluid portion at the bottom (Fig. 6.6). The oil can be decanted from the Luer-Lok syringe. The residual oil is wicked with a cotton strip or swab. The infranatant fluid at the bottom can be easily drained out once the plug at the Luer-Lok aperture is removed. The concentrated fat in the 50-cc syringe can then be transferred to a 10-cc syringe (our preferred size of syringe for fat injection in primary fat grafting to breasts) with an adaptor (Figs. 6.7 and 6.8). Attention should be given to the air bubbles inside the syringe because they could be removed and thus quantification of the volume injected can be recorded precisely.

Pre-expansion of Tight Breast Skin Envelope

Several methods of pre-expansion of tight skin of the breasts can be considered depending on the acceptance of the patients, including the external vacuum expansion (EVE) or internal expansion with implant. External vacuum

• **Fig. 6.7** Transfer of fat in a 50-cc syringe into a 10-cc syringe with an adaptor.



• **Fig. 6.8** The grafts are ready for injection and placed in 10-cc syringes.

expansion, such as with the Brava system, creates a continuous negative pressure on the breast skin mounted by a cup of an appropriate size for the breast. EVE requires attentive education of patients and strict patient compliance. Therefore, the authors prefer implants or tissue expanders for internal expansion, which provide a stable and reliable expansion of the breast skin pocket especially at the lower pole of the breast. The implant/tissue expander is placed subpectorally to achieve an aesthetically larger breast mound, and this procedure is no different from implant-based breast augmentation surgery. The implant/tissue expander is then explanted as early as 1–3 months after implantation with simultaneous fat grafting to the breasts.

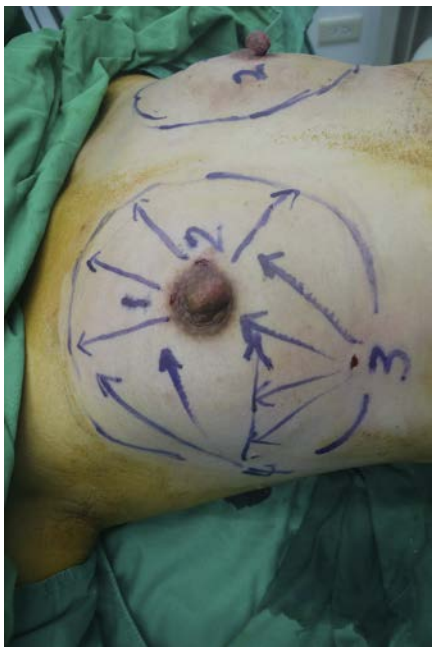
Placement of Fat Grafts

The key to a successful fat graft injection is to achieve an even distribution of fat grafts in the recipient site. Not only can grafting with small volume in each pass produce better surgical outcomes, but, in addition, complications such as fibrosis, oil cyst formation, calcification, or even infection with large-bolus grafting can be avoided. To achieve this goal, a small volume (no more than 1 cc) of fat graft should

be injected during the withdrawal phase in each pass. A 15-cm, 12-gauge cannula is attached to a 10-cc syringe containing the fat graft, which is then slowly injected into the breast in a radial fashion through tiny incisions at the inferior and lateral positions on the breast border and at the upper and medial positions on the areolar margin to achieve even distribution of fat graft into the breast mound (Figs. 6.9 and 6.10). We avoid the 12 o'clock and medial positions on the breast border as entry sites because if hypertrophic scarring develops at these locations, it is not easily hidden (Fig. 6.11).

The fat grafts are placed above, inside, and beneath the breast tissues (Fig. 6.12). Specifically, fat graft is injected into the subcutaneous layer, inside or behind the breast parenchyma, intramuscularly, and behind the pectoralis muscle (referring to the proximal thicker part of the muscle). Fat graft is injected in small amounts as the cannula is withdrawn; we use multiple passes, with multiple tunnels, and within multiple tissue planes. One practical way to avoid repeated injection at the same place is that the resistance is felt during advancement of the cannula into the virgin tissue that has not been injected. Breast ultrasonography can be used as guidance for more precise fat graft placement (Fig. 6.13). Injection should be as gentle as possible to avoid a possible injury to vessel or nerve. Injection with too much pressure would compromise the result and increase the chances of complications. The end point of fat injection is based on the tension across the skin pocket because of filling of the fat graft as judged by the operating surgeon. The injection volume of concentrated fat is 150–250 mL for each side of breast depending on the patient's original breast tissue volume. Tight skin envelope may require pre-expansion before fat grafting.

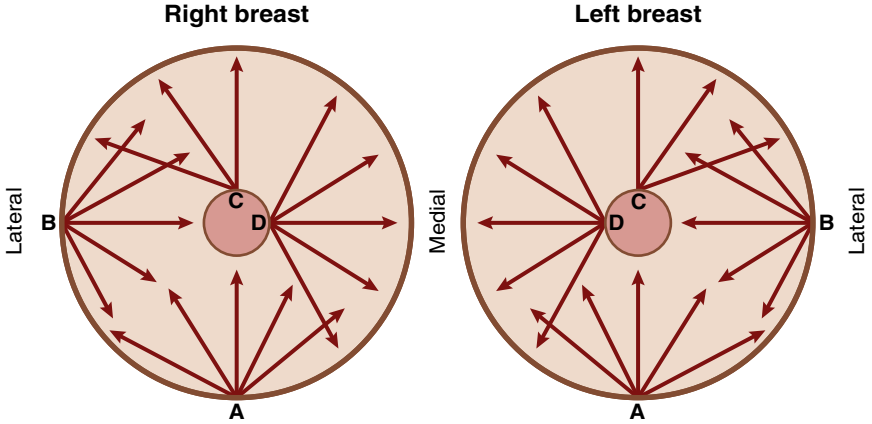
If an implant/tissue expander is used for pre-expansion and after implant/tissue expander removal, surgeons should avoid injection into the cavity formed by the capsule around the implant that was removed because injected fat grafts in the cavity will not survive and a large volume of fat necrosis will develop eventually. Fat graft can be injected under direct vision (Fig. 6.14) to the areas above the anterior wall of the capsule if explantation of the implant is done through a periareolar or inframammary incision. If capsular contracture is developed, then capsulotomy or capsulectomy should be done to release the contracture holding skin from expanding to a good contour. Capsulotomy is performed for grade 1–2 capsular contracture and partial capsulectomy on the anterior wall for grade 3–4 capsular contracture to ensure an adequate expansion of subcutaneous skin pocket for maximum lipofilling, especially in the lower pole of the breast.



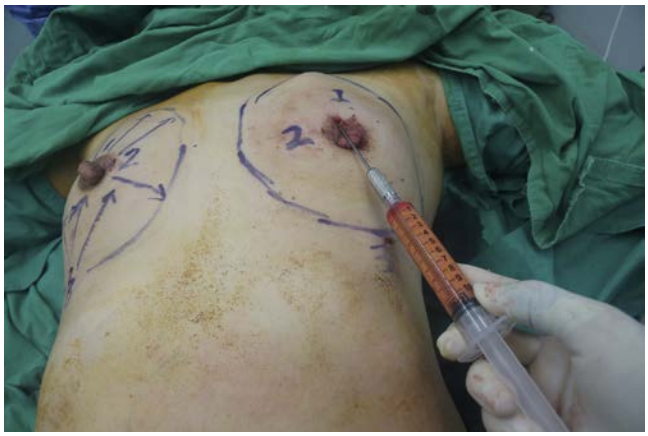
• **Fig. 6.9** The injection entry points are in the inferior and lateral borders of the breasts and superior and medial borders of areolas.

Overcorrection

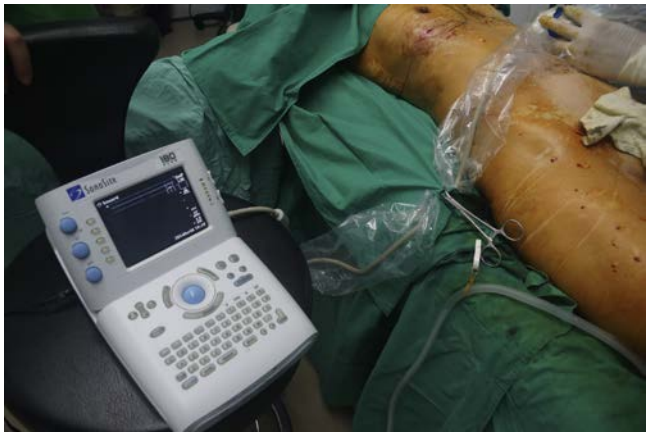
There appears to be a lack of scientific support for overcorrection for "better" graft survival in the recipient site. Significant overcorrection may increase the incidence of fat necrosis



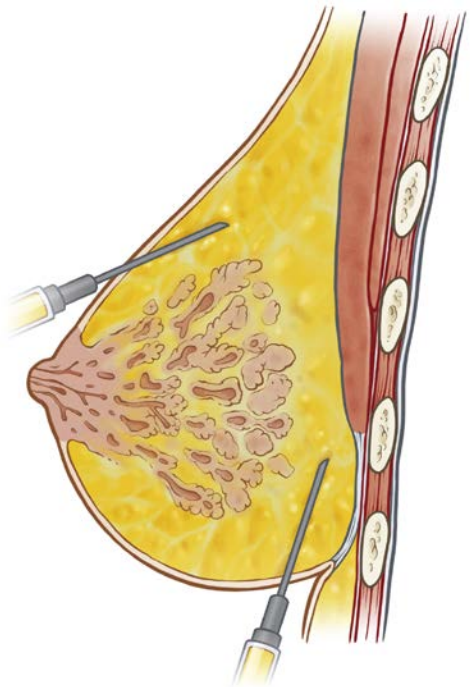
• **Fig. 6.10** The schematic illustration of entry sites for fat graft injection to the breasts. A, inferior breast border; B, lateral breast border; C, upper border of areola; D, medial border of areola.



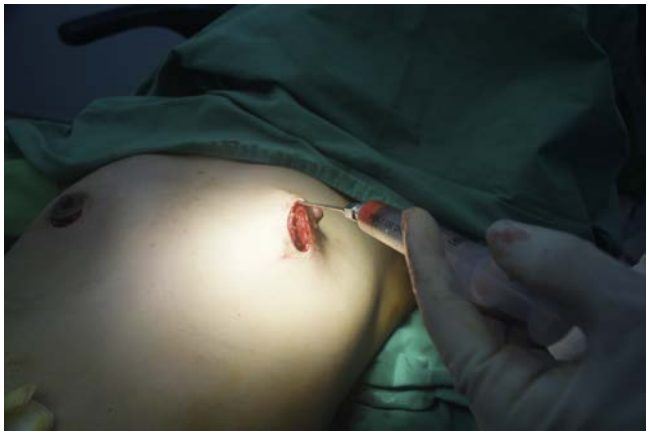
• **Fig. 6.11** Fat graft injection into the breasts in a radial fashion through multiple tunnels, multiple layers, and multiple passes.



• **Fig. 6.13** Fat grafting to the breasts with the assistance of breast echogram.



• **Fig. 6.12** The schematic diagram demonstrates the layers of fat injection. The fat grafts are injected in all layers of the breast tissues evenly with small aliquots of fat grafts.



• **Fig. 6.14** The graft is injected into the breast tissue, with the caution that injection inside the cavity of the capsule after implant explantation should be avoided. Injection can be done under direct vision of the cavity as explantation of the implant is done through a periareolar incision.

and subsequent calcification or even severe infection, especially in mega-volume fat grafting for breast augmentation, and therefore is not recommended. See video 6.1, which demonstrates our surgical technique.

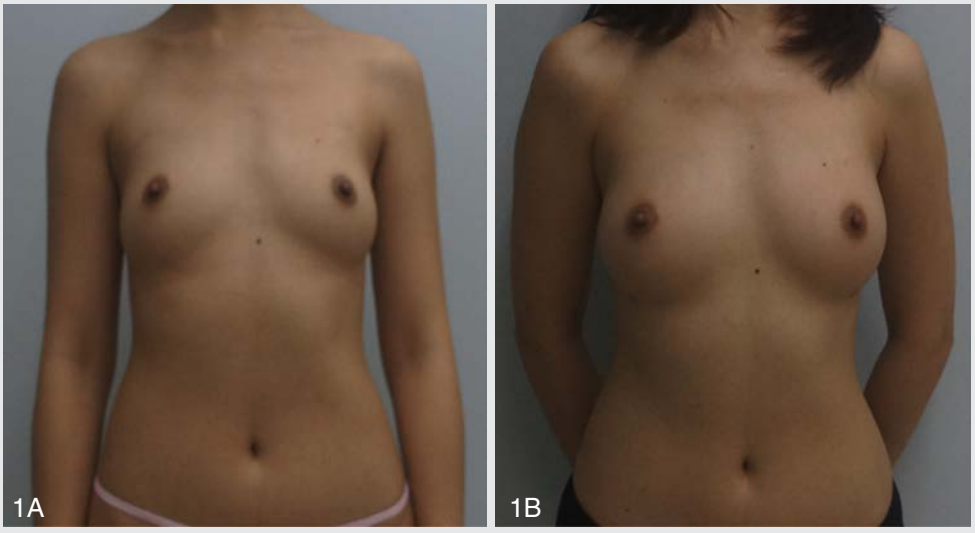
Postoperative Care and Expected Outcomes

One important factor in a successful breast augmentation with fat grafting is postoperative care. Patients are instructed not to exercise strenuously using pectoralis major muscles immediately after surgery for about 3 months. It is also imperative that patients not have hard compression or tight clothing over the breasts for the same period postoperatively. The rationale behind this is that mobility and tight compression on the graft recipient site may violate neovascularization to the fat grafts and microcirculation in the recipient bed. Swelling in the recipient site is expected for 1 or 2 weeks, and the grafted areas can become firm or hard in the first few weeks. Patients should be informed about this normal process after fat grafting; some reassurance to them may be necessary. The long-term fat graft retention rate has been reported with variable success in the literature.[11–14] Based on our experience, 50%–60% of the long-term graft volume retention rate can be achieved; in other words, a volume of approximately of 100–120 cc can be maintained long term.

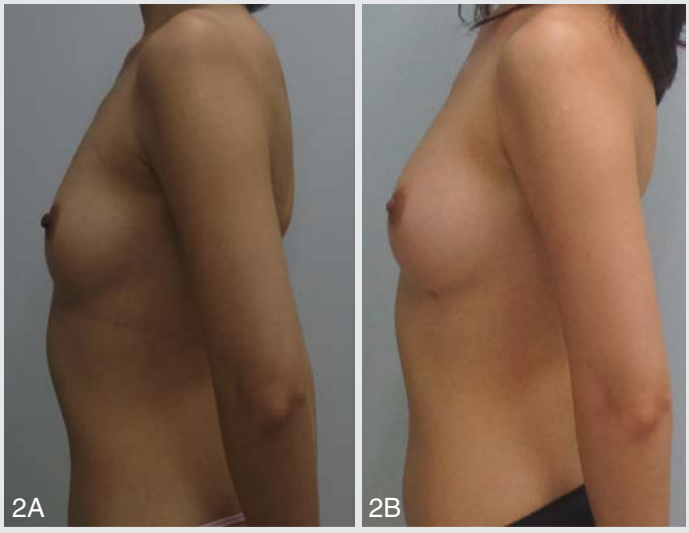
Case Examples

CASE 6.1

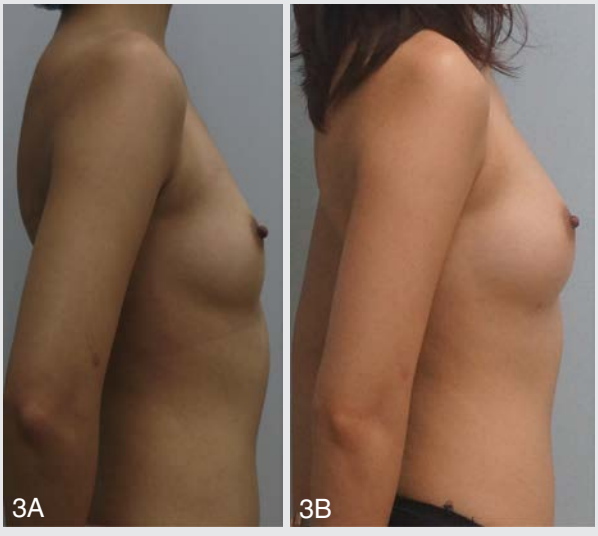
This 26-year-old Asian woman underwent breast augmentation with primary fat grafting. She had pliable skin on the breast mound that was identified by a skin stretch test. Fat grafts were harvested from her abdomen and both medial and lateral thighs. About 200 cc of fat grafts were injected to each side of her breast. At 1 year postoperatively her result was satisfactory, with good long-term graft retention (Case 6.1.1A, B, Case 6.1.2A, B, and Case 6.1.3A, B).



• **Case 6.1.1** Breast augmentation with 200-cc fat graft was performed. (A, left) Preoperative and (B, right) 6 months postoperative.



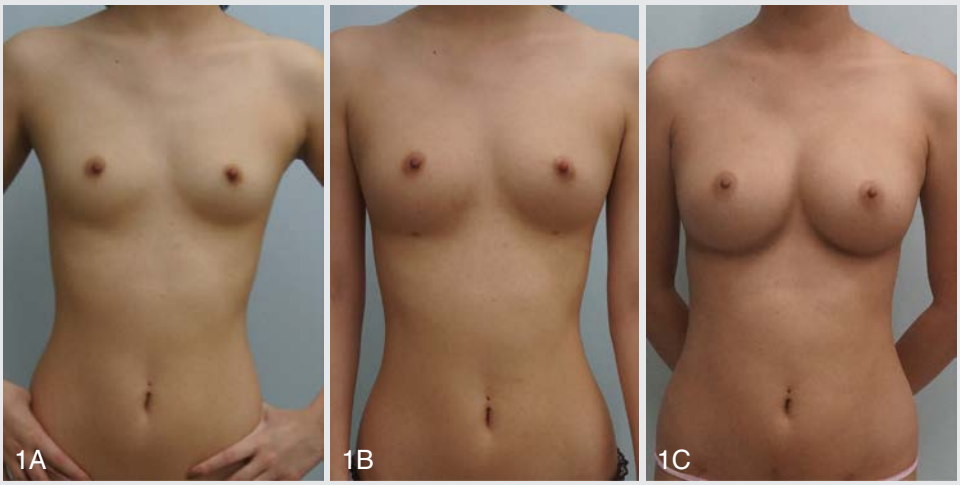
• **Case 6.1.2** Left lateral views (A, left) preoperatively and (B, right) postoperatively.



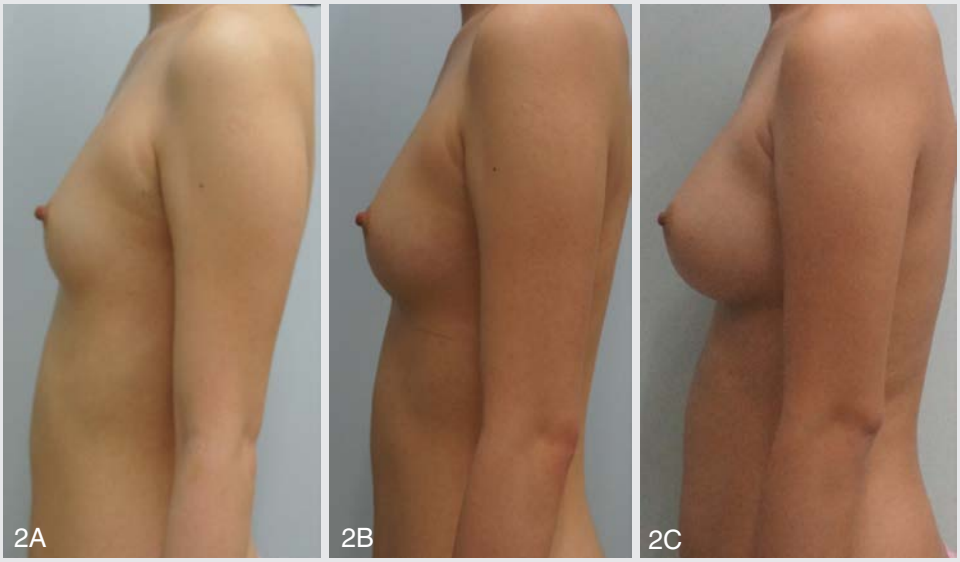
• **Case 6.1.3** Right lateral view (A, left) preoperatively and (B, right) postoperatively.

CASE 6.2

This 22-year-old Asian woman desired a major breast augmentation using fat grafts. She had an abundance of fat reserve in her abdomen and thighs that could be sculptured by liposuction. Her breast skin was relatively pliable. She had the first fat grafting to each side of her breast with 220-cc fat grafts. She was happy with her first result at 6 months postoperatively but wished to have further augmentation. Therefore, she underwent the second fat grafting with 180-cc fat grafts to each side of her breast. One year after the second session of fat grafting, she was satisfied with her outcome (Case 6.2.1A–C, Case 6.2.2A–C, and Case 6.2.3A–C).



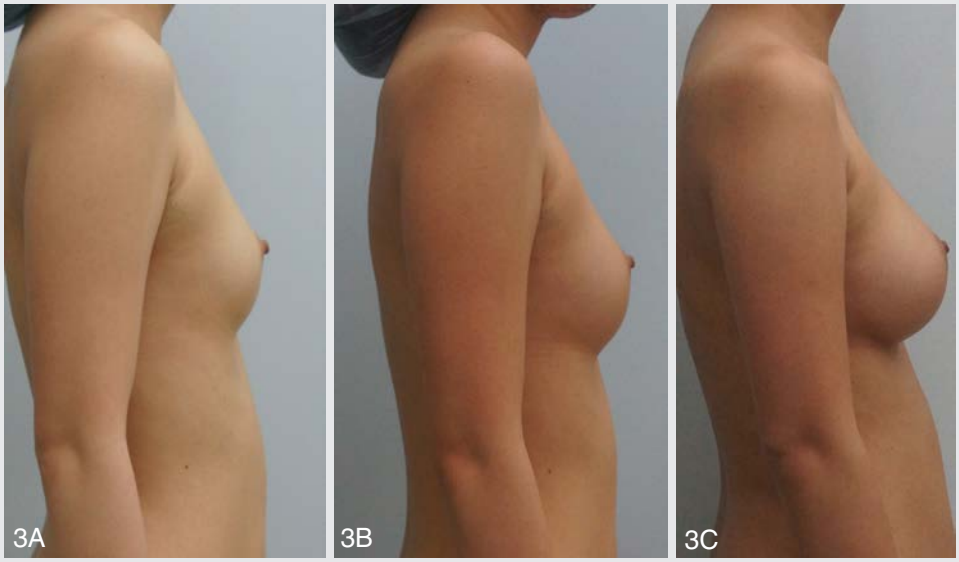
• **Case 6.2.1** Breast augmentation with 220-cc fat graft was performed during first session of fat grafting. A second session was done 6 months after the first with 180 cc of fat graft. (A, left) Preoperative view; (B, middle) 6 months after first session; (C, right) 1 year after second session.



• **Case 6.2.2** Left lateral view (A, left) preoperatively, (B, middle) 6 months after first session, and (C, right)1 year after second session.

Continued

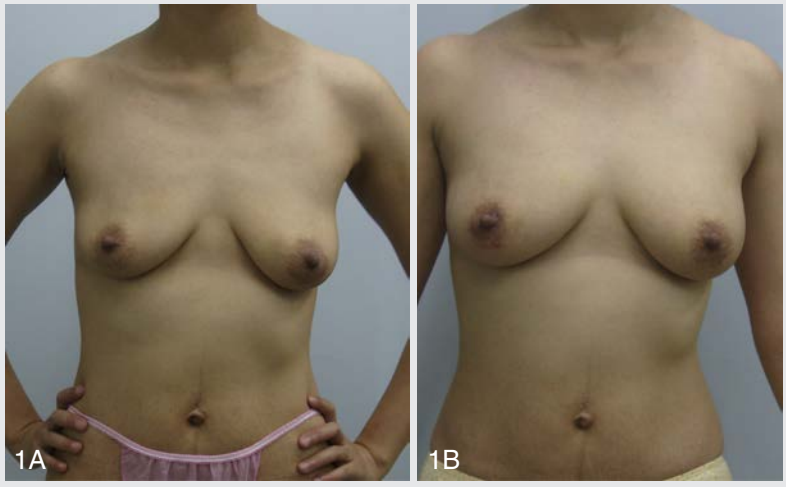
CASE 6.2—cont'd



• **Case 6.2.3** Right lateral view (A, left) preoperatively, (B, middle) 6 months after first session, and (C, right) 1 year after second session.

CASE 6.3

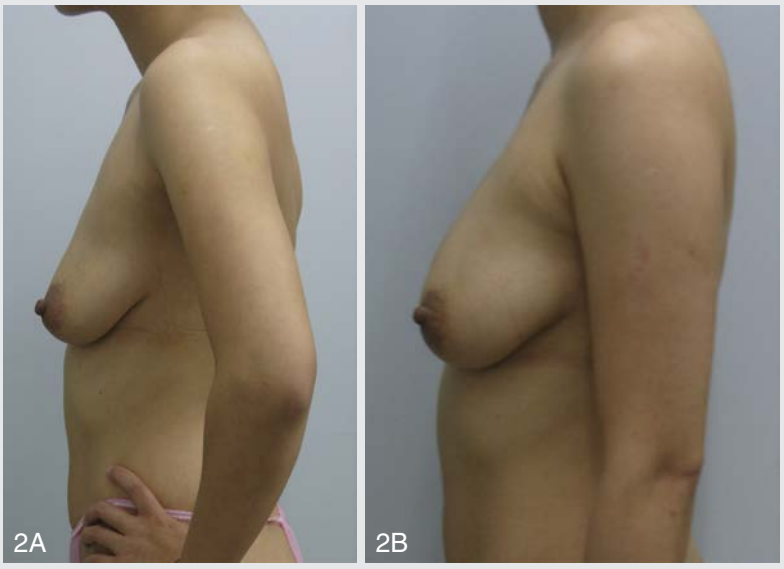
This 33-year-old Asian woman complained of breast atrophy after pregnancy. Excessive breast enlargement during her pregnancy had stretched her breast skin envelope to give her a good dimension for fat grafting. A 220-cc fat graft was injected to each side of her breast. She was satisfied with her breast size and shape at 1-year follow-up (Case 6.3.1A, B, Case 6.3.2A, B, and Case 6.3.3A, B).



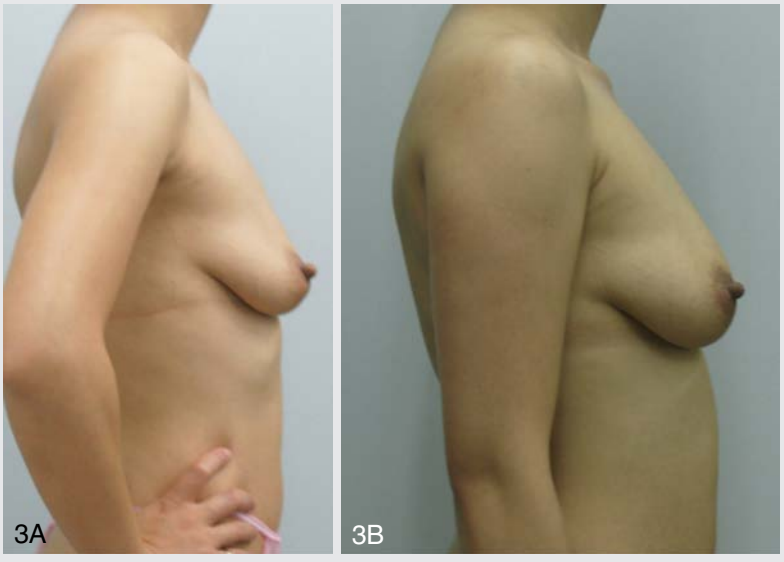
• **Case 6.3.1** Breast augmentation with a 220-cc fat graft in a 33-year-old woman with postpartum breast tissue atrophy. (A, left) Preoperative and (B, right) 1-year postoperative views.

Continued

CASE 6.3—cont'd



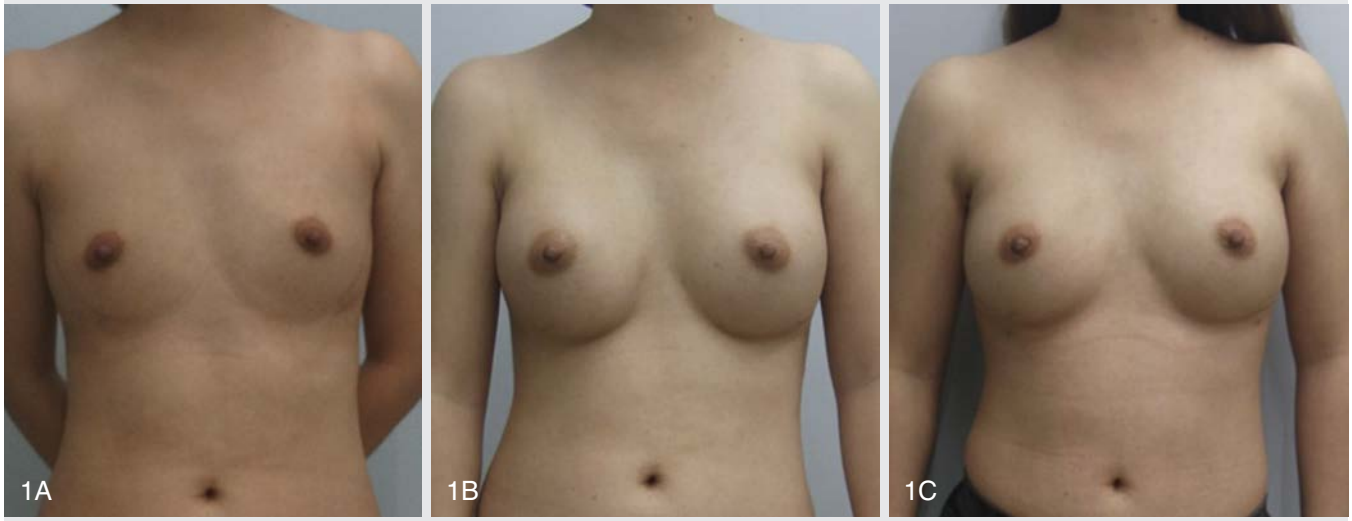
• **Case 6.3.2** Left lateral view (A, left) preoperatively and (B, right) 1-year postoperative.



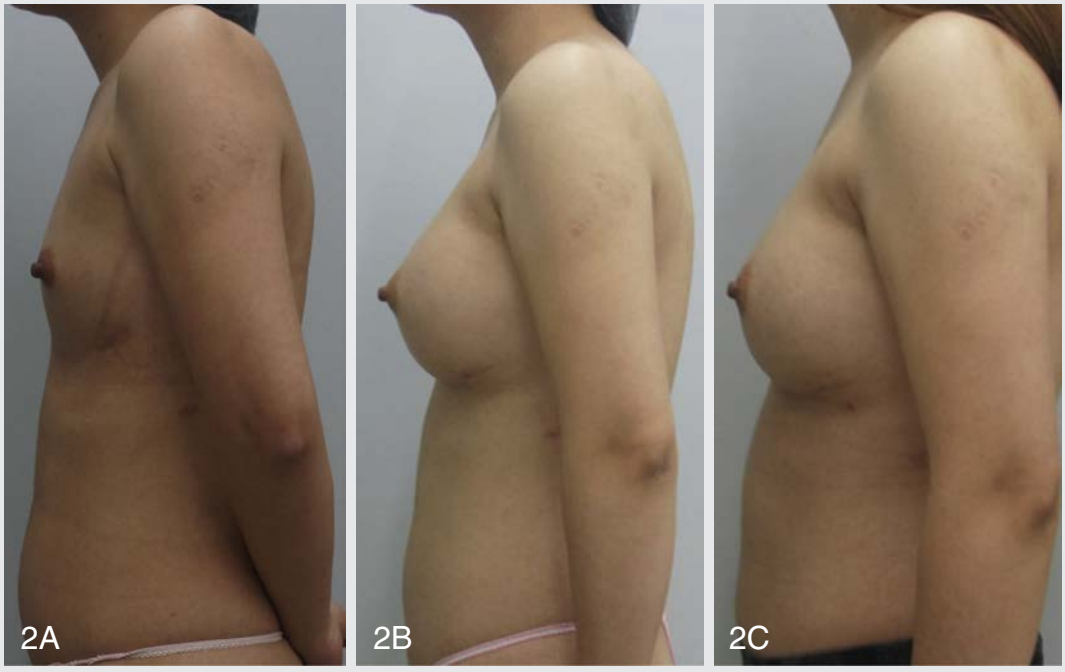
• **Case 6.3.3** Right lateral view (A, left) preoperatively and (B, right) 1-year postoperative.

CASE 6.4

This 35-year-old Asian woman had a very tight skin envelope on each side of her breast based on a preoperative skin stretch test. Pre-expansion of her breasts with a 250-cc saline implant was performed for each side and left in for 6 weeks. A 250-cc fat graft was injected to each side of her breast immediately after removal of the implant. She had the second fat grafting with 200-cc fat grafts to each side of breast about 6 months after the first fat grafting. She had a good lower pole fullness with a natural shape and volume increase at 1 year after the second session of fat grafting for breast augmentation (Case 6.4.1A–C, Case 6.4.2A–C, and Case 6.4.3A–C).



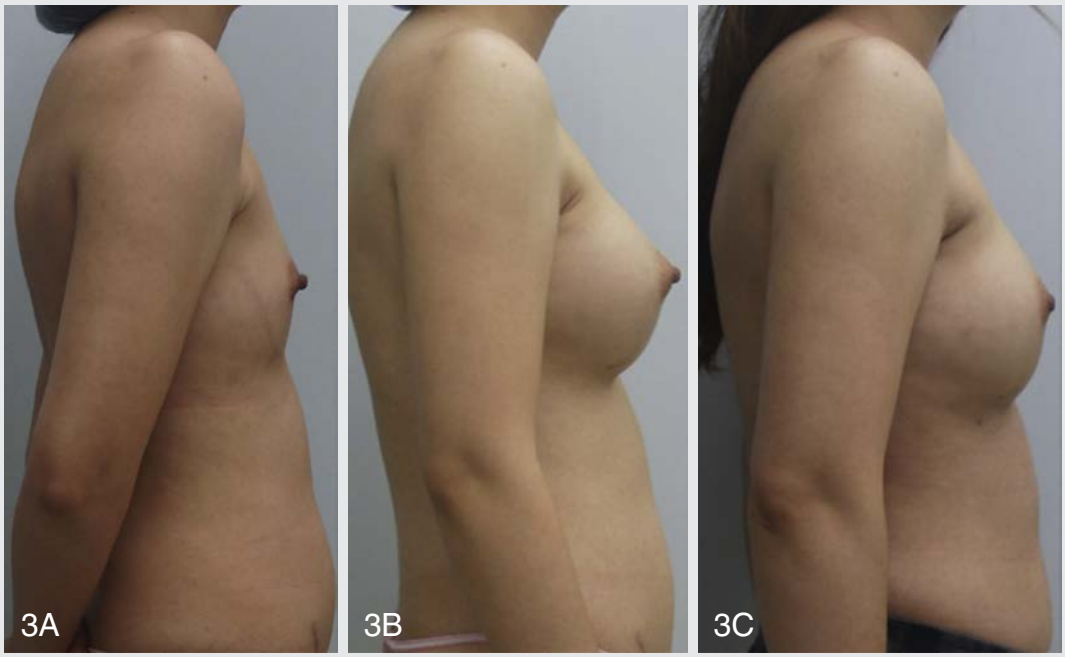
• **Case 6.4.1** This 35-year-old woman has a tight skin envelope in her breasts. She desired at least a two cup size increase for breast augmentation with fat graft. (A, left) Preoperative; (B, middle) 3 months after breast implant implantation for pre-expansion of skin pocket; and (C, right) after removal of implant and breast augmentation with two sessions of fat grafting (250 cc for first session and 200 cc for second session).



• **Case 6.4.2** Left lateral view (A, left) preoperatively, (B, middle) 3 months after breast implant implantation for pre-expansion of skin pocket, and (C, right) after removal of implant and breast augmentation with two sessions of fat grafting.

Continued

CASE 6.4—cont'd



• **Case 6.4.3** Right lateral view (A, left) preoperatively, (B, middle) 3 months after breast implant implantation for pre-expansion of skin pocket, and (C, right) after removal of implant and breast augmentation with two sessions of fat grafting.

Management of Complications

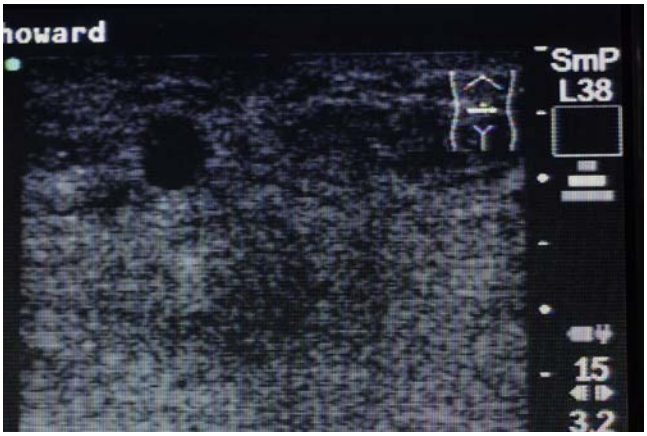
Hematoma of the breast is rare if the procedure is performed gently and meticulously using blunt cannula for injection. If hematoma occurs, compression on the site is usually enough for its management. Infection is also rare in a healthy patient after primary breast augmentation with fat grafting. Aggressive antibiotic treatment may be necessary for its treatment, as well as serial debridement and adequate drainage.

The most common complication of fat grafting to the breasts is fat necrosis. Non-absorbed necrotic fat in the form of oily cysts, sclerotic induration, and calcified solid tumor may cause palpability, pain on palpation, skin retraction, dermatitis, or even postinflammatory hyperpigmentation in Asian patients. Although there are no scientific data indicating that fat necrosis–related scarring and calcification may interfere with breast cancer surveillance, they potentially may complicate routine mammogram checkups. Therefore, fat necrosis in the breast should be managed promptly and properly.

We suggest that patients with any palpable mass noticed postoperatively should have a breast imaging study such as a breast echogram (Fig. 6.15), which is relatively quick to perform and noninvasive, to rule out malignancy. Oily cysts located superficially can simply be aspirated using a syringe with an 18-gauge needle. Hard fibrotic or calcified nodules (Fig. 6.16) can be excised through a stab incision directly above the lesion site. The stab incision is tiny and can heal satisfactorily. An algorithm has been developed and used by the authors for management of fat necrosis (Fig. 6.17).

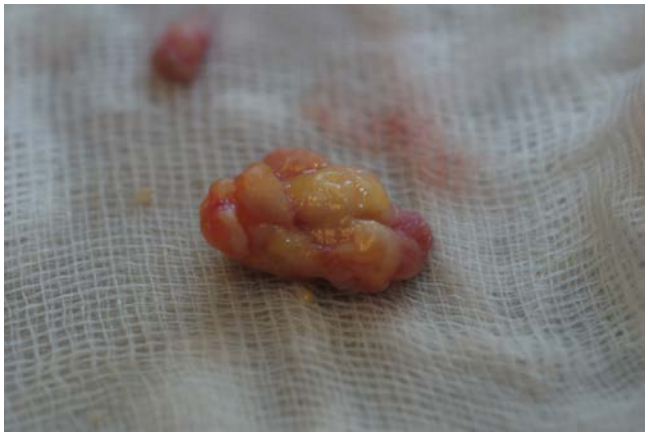
Secondary Procedures

Some patients may need subsequent injection of fat grafts to certain localized areas as a secondary procedure to further



• **Fig. 6.15** A typical image of an oily cyst under breast ultrasound.

improve the shape and volume of the breast. However, there is no scientific study that addresses the timing of subsequent fat grafting. It is often difficult to assess the surgical outcome during the first few weeks after fat grafting. In general, the extent of swelling and the waiting period are also volume dependent. We have found that the transplanted fat gradually loses its volume with time and usually becomes stable at 3 months postoperatively if surgical recovery is uneventful. Therefore, the timing of a subsequent fat grafting procedure should be deferred to at least 3 months after previous transplantation.



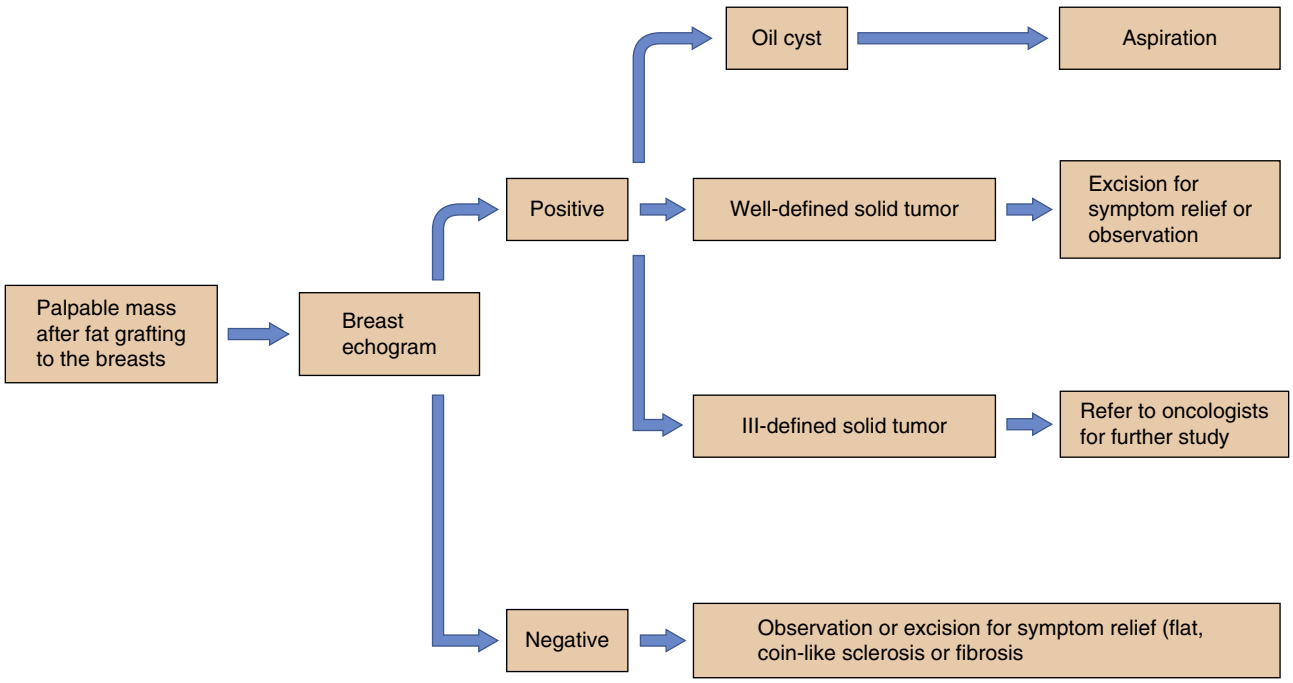
• **Fig. 6.16** The calcified and fibrotic nodule of fat necrosis excised from the breast tissues.

Conclusion

Breast augmentation with primary fat grafting offers a valid option for breast augmentation. With a comprehensive understanding of the science of autologous fat transplantation, the surgeon can master his or her techniques for fat grafting using the appropriate instruments. With proper patient selection and adherence to all the principles described herein, this minimally invasive procedure can be performed safely with a good outcome and minimal complications.

Pearls for Success

- Patient selection is the key to a satisfactory outcome for this procedure.
- Understanding the principles as well as good techniques for proper harvesting, processing, and injection of the fat grafts are critical to a higher rate of long-term fat graft retention and avoiding complications.
- Tight skin envelope should be pre-expanded to achieve a nice breast shape especially in the lower pole of the breast.
- Achieving an even distribution of fat graft placement and avoiding high-pressure injection or overcorrection can reduce the risk of fat necrosis.
- Subsequent fat grafting is necessary to obtain more than a two bra cup size increase.
- Postoperative care is also an indispensable part of a good outcome.



• **Fig. 6.17** The algorithm used for management of fat necrosis in the authors' practice.

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7

Composite Breast Augmentation

OBAID CHAUDHRY AND DANIEL DEL VECCHIO

Introduction

Breast augmentation with fat has evolved over the past 12 years. According to the American Society of Aesthetic Plastic Surgery, fat transfer to the breast dramatically increased 41% over 2016, and this trend does not appear to be diminishing.[1] Core breast volume augmentation with fat alone, despite its potential, has experienced poor adoption because of patient and physician opposition to BRAVA pre-expansion and the graft to capacity limitations of enlarging breasts with fat in one session.[2–6]

With prosthetic implants alone, the revision rate remains high and a majority can be attributed to soft tissue failure, which is not necessarily failure of the prosthesis but lack of sufficient breast tissue leading to unappealing visibility. With a sudden spike in the interest of fat grafting, many sought to rely on fat for core volume augmentation; however, its limitations for this application are analogous to the "mountains of sand" theory, in which core volume is lost at the expense of a wide breast base. This drawback paved the way for a new concept in which the combination of core volume projection of an implant and the soft, natural appearance and impression of fat provided an ideal solution to the world of primary breast augmentation.

As an offshoot of this experience, some, including the senior author, sought to obtain the core projection using an implant and surround this with fat to obtain the best of both worlds—the so-called composite breast augmentation.[3,5,8]

Since that time, composite breast augmentation has gained popularity to manage a variety of cosmetic and reconstructive problems. This chapter will focus on composite breast augmentation's evolution into a spectrum of fat-to-implant ratios and clinical cases in which these ratios make surgical sense.

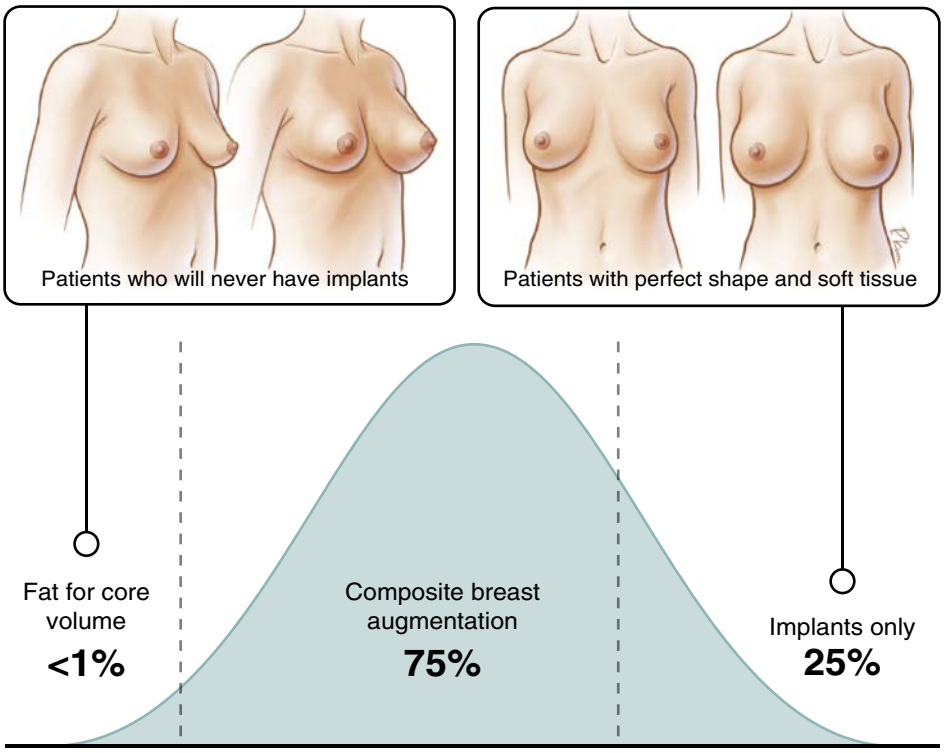
Indications and Contraindications for Composite Breast Augmentation

The classic patient who benefits from composite breast augmentation has small breasts and inadequate breast tissue to cover her desired implants. In an implant-only world, if one follows the classic Tebbetts/Adams "high five" principles, the surgeon is faced with either placing an inadequately small implant in a patient or violating her soft tissue footprint to maintain a narrow cleavage gap.[9] In the composite scenario, the surgeon does not violate the native soft tissue footprint and instead it helps maintain the high five principles. Composite breast augmentation liberates us from this predicament by placing small implants with a narrow diameter and is allowing the fat to do the transitional filling of the cleavage gap instead of the implant.

Contraindications for a composite procedure are similar to those for liposuction, including patients with a significant family history of breast cancer, unreasonable expectations with regard to size and shape, or unwillingness to undergo touch-up procedures for further volume and filling of the cleavage gap. In addition, as noted earlier, patients desiring implant removal after capsular contracture or other device-related issues are likely better candidates for simultaneous implant exchange with fat (SIEF) rather than a composite breast augmentation.

Preoperative Evaluation and Special Considerations

The majority of patients presenting for primary breast augmentation are candidates for a composite procedure (Fig. 7.1). The implant provides the core volume projection, and the fat delivers width and transition and addresses asymmetries. Unlike other composite approaches, the implants and fat are co-dependent. The ideal patient would be one with inadequate soft tissue and



• **Fig. 7.1** As one can see from the graph, fat for core volume is rare. Implant-only augmentation is only suitable for a quarter of patients. The remaining majority are candidates for the composite breast augmentation.

TABLE 7.1 Three Methods for Composite Breast Augmentation Based on Implant Location[a]

Implant Plane	Anatomic Boundaries	Capacity of Third Space	Volume Possible to Graft	Location on AP Footprint
Subglandular	Superficial subcutaneous fat	Low	50–100	Periphery, mainly upper border
Subfascial	Subcutaneous fat to fascia	Medium	50–200	Periphery
Submuscular	Subcutaneous fat, fascia, muscle	High	50–500	Complete implant overlay

AP, Anteroposterior.
[a]The versatility of implant position and fat offers three primary composite breast augmentation approaches. Each approach differs by the capacity of the recipient site. In general, the deeper the implant plane, the larger is the capacity of the space of the breast.
Reproduced from Auclair, E., Blondeel, P., Del Vecchio D.A., 2013. Composite breast augmentation: soft-tissue planning using implants and fat. *Plast. Reconstr. Surg*. 132 (3), 558-568 (Table 2, p. 565). Author (Del Vecchio) is the same as chapter author.

a thin body frame. The sharp transitions can be addressed with fat and the optimal 45/55 rule achieved without an anatomic implant. Patients with adequate soft tissue and ideal breast aesthetics are candidates for implants alone; however, this group tends to vary among practices and does not embody all patients. A third group of patients who desire larger breasts but do not favor prosthetic devices make up the "padded bra" cohort. These women desire larger breasts but do not want breast augmentation. Some of these women may seek out core volume fat augmentation.

Within the composite spectrum, three different scenarios were created. These include type 1: subglandular or subfascial primary breast augmentation and fat overlay, type 2: submuscular primary breast augmentation with implants and fat, and type 3: revision breast augmentation using implants and fat (Table 7.1). The senior author prefers a subfascial approach with fat overlay because this prevents animation deformities and lateral malposition of the implant. In type 3 patients, pre-expansion with BRAVA is usually required to significantly increase the third space recipient site, usually two to three times the volume of the subcutaneous tissue.

Fat transplantation to the breast can be divided into three major categories: core volume fat transplantation to the breast with BRAVA pre-expansion, SIEF, and composite breast augmentation, each with its own applications.[3–6,10,11] Of the three categories, composite breast augmentation

• **Fig. 7.2** Fat for core volume is reliable but not robust. An analogy provided here compares fat to "mountains of sand." A significant limitation of fat is its inability to provide core volume projection.

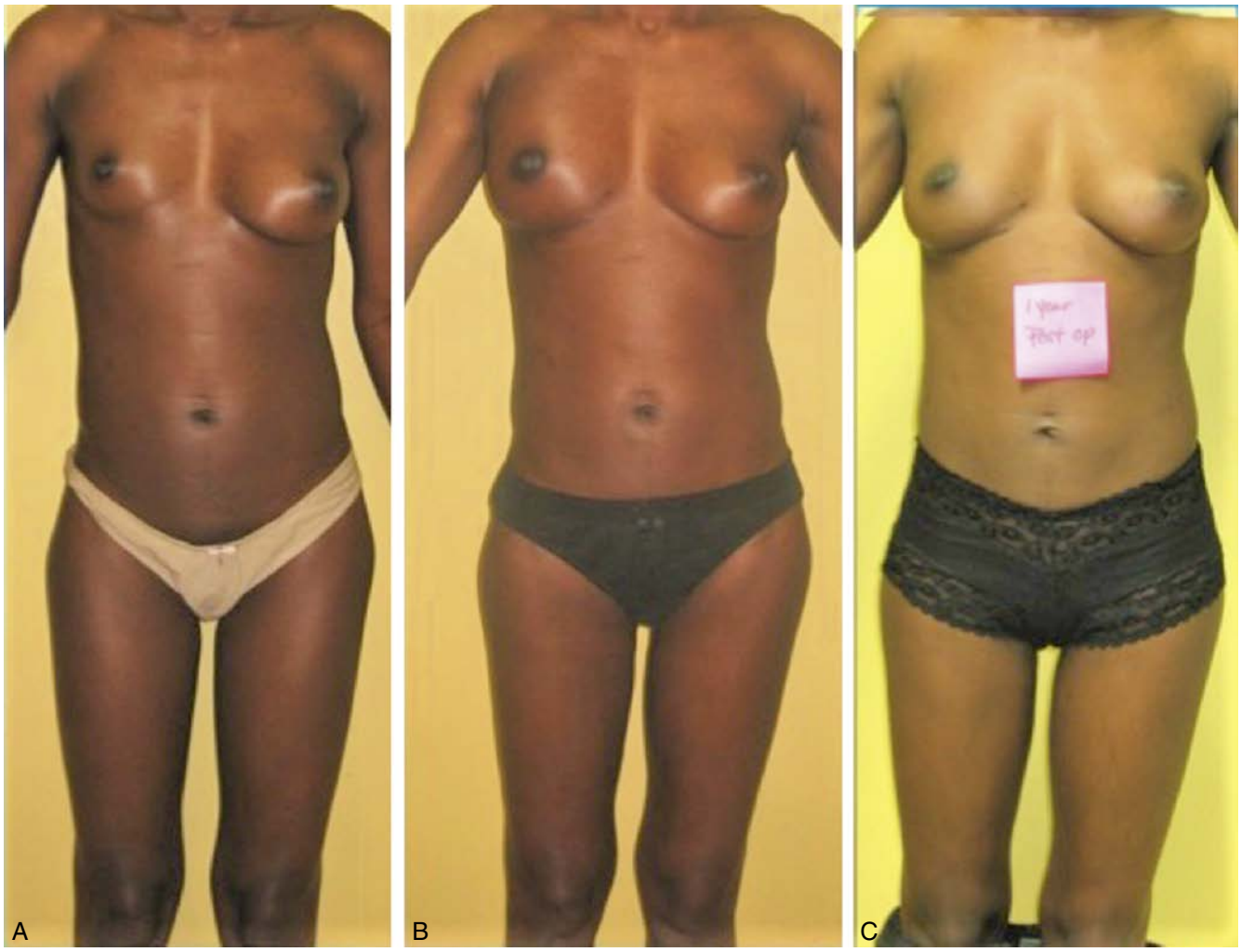
is positioned to be the most common technique for all patients requiring some form of fat transfer to the breast (see Fig. 7.1).

Fat for core volume transplantation for primary breast augmentation is a reliable solution for less than 1% of patients (see Fig. 7.1). However, comparable to the mountains of sand analogy, fat is a poor material to provide projection, and as more fat is transplanted, even with BRAVA pre-expansion, this leads to an undesirable wide breast base without a robust centrally projected mound (Fig. 7.2). Nevertheless, core volume fat transplantation remains useful in severe congenital asymmetries, constricted breasts, or use with a mastopexy only to obtain volume restoration (Figs. 7.3–7.7).[3] Targeted fat transplantation affords preferential fill of the breast in the lower pole, obviating the need for anatomic textured implants to achieve the Mallucci 45:55 ideal beautiful breast ratio (Fig. 7.8).[12]

At times, breast deformities after implant placement may be due to soft tissue failure rather than implant malposition. In these cases, one may modify the soft tissue over the device and not replace the implant for a notable improvement (Fig. 7.9). However, when all else fails, one must remove the implant. In these cases, SIEF, initially described in 2012 by the senior author, affords a viable option for patients needing prosthetic device removal.[10] Here, pre-expansion of the breast before removal of the implant and subsequent placement of fat in the third space of the breast mound, provides an independent plane for fat placement to help alleviate breast deformities and asymmetries secondary to capsular contracture or implant drift (Fig. 7.10).[3,6–8,11,13–16]

In approximately 25% of patients, implants alone will provide an adequate result for patients with perfect shape and soft tissue coverage. However, the majority will require some form of fat and implants together. First described in 2013, composite breast augmentation with breast augmentation under local anesthesia (BALA) is considered the best of both worlds—the projection of the implant in the natural look of autologous fat. Since the time of that paper, composite breast augmentation has been adopted by many for both breast reconstruction and cosmetic applications.[3,6–8,11,13–16]

In the 2013 original composite breast augmentation paper by Auclair et al.,[3] several case examples were



• **Fig. 7.3** Severe congenital asymmetry treated with core volume fat transplantation only (shown at 1 year after surgery). (A) Preoperative; (B) 1-month postoperative; (C) 1-year postoperative.

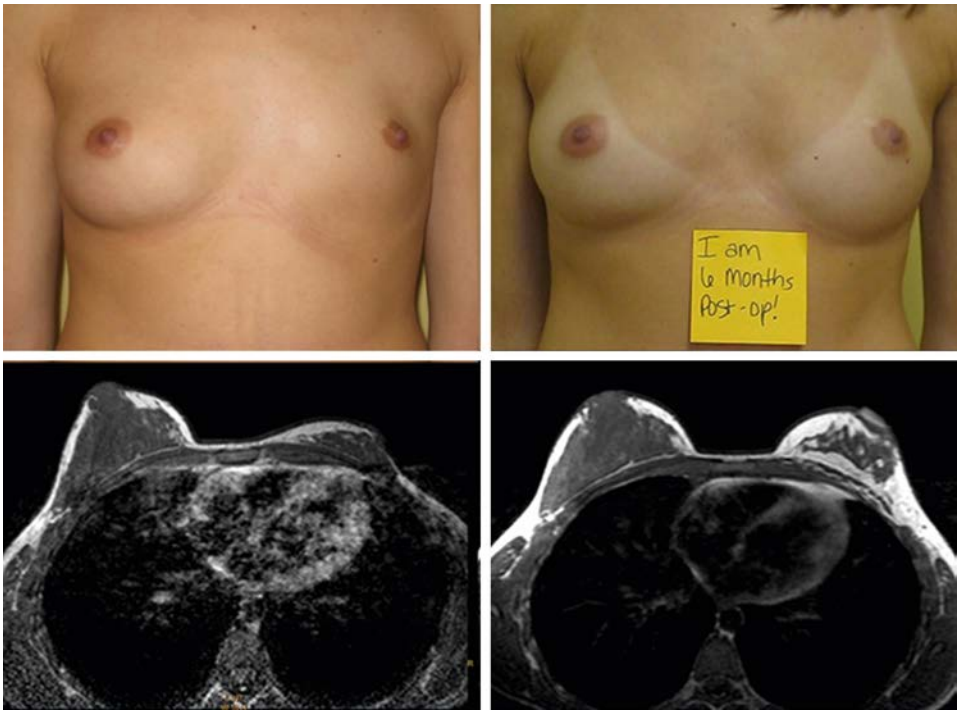
described by the authors. A typical surgery performed by Auclair used a 300-cc implant with approximately 80–100 mL of fat typically placed in the cleavage gap in the upper inner quadrant area for softness. In contrast, Del Vecchio placed an equal volume of implant with an equivalent amount of fat. Analyzing these two surgeon preferences, we see two ratios: a 1:3 fat-to-implant ratio and a 1:1 ratio, respectively. Yet, in a third scenario, a 2:1 fat-to-implant ratio, the implant provides core projection and fat delivers width and transition. Unlike with other composite approaches, the fat and the implant are co-dependent, meaning the volume maintenance of the fat is vital for a successful outcome. The surgeon is able to provide the best of both worlds with this ratio—the core projection of an implant with the natural look of fat (Fig. 7.11).

Expanding on this concept, we can actually have an infinite number of implant-to-fat ratios in any given breast procedure. The senior author trends toward a 2:1 ratio and generally does not recommend anything below a 1:2 ratio; however, a large spectrum does exist with realistic expectations of fat survival and favorable aesthetic outcomes from 1:3 to 2:1. Anything below or above this range would be fat-insufficient or fat-excessive, respectively (Fig. 7.12A, B).

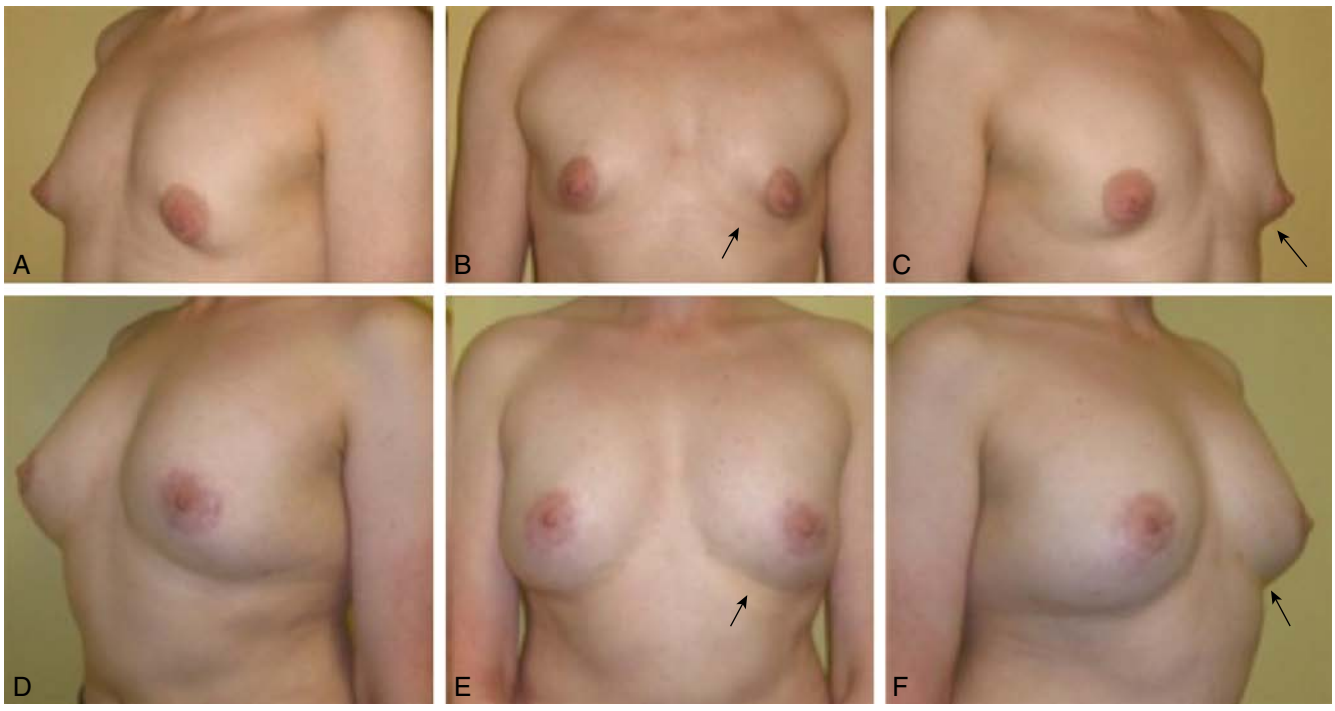
As seen in Fig. 7.12A and B, the spectrum of fat-to-implant ratios is 1:3–2:1, with implant-only or fat-only methods being at the extreme ends. It must be emphasized, however, that the ratios are derivatives and the end result is aesthetics. The ratio is not what derives the surgical strategy. A simple analogy is that of filling a tank of gas in a car. The driver does not look at how many gallons will be needed to obtain a full tank of gas. Instead, the driver will fill up the tank until it is complete and will look at the number of gallons and price at the end. The same holds true for the composite breast augmentation surgery, because aesthetics is the important end result, and the ratio is the derivative. The key point is to keep the implant within the soft tissue envelope and add fat to improve the cleavage gap.

Surgical Technique

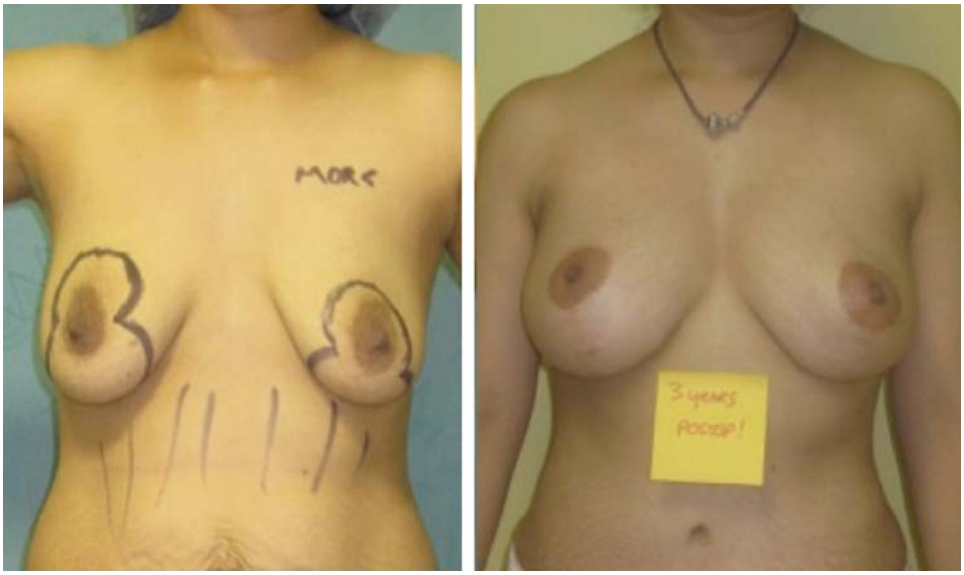
Preoperative markings are shown in Video 7.1. A thorough examination must include evaluation of nipple height, inframammary fold (IMF) level, volume, and



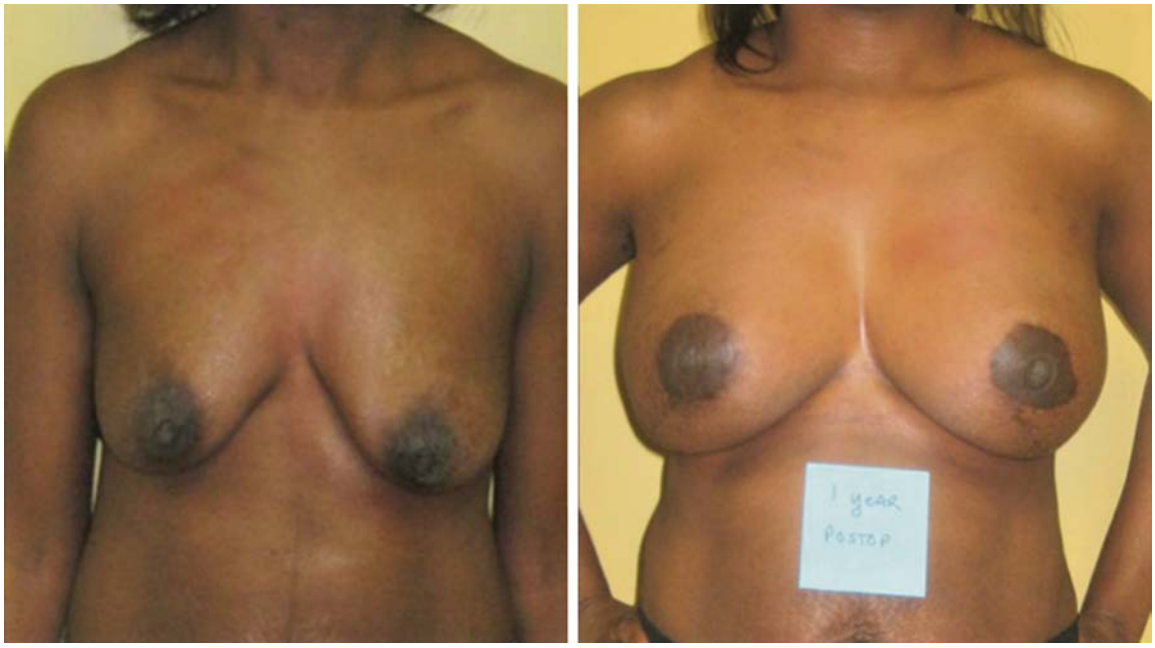
• **Fig. 7.4** Severe congenital asymmetry treated with core volume fat transplantation only shown at 6 months after surgery.



• **Fig. 7.5** Severe constricted breast treated with 600 cc total fat. The *arrows* point to the lower pole, which has been expanded postoperatively. (A-C) preoperative; (D-F) 1-year postoperative.



• **Fig. 7.6** Mastopexy combined with 400 cc fat shown at 3 years after surgery. To avoid ptosis, one may avoid an implant and use fat.

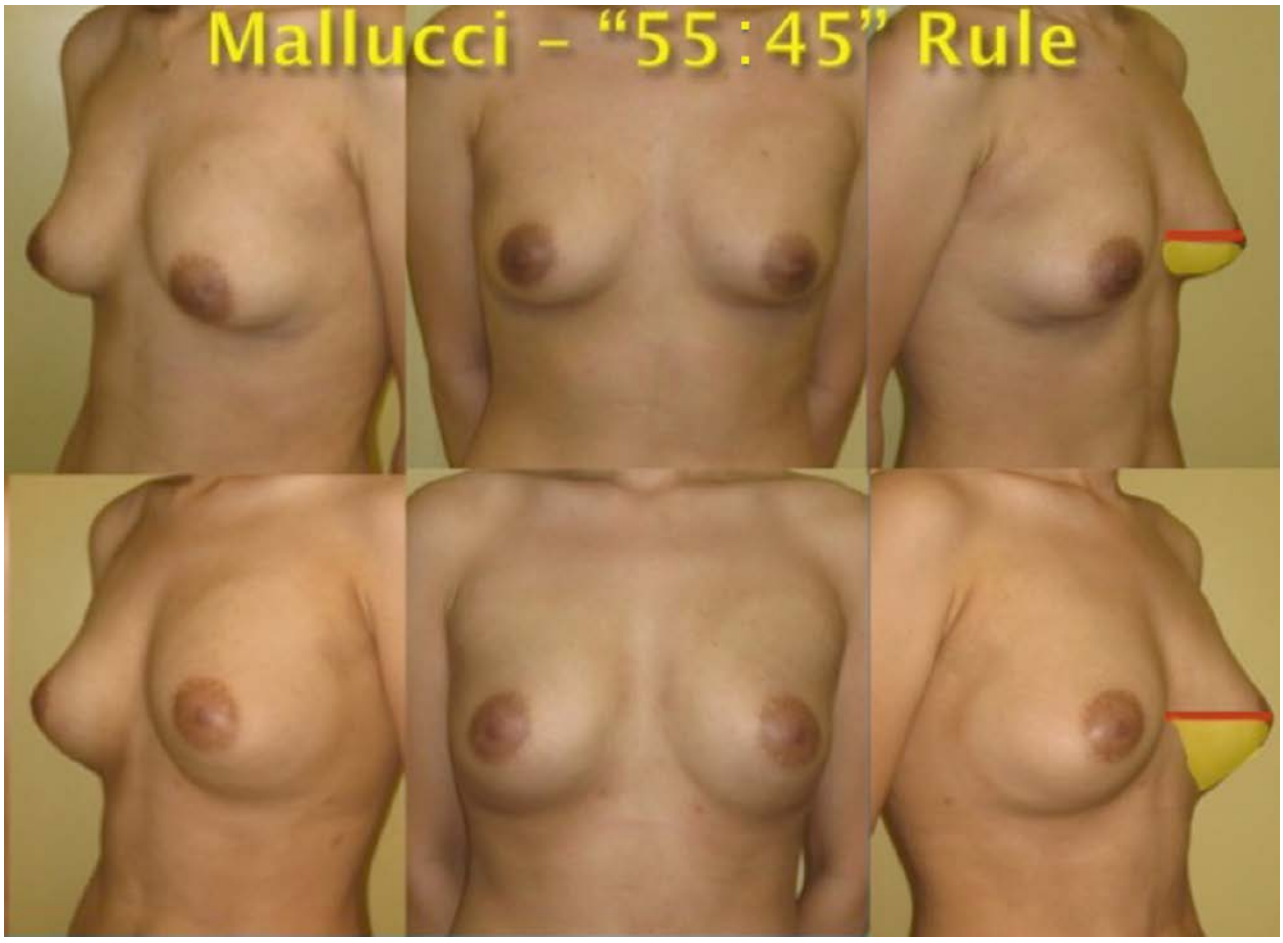


• **Fig. 7.7** Mastopexy with combined with fat shown at 1 year after surgery. One must recognize that a breast lift is more than just nipple repositioning and also entails volume restoration. When fat is used, the complications associated with a mastopexy augmentation are not present.

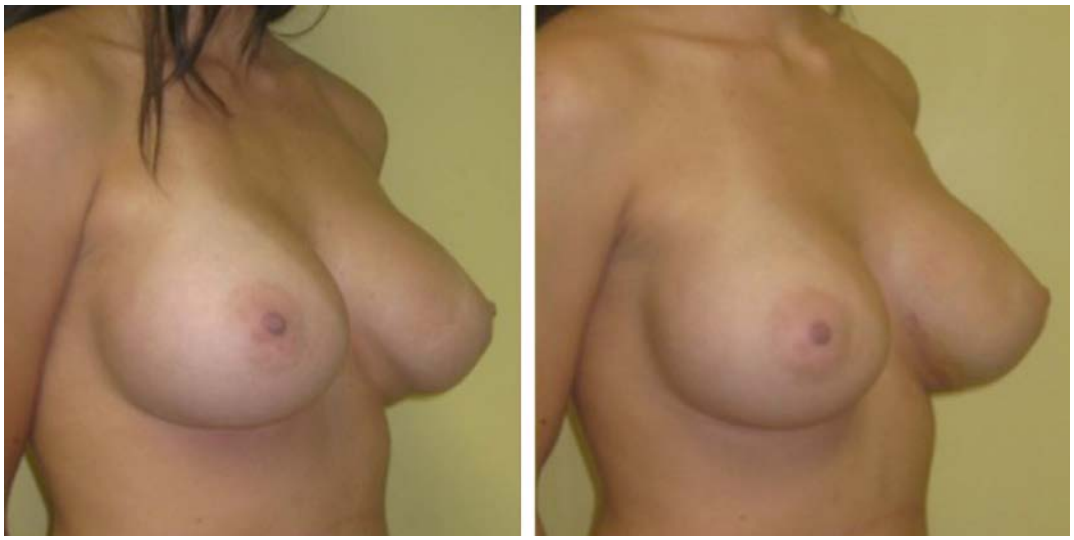
chest wall asymmetry and rotation. Implants are chosen based on base diameter or the high five technique. One must keep in mind that the implant should not violate the breast base, and any disruption of the footprint of the breast leads to complications of the device and/or breast itself.

Anesthetic may be local (BALA) or general. Regardless, a similar technique is performed for either method. Tumescent solution is prepared based on surgeon preference; however, the senior author uses epinephrine in the solution only if patients are undergoing general anesthetic. This removes any concern for lidocaine toxicity, and, based on previous studies it appears lidocaine has no long-term postoperative analgesic benefit.[17]

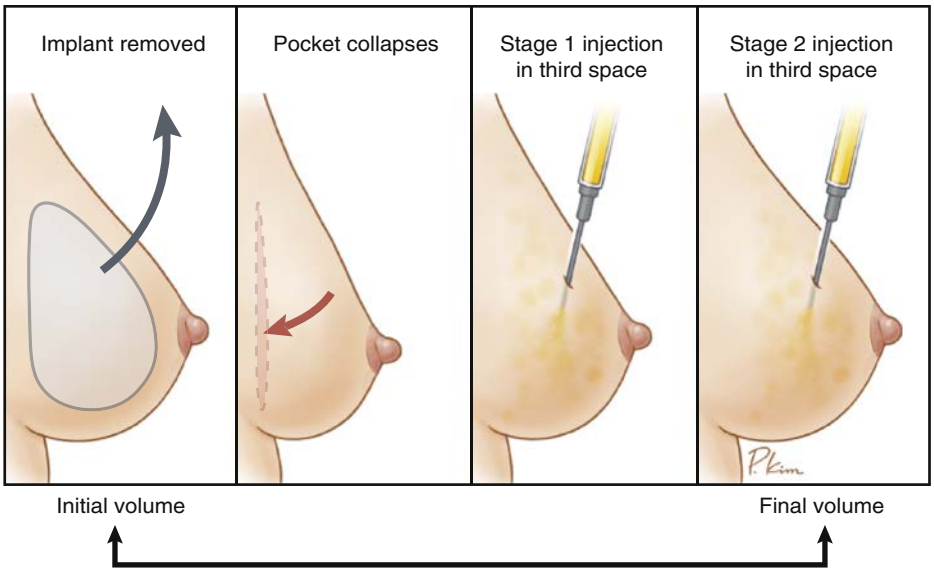
Simultaneous separation tumescence (SST) may be used to infiltrate the abdomen and any other region of the body based on the amount of fat required.[18–20] This provides a bloodless lipoaspirate with a quicker means of infiltrating. While infiltrating the abdomen, the tumescent should also be introduced in the breasts in a subglandular plane. This will aid in a bloodless dissection after the fat collection has occurred.



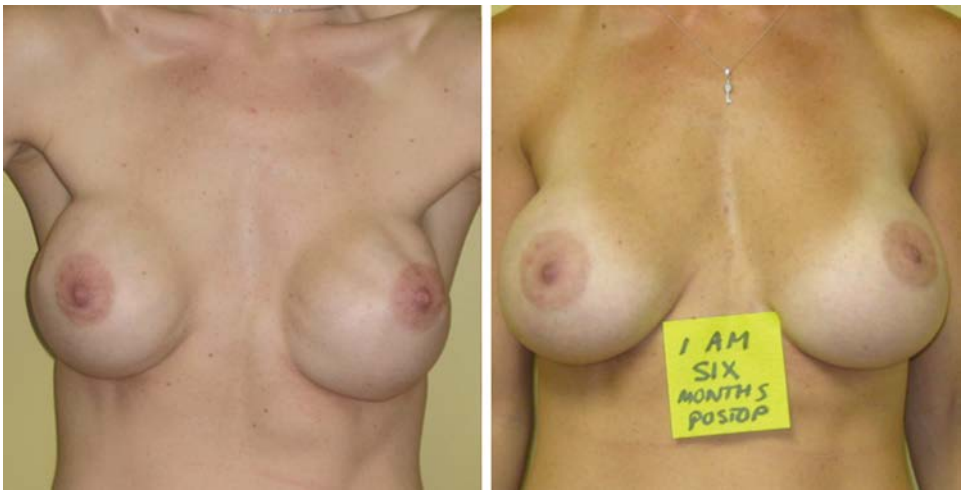
• **Fig. 7.8** Core volume fat transplantation used to obtain the ideal 45:55 upper to lower pole aesthetics, as described by Patrick Mallucci. Here, the lower pole has been expanded.



• **Fig. 7.9** An obvious lower pole deformity is seen on the left breast. This is not due to implant malposition, and rather than removing the device, the soft tissue can be modified over the implant to create a natural and aesthetically pleasing lower pole. This is one of the basic tenants of the composite procedure.



• **Fig. 7.10** Simultaneous implant exchange with fat (SIEF). The process may require BRAVA pre-expansion. Shown here is injection of fat in the third space of the breast in two stages, with simultaneous removal of the implant.



• **Fig. 7.11** Composite breast augmentation also may be used in revision cases. Shown here is an example of inadequate soft tissue coverage, rippling, and a wide cleavage gap. A 1:1 fat-to-implant ratio was used with a 6-month postoperative result showing significant improvement. Notice the improved cleavage gap and lack of rippling postoperatively.

A high-definition approach to the torso is generally preferred, because this complements the aesthetic results of a composite breast augmentation. The author prefers a suction-assisted approach for collecting the fat. Incisions are placed in the groin creases bilaterally and one in the supraumbilical region for access to the breasts. Donor site deformities will detract from the results of the breast procedure, and thus care must be taken to minimize these complications. One such way is to use SAFELipo, as described by Wall and Lee. [19,20] Equalization with an exploded-tip cannula off suction on the power-assisted device will aid in diminishing contour irregularities of the donor site, similar to a rake flattening and "equalizing" a mound of sand.

Fat is collected in a sterile canister and separated from the tumescent by a gravity approach. No washing or centrifuging is performed. Once the amount of fat collected is deemed appropriate in both quality and quantity and the donor site is aesthetically appealing, the surgeon then focuses on the breast portion.

A 4-cm incision is created in each IMF. The surgeon then continues a subfascial approach and dissection is carried out based on preoperative markings and breast implant shape and diameter. The plane should be relatively bloodless because of the tumescent previously infiltrated. Once the dissection is completed on both sides, fat is injected before implant placement to prevent inadvertent

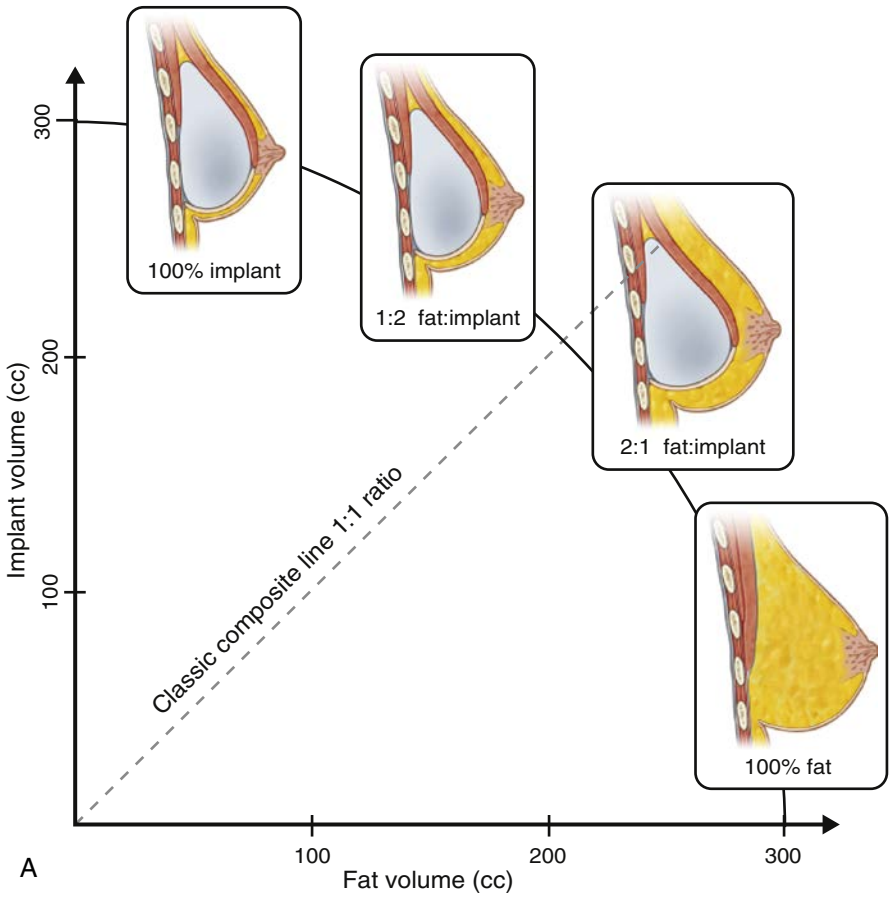
implant rupture. Fat is placed based on preoperative markings, usually in the superomedial transition zones in the subcutaneous tissue. More recently, the senior author has used a roller pump to directly inject the fat through the exploded-tip cannula on the power-assisted device in place of cannulas.

After the fat has been injected, the pockets are washed with triple antibiotic solution. Implants are opened and doused in triple antibiotic solution. Care is taken to follow the 14-point plan as outlined previously.[21] A no-touch technique has been adopted, and a Keller funnel is used for this purpose. Implant size for most women usually ranges between 200 and 300 cc; however, this varies based on soft tissue characteristics. No sizers are used and implants are of the same size, even in asymmetric cases, because fat will aid in camouflaging asymmetries. Once implants are placed, the wounds are closed with absorbable sutures, usually with a 3-0 Vicryl for the fascia and a 3-0 Monocryl for the deep dermis and subcuticular skin. Donor sites are closed with 3-0 chromic sutures. Compression garments are placed on the donor sites but not on the breasts.

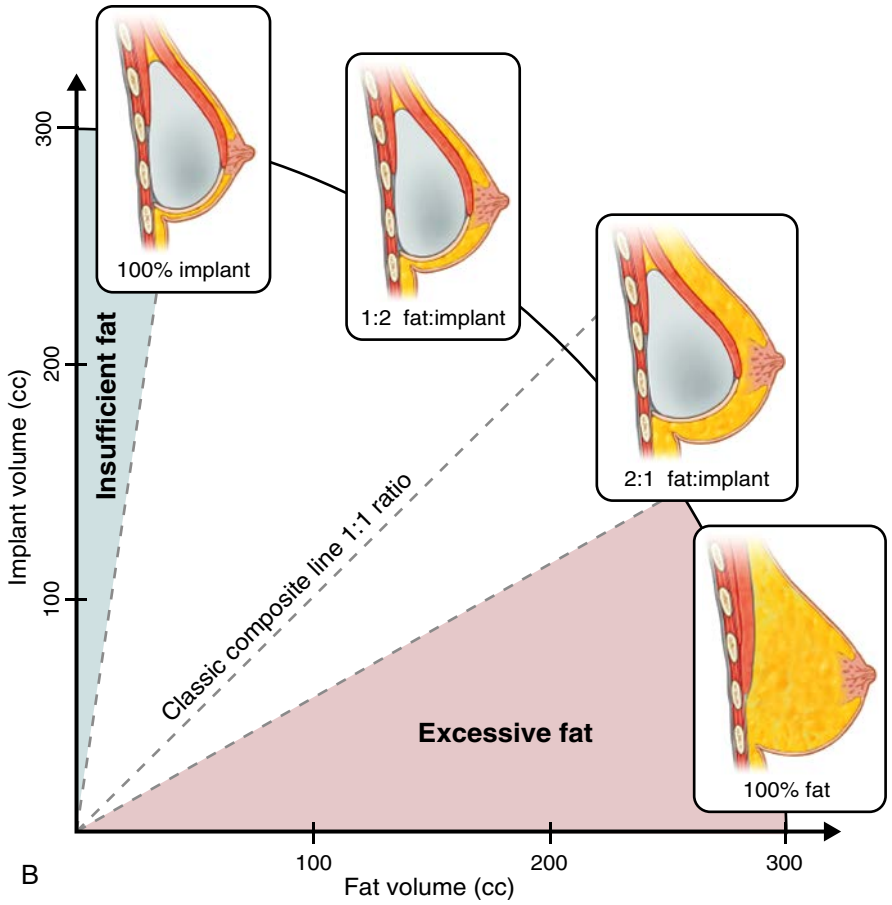
The location of fat placement can vary depending on location of the implant. In a complete submuscular placement of the implant, a higher volume of fat can be placed for a larger overlay. If the implant is placed in the subfascial or subglandular area, there is a progressively smaller volume of total fat that may be used for footprint coverage.

The approximate volume of fat needed can be estimated preoperatively based on tissue characteristics and the wide variety of implant volumes. Assuming the geometry of an implant to be a sphere, the amount of fat needed can be calculated based on a variety of radius measurements for a range of implant volumes (Fig. 7.13). One may be able to quantitatively measure the residual volume postoperatively if a preoperative and postoperative three-dimensional image is obtained, which is based on the following equation:

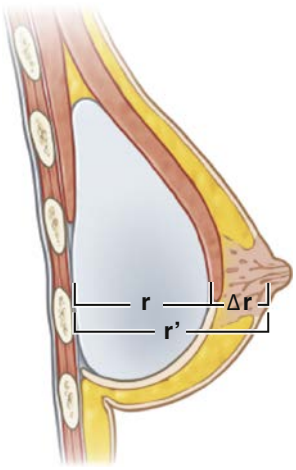
Total postoperative breast volume – Total preoperative breast volume – Implant volume = Retained volume



• **Fig. 7.12** (A, B) The spectrum of fat to implant ratios is shown. Although a wide range of ratios can be used, the realistic limits for composite breast augmentation is 1:3–2:1. The extreme ends of the spectrum are core volume fat only, where a range of fat excess ratios exists, to implant only, which is in the realm of insufficient fat volumes. One must recognize the ratio is a derivative, whereas aesthetics drives the end result. The ratio should not define the surgical strategy by the plastic surgeon.



• **Fig. 7.12 cont'd**



$V_0 = 4/3\pi\ r'1 \times r'2 \times r'3$

$V_1 = 4/3\pi\ r1 \times r2 \times r3$

V overlay = $V_0 - V_1$

Volume of implant	Volume of fat required for overlay thickness (Δr)		
	1 cm	1.5 cm	2 cm
300 cc	151 cc	239 cc	337 cc
325 cc	168 cc	261 cc	363 cc
350 cc	168 cc	264 cc	370 cc
375 cc	177 cc	278 cc	387 cc
400 cc	177 cc	280 cc	394 cc
450 cc	193 cc	304 cc	425 cc

• **Fig. 7.13** Spectrum of fat needed for coverage of implant, with different thickness, based on implant size. This does not take into account the amount of volume that diminishes over time. (Redrawn from Auclair, E., Blondeel, P., Del Vecchio, D.A., 2013. Composite breast augmentation: soft-tissue planning using implants and fat. *Plast. Reconstr. Surg*. 132 (3), 558-568 [Figure 7, p. 567]. Author [Del Vecchio] is same as chapter author.)

Percent volume maintenance = Retained volume / Total volume of grafted material

Postoperative Care and Expected Outcomes

The composite procedure is generally performed as a same-day surgery, and patients are able to go home within a few hours. No compression or bra is worn for 3 weeks to minimize compression on the implanted fat. Because a subglandular approach is preferred by the senior author, patients may return to exercise and heavy lifting after 7–10 days. Drains are not used in either the breasts or donor site. Pain may be controlled with either opioids or over-the-counter non-steroidal anti-inflammatory drugs. Breast pain is minimal because implant size does not violate the breast footprint and a subglandular approach is performed. Donor site dressings include an abdominal binder or compression garment.

Patient satisfaction is generally high, because they favor the quick, painless recovery with a subglandular augmentation combined with the natural look and feel of fat, which provides the best of both worlds.

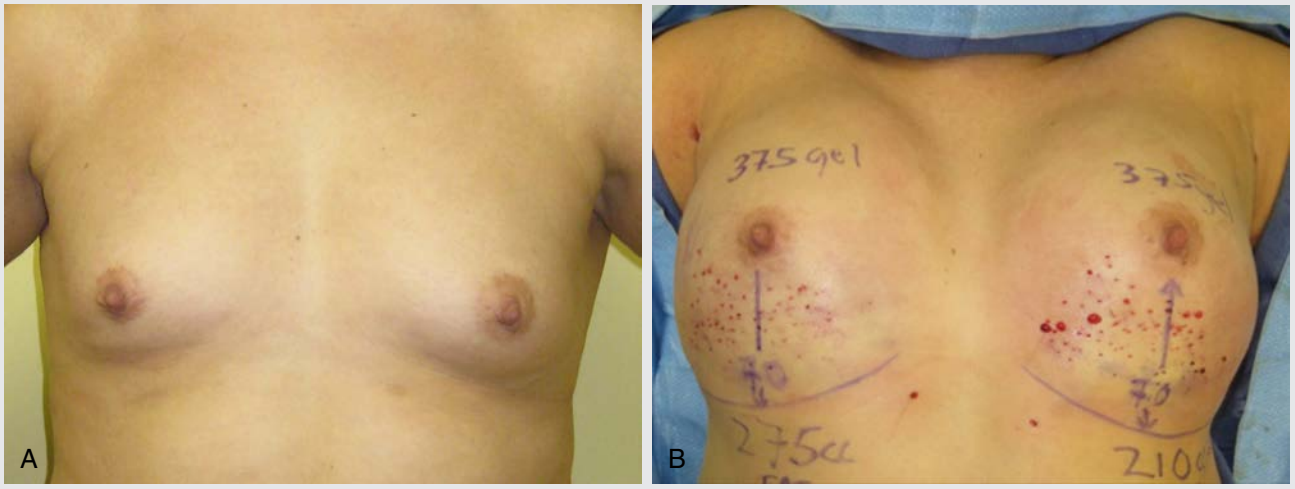
Based on the graft-to-capacity ratio, survival of the fat is generally superior in composite breast augmentation than core volume.[2,3] The decreased volumetric stresses on the recipient site provide an ideal environment for fat survival in the composite scenario. Fat volume does not violate the graft to capacity and is on par with a two-dimensional skin graft model.[3] The distinct yet complementary volumetric spacers of both fat and implants allow the surgeon to size and shape the breast in a customized fashion that normally is addressed with either tissue resection or differential implant sizes. A surgeon can achieve core volume augmentation with an implant and overlay this with the natural filler of fat.

Disadvantages of composite breast augmentation include a variable learning curve among plastic surgeons. Because implant placement is easily reproducible among surgeons, fat placement in the breast is technique dependent and fat survival rates may differ depending on technique and skill level of the surgeon. Another concern among surgeons and patients is the development of benign calcifications, which may cause concern on radiologic imaging. However, Cameron et al.[22] demonstrated composite breast augmentation to be safe and not interfere with interpretation on mammography, and no further studies were necessary in their average follow-up period of 29 months.[7,7a]

Case Examples

CASE 7.1

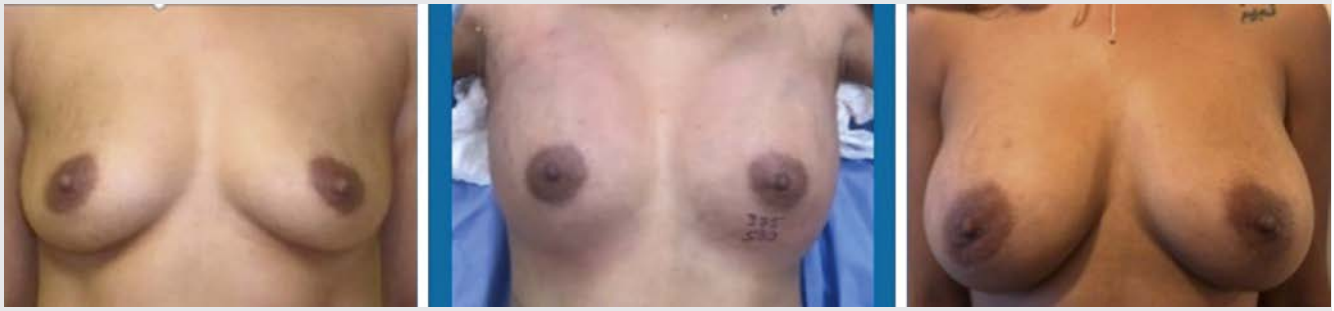
A 29-year-old patient with a 1:2 composite ratio is shown with preoperative and immediate surgical results (Case 7.1A, B). The silicone gel implants placed were 375 cc, with 210 cc of fat on the left and 275 cc on the right.



• **Case 7.1** A 1:2 composite ratio is shown with preoperative and immediate postoperative surgical results.

CASE 7.2

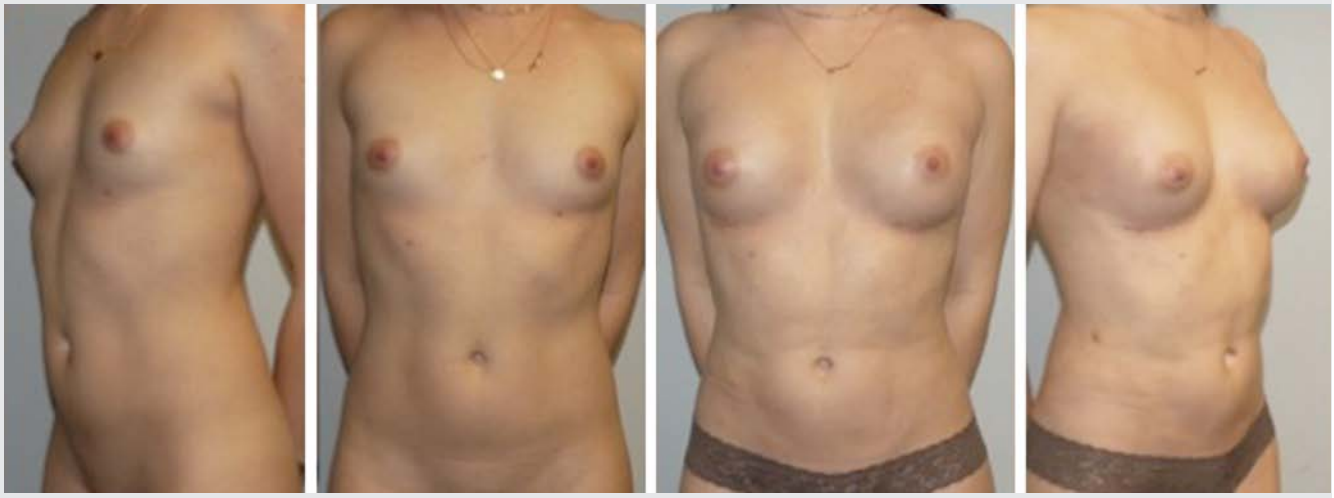
A 35-year-old patient with a 1:1 composite ratio is shown, with preoperative, on table, and 3-year postoperative results, respectively. The long-term results show significant maintenance of the fat with improvement of the cleavage gap. The natural look and feel of a breast with the core volume projection of an implant is obtained.



• **Case 7.2** A 1:1 composite ratio is shown, with preoperative, on table, and 3-year postoperative results, respectively.

CASE 7.3

Preoperative and postoperative results in a 25-year-old patient showing a 2:1 fat-to-implant ratio. A 180-cc implant in the subfascial plane was used with 350 cc of fat.



• **Case 7.3** Preoperative and postoperative results showing a 2:1 fat-to-implant ratio.

Management of Complications

Although uncommon, complications are similar to those with any standard breast augmentation and include hematoma, implant malposition, and capsular contracture. Hematomas require immediate drainage, and implant malposition may be treated with external massage; however, if the hematomas are significant, reoperation will be needed. Capsular contracture, although rare, will require an open capsulotomy versus capsulectomy. The best treatment for contracture is prevention, which includes a no-touch technique, minimal to no contamination during the procedure, and prospective hemostasis. To our knowledge, there is no evidence in the literature that shows a differential rate in capsular contracture between a composite procedure and standard breast augmentation.

The most common donor site complications include seroma and contour irregularities. Seromas are drained with needle aspiration, and small contour deformities may be manipulated with massage. However, if these persist longer than 6 months or are significant, reoperation may be required with the equalization technique, as described previously.

Secondary Procedures

Fat atrophy may occur, and in these cases a "round 2" will be required if there is need for further filling of the deficient areas based on surgeon evaluation and patient preference.

Generally, these patients may be thin, and obtaining fat from previously used donor sites may be more challenging; thus, other areas such as the thighs and arms may be used. To prevent this, overgrafting during the initial operation is recommended, and as suggested previously, the clinical endpoint is aesthetics of the breast rather than the amount placed.

Donor site deformities, as mentioned earlier, can be treated conservatively with aggressive massage. However, equalization at a later date, usually longer than 6 months postoperatively, may be necessary if these areas are substantially displeasing to the patient.

Conclusion

Since its inception in 2013, composite breast augmentation is not simply just implants with fat. It represents at the very least three major ratio subsets of a 1:2, 1:1, and 2:1 composite ratio, all of which seek to achieve different solutions for breast augmentation with BALA. Composite breast augmentation should be considered in a majority of patients undergoing primary breast augmentation because it provides the natural look and feel of fat with the core volume project of an implant. This procedure will continue to evolve in the future and address challenging breast implant problems.

SUMMARY BOX

Pearls for Success

- Fat-to-implant ratios are there for guidance but should not dictate the amount of fat needed. The end result is based on aesthetics rather than numbers.
- Do not violate the breast footprint with an oversized implant. Base diameter is important.
- Use simultaneous separation tumescence and equalization to minimize bleeding and donor site deformities, respectively.
- Subglandular augmentations are less painful and are not plagued with animation deformities postoperatively.
- If there is limited fat, fill the superomedial pole and cleavage gap first. Do not fill over the implant, because it is not necessary. Fill around the implant.
- There should be no compression on the breast for 3 weeks postoperatively.
- Secondary fat grafting procedures, although rare, may be necessary, and it is important to discuss them with the patient preoperatively.

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SECTION 2

Revision Breast Augmentation

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8

Revision Breast Augmentation – Exchange With a Different Type of Implant

MARK L. JEWELL

Introduction

Women who have undergone breast augmentation live with their breast implants for years and typically want to maintain their outcomes because it adds value to their lives. Revision breast augmentation provides patients an opportunity to maintain or improve their long-term outcomes with the latest in breast implant technology. Breast augmentation is not a one-time surgery, and maintenance surgery will be necessary. There are excellent options for breast augmentation maintenance surgery that will benefit patients for years to come.

For patients who have a good long-term outcome, without issues, a simple implant exchange within the same pocket to newer styles of gel devices is straightforward. For patients who have developed implant or soft tissue–related issues, planning must encompass steps to address both implant exchange and correction of the underlying disorder(s). Some patients opt for removal of their implants with or without adjunctive procedures such as mastopexy or autologous fat grafts that restore volume loss at explant. This topic, however, is outside of the scope of this chapter. Silicone gel–filled breast implants have become highly differentiated, with many options of high fill ratio gel devices that come in a variety of size and shape configurations and with different gel specifications.

Millions of women with aging breast implants will require maintenance surgery. This remains a great opportunity for plastic surgeons to help them enjoy the benefits of cosmetic breast augmentation for years in the future. Although surgery is part of the process, careful attention must be given to preoperative planning, management of patient expectations, and aftercare.

Indications and Contraindications

There are two primary indications for exchange of different type of breast implant: (1) patients with good to excellent outcomes seeking maintenance implant surgery; for those patients who have had a good long-term outcome, without issues, a simple implant exchange within the same pocket to newer styles of gel devices can be performed; (2) patients who have implant or soft tissue issues who seek implant maintenance surgery; for those patients who have developed implant or soft tissue–related issues, planning must encompass steps to address both implant exchange and correction of the underlying disorder.

Preoperative Evaluation and Special Considerations

The female breast is a dynamic structure, with changes that occur naturally during a woman's life and secondary to the presence of breast implants placed for augmentation. Successful maintenance surgery should follow a similar process that the surgeon has for primary breast augmentation, with a few other considerations. Patient evaluation templates (Fig. 8.1) are useful to record measurements, patient data, implant data, and planning.

For patients who have had a good long-term outcome without issues, a simple implant exchange within the same pocket to newer styles of gel devices is straightforward. For patients who have developed implant or soft tissue–related issues, planning must encompass steps to address both implant exchange and correction of the underlying disorder. This adds a degree of complexity and risk. Breast implants cannot last forever, and an understanding of their failure modes is needed. There are many different approaches to improving the quality of breast augmentation in patients who have soft tissue–related disorders, provided that both patient and surgeon understand the risks of operating on both the inside and outside of the breast.

Augmentation Mammaplasty Prior Breast Implants

Patient:_____ Date:_____

Age: _____

Height / Wt: _____

Bra Size: _____ Pant:_____

Parity:_____ Br. Feeding?_____

Medical Hx: _____

Surgical Hx: _____

Meds:_____

Allergies: _____

Smoker? _____

Br. Disorders/Bx?: _____

Mammogram/DUS/MR? _____

Br. CA HX? _____

BA Surg. Date:_____

Prior Surgeon: _____

Implant Size/Brand: _____

Assessment & Plan:

Breast Type: _____

Larger breast: _____

IMF Levels _____

Vertical Ht: _____

Chest wall circum.: _____

VECTRA Imaging Y/N: _____

Implant Placement: **RM** **RM/SF** **PRP**

Incision: **IMF** **TA** **PA**

Baker Class: Right I II III IV
Left I II III IV

Screening DUS: _____

Rippling: _____

Options: _____

Special considerations:_____

_____

_____

Caregiver:_____

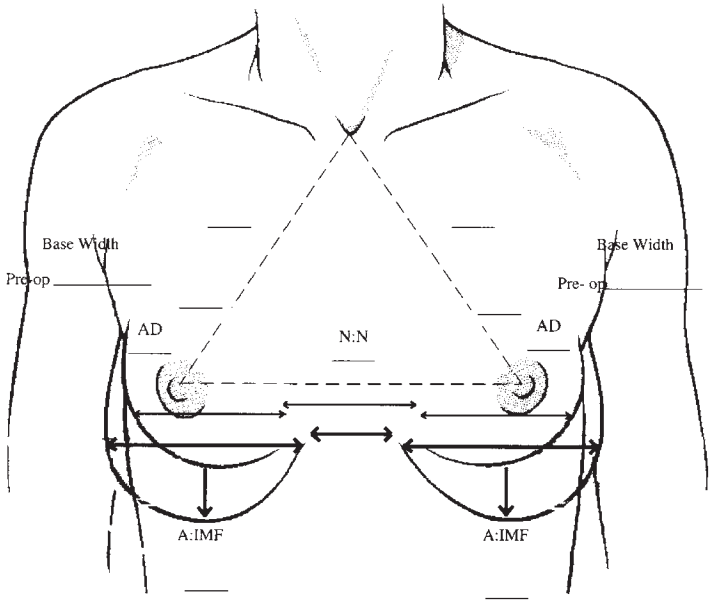
Packet given: _____

Plan: _____

_____

_____

_____



Augmentation Mammaplasty Prior Breast Implants

• **Fig. 8.1** Patient data template.

Silicone gel–filled breast implants have become highly differentiated with many options of high fill ratio gel devices that come in a variety of size and shape configurations and with different gel specifications. If a patient has round implants, a straightforward implant exchange can be planned. Individuals who have the highly cohesive, anatomically shaped implants can either continue with shaped implants or be converted to round implants. Although a conversion from round to shaped implants is possible, this requires a total capsulectomy and a tight pocket for the shaped implants to avoid rotation.

The best of all situations is having one of your own patients who returns for maintenance surgery (elective or emergent, e.g., saline implant deflation), where you have important data regarding the date of surgery, implant type and location, and the patient's clinical course. More challenging situations involve a patient from elsewhere, without implant information, lacking medical records.

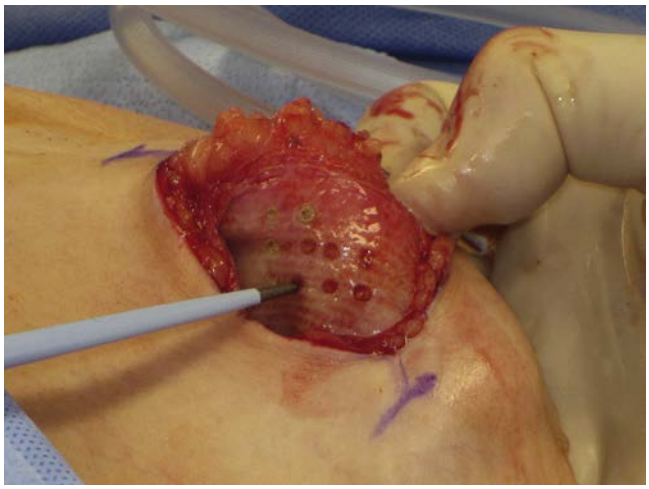
Even in situations of a known patient, with known implants, diagnostic ultrasound (DUS) proves useful to determine implant integrity and the presence of periprosthetic fluid, capsular calcification, or extracapsular gel. There are still many women with implants filled with the more liquid gels found in the pre-1992 era who have gel bleed, capsular calcification, and gel migration and require a total capsulectomy with removal of extracapsular gel. DUS is a useful tool to help plan surgery because it helps minimize planning mistakes when there is a problem with the implant or implant capsule that requires more extensive revisionary surgery.

Fig. 8.1 is a useful planning template to record physical measurements, information about the patient's breast surgery history, and plans for surgery.

Patients With Good to Excellent Outcomes Seeking Maintenance Implant Surgery

The best outcomes from maintenance surgery come from situations of good to excellent long-term clinical outcomes, such as a Baker I or II result where patients elect to place newer-generation gel-filled implants in an existing pocket where there is a mature capsule. This is certainly the most straightforward approach, where it comes down to an implant exchange. Minimal modification of the capsule is required.

If a patient with saline-filled implants has a deflation, prompt reoperation and replacement with newer-generation gel-filled implants offers a better aesthetic outcome, without the limitation of rippling and feel of liquid. The dimensions of the saline implant pocket can change with slow deflation over time. Be certain to measure the pocket dimensions and weigh the saline-filled implant to avoid inserting the replacement implant into a constricted pocket. The use of sizer implants is a useful strategy to verify that the pocket has adequate capacity for the replacement implant. The replacement implant should be inserted one time into the pocket. It should not be used as a sizer because this increases risk of biofilm contamination from repeated insertion.



• **Fig. 8.2** Thermal "popcorn" capsulorrhaphy.

A capsulotomy may be required if pocket capacity needs to be increased because of constriction or to accommodate a larger implant. One sign of a constricted pocket is found in measuring the base diameter (BD) of the breast with calipers. If the BD of the breast is less than the BD of the implant, constriction of the implant pocket has occurred due to deflation or capsular contracture. A capsulotomy will be required to open the pocket somewhat to add capacity.

It is straightforward to find replacement implant choices that match the engineering specifications of the patient's existing implants. Subtle changes in volume (plus or minus) may be possible but may require a capsulotomy for larger size implants. The use of newer-generation, highly filled, round silicone gel implants permits correction of rippling and the unnatural feel of saline. The only caveat here is to be careful when planning surgery to have the replacement implant match the engineering specification of the BD to fill the width of the pocket and avoid a possible implant flip-over or mismatch between replacement implant size and pocket capacity. A "popcorn" capsulorrhaphy with the electrosurgical pencil may be useful to decrease pocket capacity somewhat if the patient requests replacement with a smaller implant (Fig. 8.2).

Surgical Planning and Technique: Simple Implant Exchange

A simple implant exchange is a straightforward procedure, capable of being performed with intravenous (IV) sedation and local anesthesia. The existing inframammary fold (IMF) incision is used. My personal approach is to preinject the existing IMF incisions, use nipple shield covers, and excise the old IMF surgical scar. A stair-step dissection down to the capsule helps with the closure at the end of surgery. A

capsulotomy can be easily made with the electrosurgery pencil to access the implants. For patients with transaxillary or periareolar incisions, I recommend a new incision in the inframammary region versus repeating the original incision that could produce a visible soft tissue deformity.

From that point, removal of the existing implants and replacement can be accomplished. Most implants have information on the patch that indicates manufacturer and style, which is potentially useful when medical records from earlier surgery are not available. In some cases, it may be necessary to measure the implant BD once the implant is outside the pocket and weigh the implant. Even in situations of ruptured gel implants, try to locate the patch on the implant shell for information.

Insertion of the new implants follows a standard technique designed to prevent biofilm contamination of implants (glove change, "no-touch" technique, use of anti-infectives [antibiotics and povidone-iodine [Betadine], and an insertion device). The replacement implants should go in one time only. If consideration for size change and possible capsulotomy are planned, use a sizer implant and measure the pocket dimensions internally. Wound closure with an absorbable monofilament suture and a skin glue finishes the procedure. Drains are not necessary, unless there has been extensive capsule work.

Surgical planning for a simple exchange is summarized in Boxes 8.1 and 8.2.

• BOX 8.1 Implant Exchange in Patients With Good Long-term Outcome When Patient Wants Similar Size

- Obtain biodimensional measurements and a diagnostic ultrasound imaging study (implant, capsule, and parenchyma).
- Obtain the previous operative report or implant information for implant dimensions.
- Select replacement implants based on existing implant dimensions.
- Round-to-round may require minimal capsule modification.
- For shaped-to-round, plan on capsulotomy to enlarge the capsule.
- For round-to-shaped, plan on total capsulectomy and a larger implant that will have a tight fit (most complex; use anatomically shaped sizers to confirm tight pocket fit).
- Surgical planning: Use inframammary fold access.
- Surgical technique: Remove old implant and measure pocket dimensions; a trial size implant is required to verify pocket capacity.
- Insert the implant using the no-touch technique; irrigate the pocket with povidone-iodine (Betadine), change gloves, and insert the device.
- Drains are typically not required.

• BOX 8.2 Implant Exchange in Patients With Good Long-term Outcome When Patient Wants Larger or Smaller Size

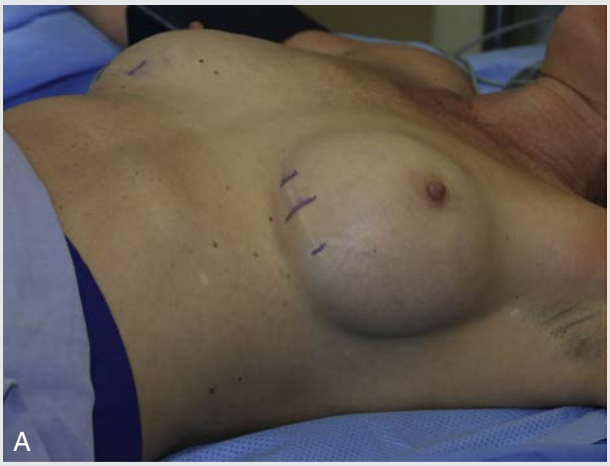
- Obtain biodimensional measurements and a diagnostic ultrasound imaging study (implant, capsule, and parenchyma).
- Obtain the previous operative report or implant information for implant dimensions.
- Select replacement implants based on existing implant dimensions: To go larger, pick a higher-projecting implant that will fit into the pocket; for smaller, select a lower-projecting implant.
- Round-to-round may require minimal capsule modification.
- For shaped-to-round, plan on capsulotomy to enlarge capsule for larger size.
- Round-to-shaped may not be feasible because of large pocket size and risk of rotation.
- Surgical planning: Use inframammary fold access.
- Surgical technique: Remove the old implant and measure pocket dimensions; a trial size implant is required to verify fit. Consider "popcorn" capsulorrhaphy to diminish pocket size when downsizing.
- Insert the implant using the no-touch technique; irrigate the pocket with povidone-iodine (Betadine), change gloves, and insert the device.
- Drains are typically not required.

Case Examples

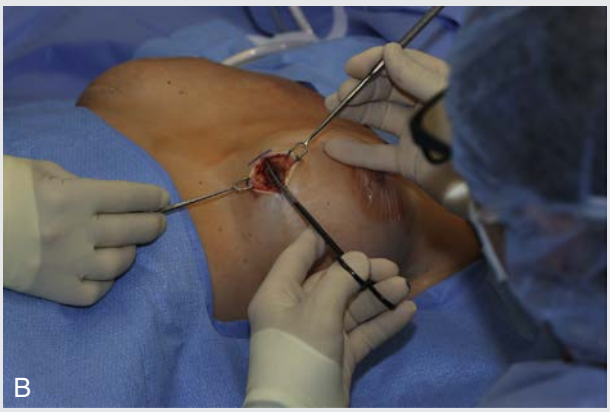
Breast implant replacement surgery can vary from a simple implant exchange in the same pocket to more complex procedures where additional steps must be taken to correct implant or soft tissue problems. Five case studies are shown that have increasing complexity. Cases 8.1 and 8.2 are shown in a step-like fashion.

CASE 8.1

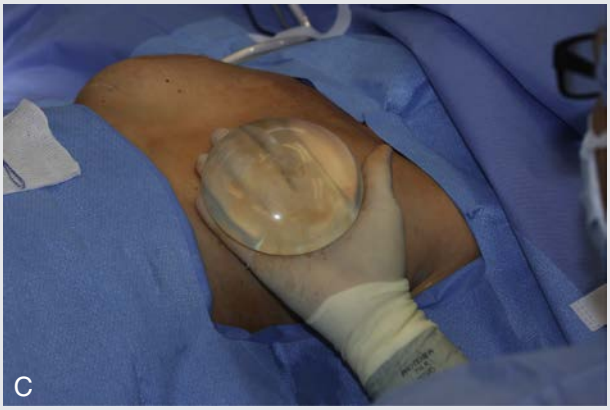
A 46-year-old woman presented 13 years after a biplanar saline breast augmentation with Inamed Style 68, 300–330 cc implant. She had experienced a partial deflation on the right side. She elected to replace with Allergan Inspira SRF 345 cc implants. This was a straightforward exchange without the need for capsular modification. Her surgery is shown in a stepwise fashion (Case 8.1.1A–H). This is a typical example of a saline deflation shown with a right-sided loss of volume. Her outcome after implant exchange is shown in Case 8.1.1I. The implant was found to have a valve failure with partial deflation (see Video 8.1).



• **Case 8.1.1A** Preincision.



• **Case 8.1.1B** Capsulotomy.

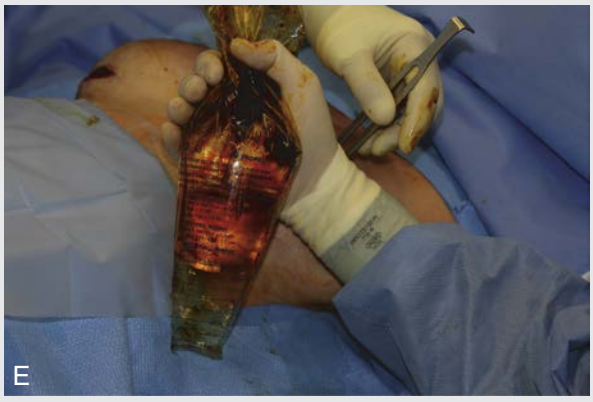


• **Case 8.1.1C** Remove existing saline implant.

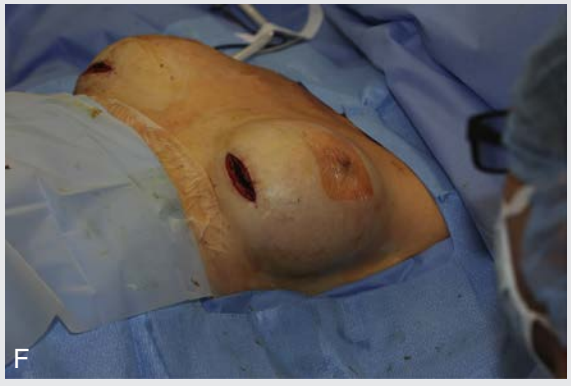
• **Case 8.1D** Inspect implant pocket dimensions.

Continued

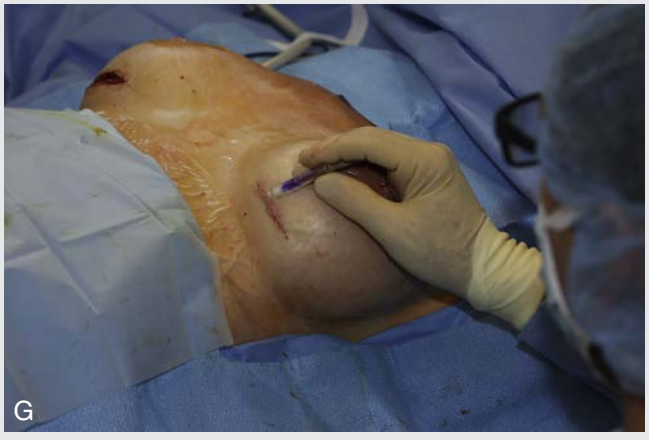
CASE 8.1—Cont'd



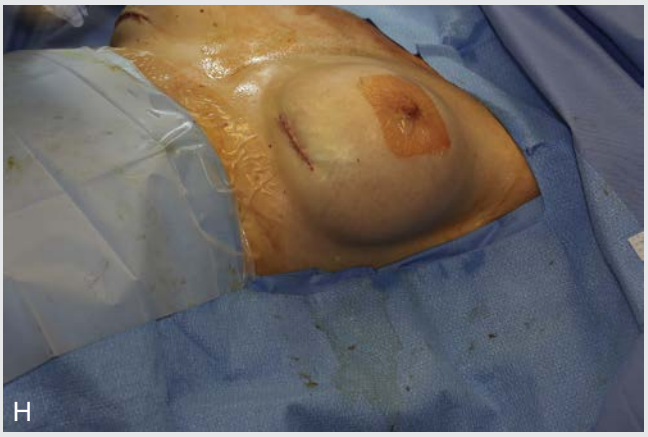
• **Case 8.1.1E** Insert new gel implant with funnel.



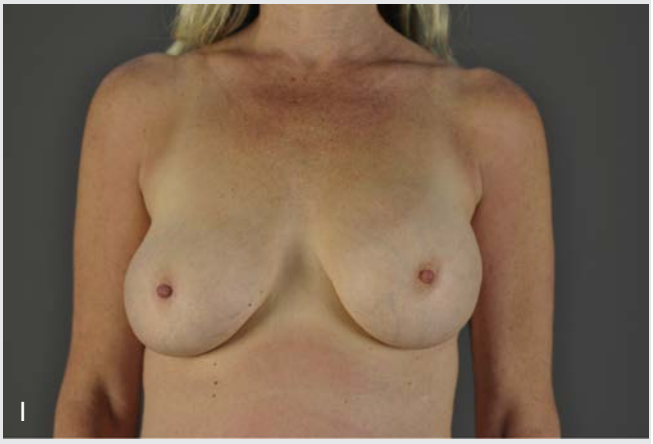
• **Case 8.1.1F** Verify symmetry and close capsule layer.

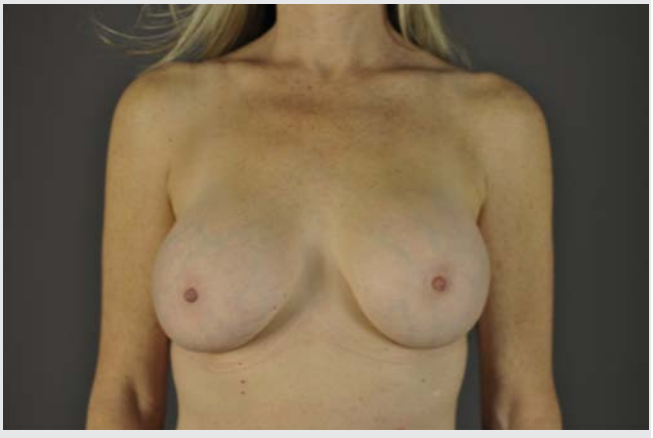


• **Case 8.1.1G** Close skin and apply skin glue.



• **Case 8.1.1H** End of implant exchange procedure (round gel replacing saline implant).

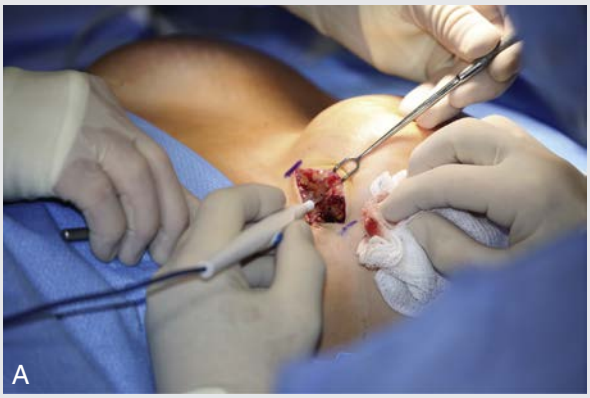




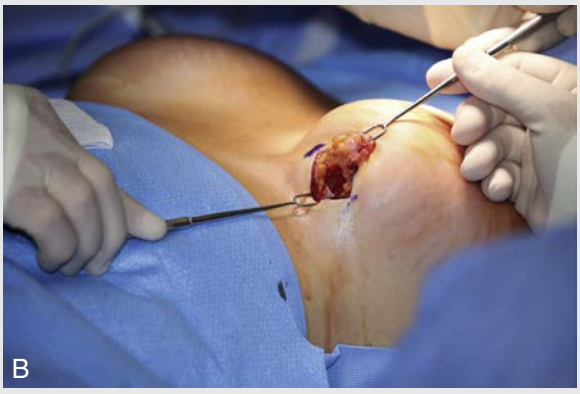
• **Case 8.1.1I** Before and after saline deflation.

CASE 8.2

A 34-year-old woman presented 8 years after a retromammary breast augmentation with Allergan Style 410, FM 350 cc implants. She experienced a buckling of her implants that was visible and annoying. Her goal was to have more upper breast roundness and a larger size. I selected the Allergan Inspira SSF 415 cc device with a more cohesive gel to enhance upper pole fullness. Her surgery was more complex because she needed a capsulotomy to increase pocket capacity from 350 to 415 cc. A trial implant of 415 cc was used to verify pocket capacity. The permanent implant should go in one time and not be used as a sizer. Her surgery is shown in a stepwise fashion (Case 8.2.1A–J). Her before and after photos are shown in Case 8.2.1K and 8.2.1L. The circles that are shown in the preoperative photo are the location of the implant buckling (see Video 8.2).

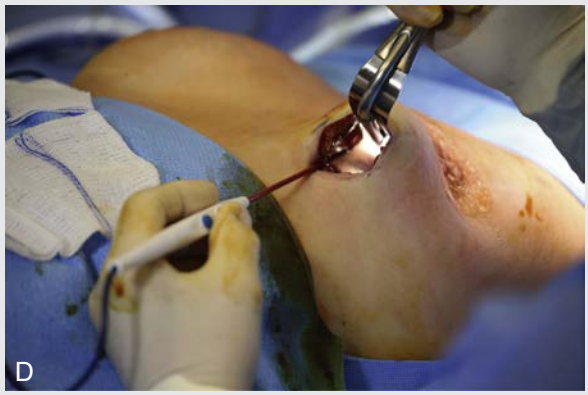


• **Case 8.2.1A** Initial incision.

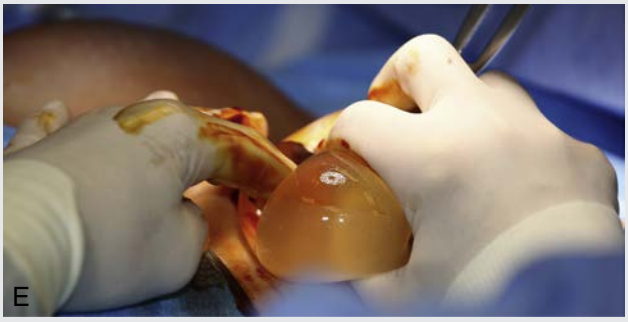


• **Case 8.2.1B** Capsulotomy is made slightly above level of IMF.

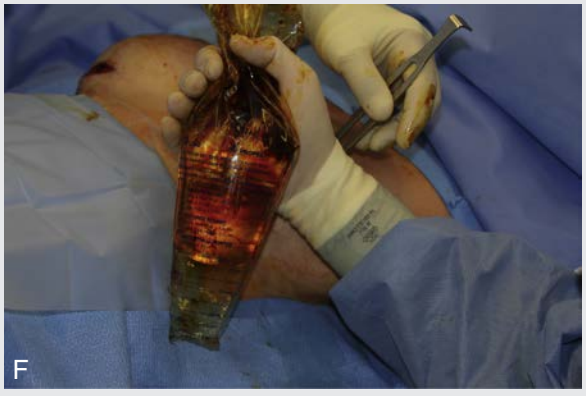
• **Case 8.2.1C** Remove shaped implant.



• **Case 8.2.1D** Perform superior capsulotomy to enlarge pocket.

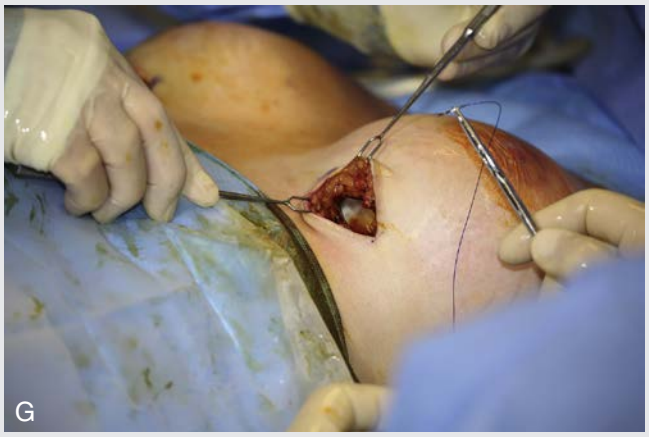


• **Case 8.2.1E** Verify pocket capacity with trial implant.

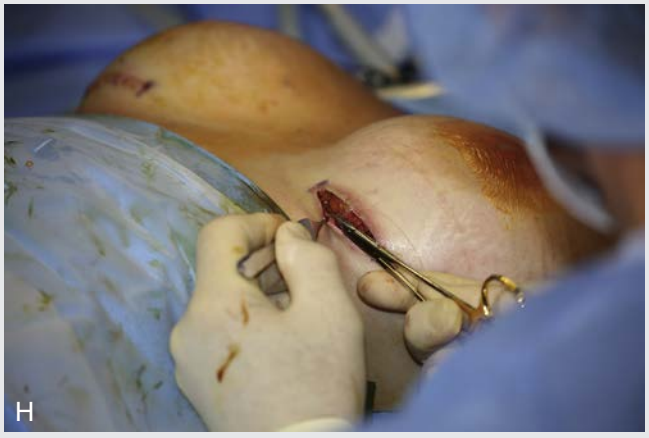


• **Case 8.2.1F** Insert replacement implant with funnel—"no touch" technique.

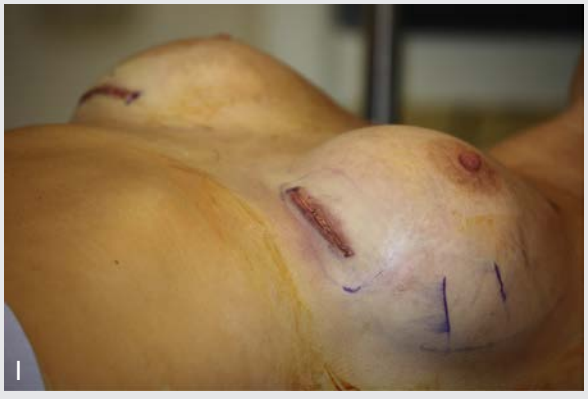
CASE 8.2—Cont'd



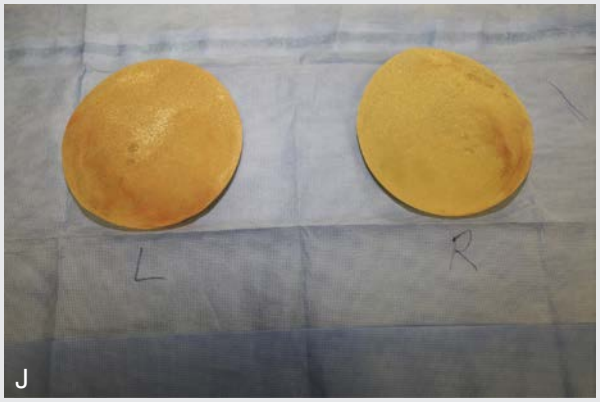
• **Case 8.2.1G** Close capsule layer with absorbable monofilament suture.



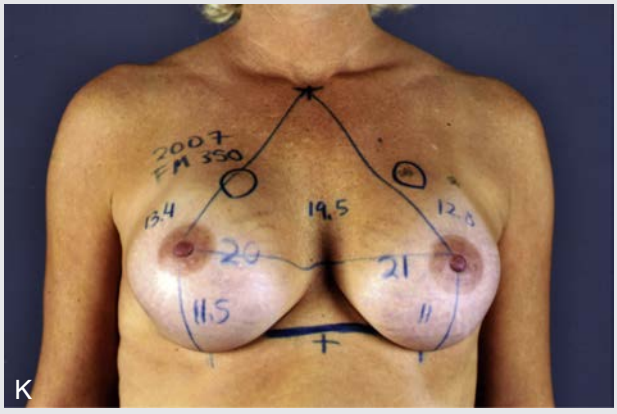
• **Case 8.2.1H** Skin closure.



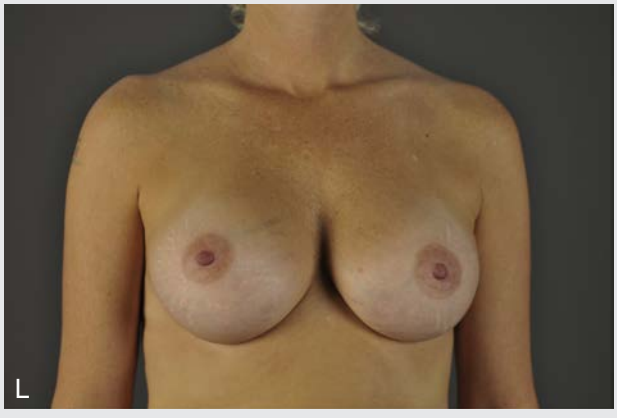
• **Case 8.2.1I** End of implant exchange (round gel replacing shaped implant).



• **Case 8.2.1J** Shaped implants that were removed.



• **Case 8.2.1K** Preoperative Allergan 410 to Inspira conversion.



• **Case 8.2.1L** Follow-up.

CASE 8.3

A 33-year-old woman underwent a saline breast augmentation with periareolar, biplanar implant location in 2002 with Mentor Style 1600 implants, 350 cc with a 50-cc overfill. She experienced a complete deflation on her left side 2 months before seeking a consultation. She was satisfied with her size, 34D, and wanted newer-generation, more cohesive gel implants that produce upper breast roundness. Physical examination showed volume loss on the left side and no malposition on the right. She was Baker I soft on the right side.

This was a fairly straightforward implant exchange in the same pocket, but with the potential need for a pocket tightening procedure (thermal capsulorrhaphy) on the right if a comparably sized, full-projecting implant did not completely fill the existing pocket. Although the engineering dimensions of a moderate-projecting implant would have been similar to her Mentor Style 1600 implants, I did not think that it would give her the desired upper breast fullness.

Regarding the deflated left side, the exact pocket dimensions could only be verified at surgery by direct measurement. It has been my experience that when a saline implant deflation occurs, the pocket becomes smaller and a capsulotomy or potential capsulectomy is required.

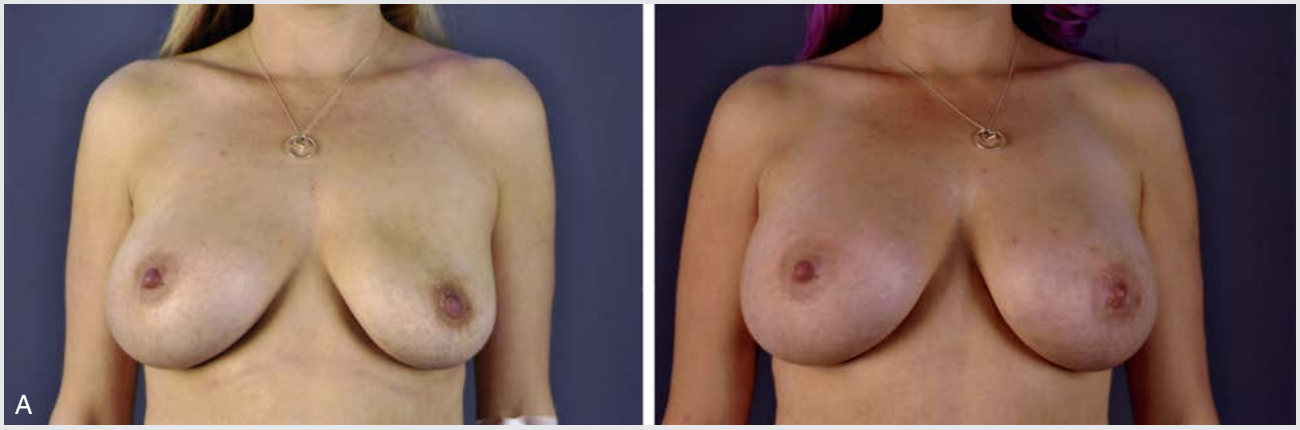
I discussed with her my recommendations for a new IMF incision versus reopening the periareolar incision.

On the right, non-deflated side, an intact saline implant weighing 400 g was removed. On the left side, the deflated implant shell and a small amount of residual saline weighed 30 g. Measurement of the right pocket indicated a 13 cm width. The left pocket was smaller, measuring 11 cm.

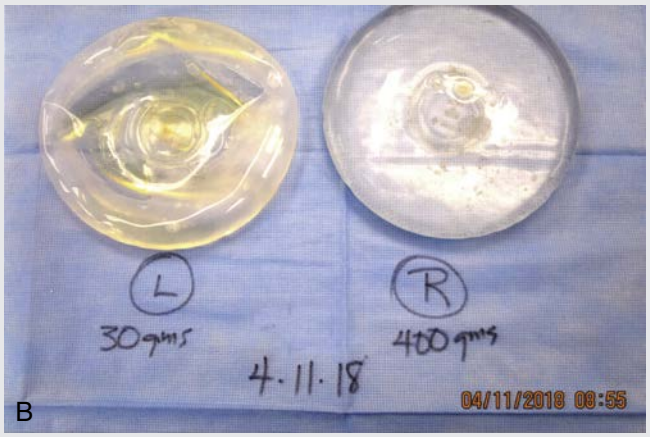
I placed an Allergan Natrelle Inspira SRF 415 cc sizer implant in the right pocket and noticed that the fit was slightly loose. I removed the sizer implant and performed a thermal capsulorrhaphy on the right side to shrink the capsule. Once this was completed, I inserted the sizer again and was satisfied with the fit.

On the left side, there was a normal-appearing capsule. It was constricted and needed enlargement to accommodate the 415 cc implant. I performed a capsulotomy to enlarge the pocket with a long Colorado electrosurgical needle around the margin, from 12 to 6 o'clock and 3 to 9 o'clock. This was adequate to increase pocket capacity for the 415 cc sizer. The Allergan Natrelle Inspira SSF 415 cc were inserted with a no-touch technique using a Keller funnel.

Before and after images along with the implants are seen in Case 8.3.1A and B.



• **Case 8.3.1A** Preoperative/postoperative implant exchange (saline to round gel, completely deflated left side).



• **Case 8.3.1B** Completely deflated left saline implant; intact right-side implant.

CASE 8.4

A 44-year old-woman presented 12 years after a biplanar augmentation mastopexy (performed by another surgeon) with Mentor Style 1600 implants, 350 cc fill. She did not like the feel of her saline implants (palpable rippling and no upper pole projection). This patient requested newer-generation gel implants and correction of inferior malposition and animation deformity.

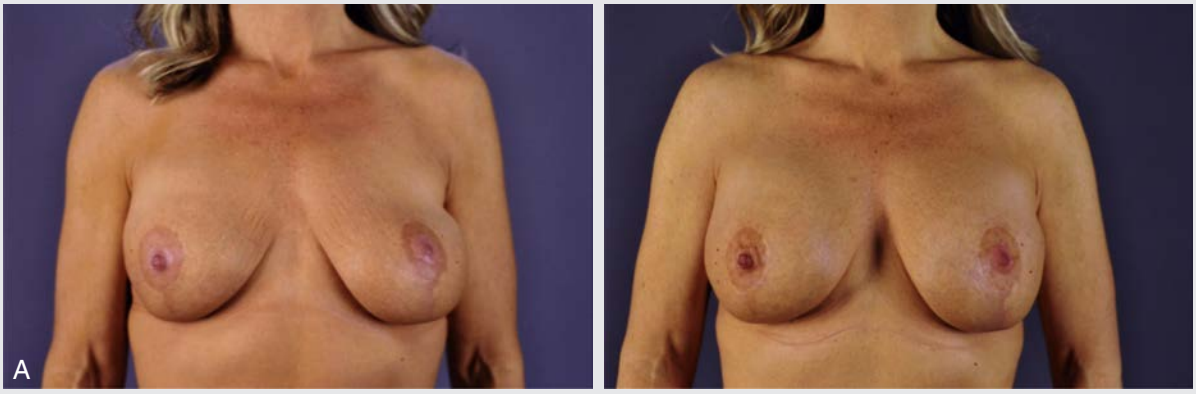
Physical examination revealed inferior malposition, more on the left than the right, and palpable rippling of the saline implants. Nipple-to-fold was 10.5 cm on the right and 11.5 cm on the left. She had a pronounced animation deformity when she tightened her pectoralis major muscles.

Her tissues were somewhat thin, especially in the lower pole, from the saline implants producing a "water hammer" effect, which contributed to the thinning and inferior malposition. My strategy here was to manage the inferior malposition with a capsulorrhaphy that incorporated absorbable mesh (Galaflex) and to release the inferior edge of the pectoralis major muscle at its sternal origin.

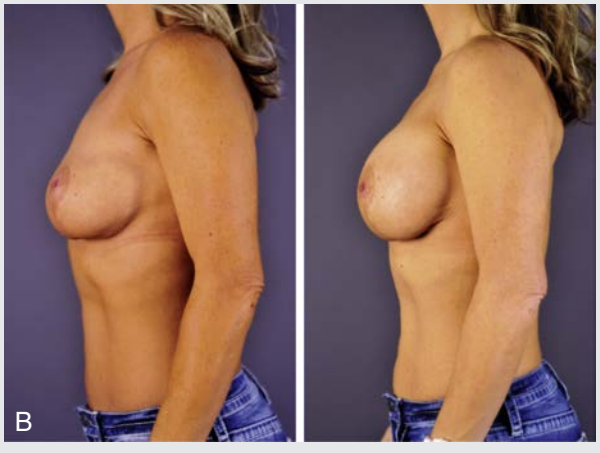
Intact saline implants were encountered. Each weighed approximately 370 g. Inferior malposition was noted, with the left side IMF approximately 1 cm lower than the right. An incompletely released pectoralis major muscle on both sides was the source of the animation deformity.

I used the long Colorado electrosurgery needle to release the inferior edge of the muscle. Next, an inferior capsulorrhaphy was performed with 2-0 PDS using stitches with buried knots before a 2.5-cm by 10-cm strip of Galaflex mesh was applied. It has been my experience that suture knots used in the capsulorrhaphy can prevent tissue contact with the mesh. The mesh was secured with interrupted 3-0 PDS and a running barbed 3-0 PDO barbed suture. A trial size implant of 415 cc was used to determine that the capsulorrhaphy was correct in both supine and semi-upright positions. Allergan Natrelle Inspira SSF 415 cc implants were inserted.

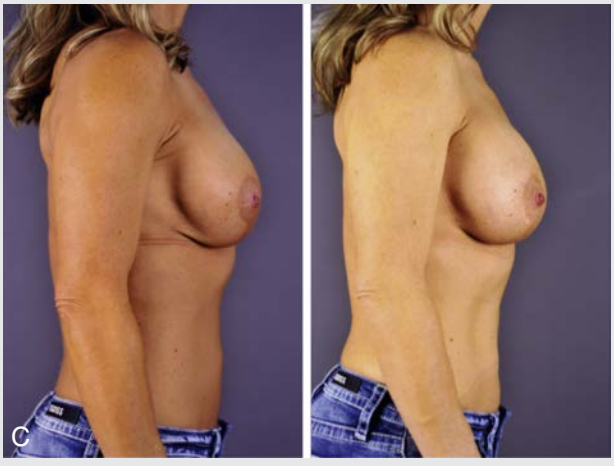
Before and after images are seen in Case 8.4.1A–C. In this patient's situation, an implant exchange was more complex because of the presence of inferior malposition, which required a capsulorrhaphy and alloplastic soft tissue support in addition to a release of the inferior edge of the pectoralis major to correct the animation deformity.



• **Case 8.4.1A** Preoperative/postoperative implant exchange saline to round Gel; capsulorrhaphy; release of pectoralis major muscle to correct animation deformity.



• **Case 8.4.1B** Preoperative/postoperative side view, left.



• **Case 8.4.1C** Preoperative/postoperative side view, right.

CASE 8.5

A 36-year-old woman presented 3 years after a biplanar breast augmentation (performed by another surgeon) and circumareolar mastopexy with 435 cc gel implants (Sientra). She wanted more upper breast roundness and larger implants. She did not like the biplanar implant location because of animation deformity.

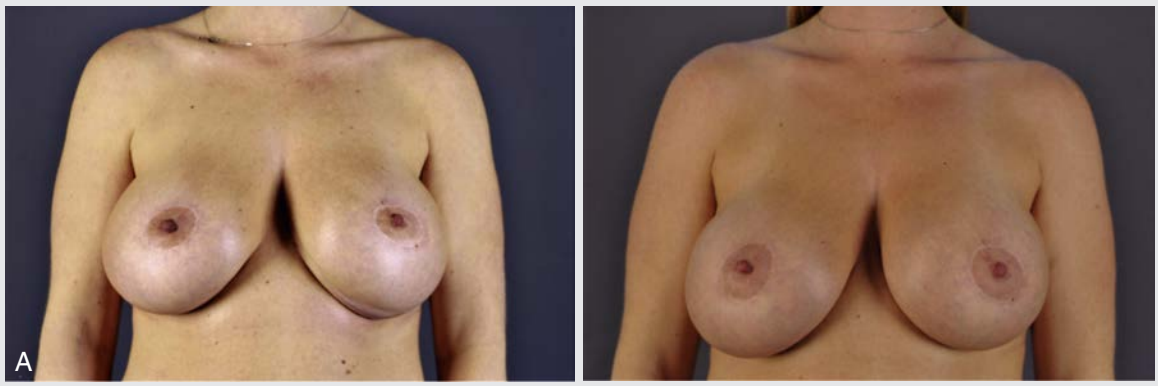
Nipple-to-fold was 12 cm bilaterally. There appeared to be extra skin in the lower breast region. She had 48 mm of upper pole pinch, indicating adequate soft tissue coverage for a site change. IMF levels were equal. She was Baker I soft on both sides.

This patient presented with a request for larger implants with newer gel formulation that would give her more upper breast roundness and at the same time correction of excess skin in the lower part of her breasts. My surgical strategy was to perform a site change to the retromammary-subfascial location and excise a strip of excess skin on the lower breast skin along the IMF to correct the horizontal skin excess. A thermal capsulorrhaphy was performed to tighten the lower breast capsule.

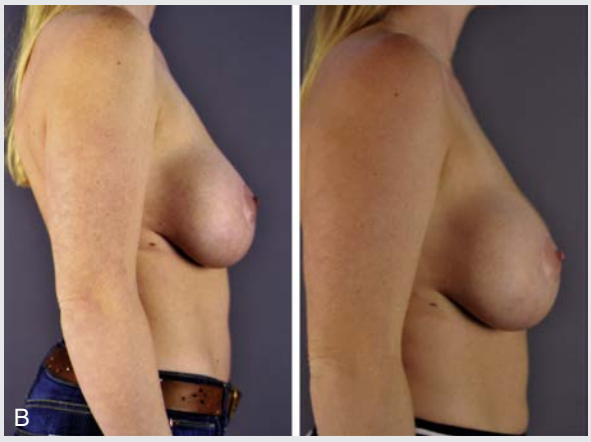
The existing 435 cc implants were removed and the site change was performed first. I used two Allis clamps to grab the edge of the pectoralis major muscle and the capsule to start the dissection. I used a flat blade electrosurgical pencil extender tip. Once I had about 1.5 cm of the capsule and pectoralis major muscle separated off the back side of the breast, I used 3-0 PDS interrupted sutures to sew the muscle and capsule back down on the chest wall, starting at the sternal region and working laterally. Once the new pocket dissection was completed, I added a second suture line of 3-0 PDO barbed sutures. It has been my experience that this technique facilitates dissection of a new pocket because the muscle and capsule are secured to the chest wall and counter traction with the fiber-optic retractor is possible. Dissection was performed upward to create a 13.5 cm wide neo-pocket in the retromammary-subfascial location.

A thermal capsulorrhaphy was performed to tighten the lower capsule. Pocket capacity was determined to be correct with a 520 cc Allergan Natrelle Inspira sizer. Next, the Allergan Natrelle Inspira SSF 520 implants were inserted. Once the capsule layer was closed with 2-0 PDS, a crescent-shaped strip of skin, approximately 1.5 cm was excised on both sides at the level of the IMF. Wound closure was accomplished with interrupted and subcuticular 3-0 Monocryl sutures.

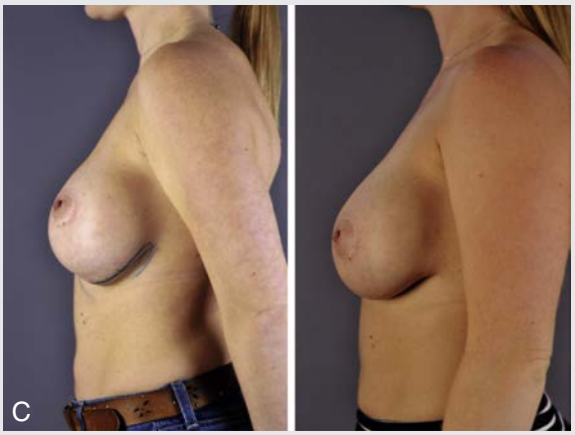
Before and after images are shown in Case 8.5.1A–C. Blue lines in the IMF area were used to determine the amount of lower breast skin to be removed in order to correct the horizontal excess of skin. She achieved a nice correction of the horizontal skin excess and animation deformity and more upper pole fullness with the newer gel formulation. This was a more complex case of a patient who wanted a revision of her breast augmentation and newer, larger implants. A simple implant exchange would not be adequate and other soft tissue issues required correction for a successful outcome.



• **Case 8.5.1A** Preoperative/postoperative implant exchange (round gel replaced with round gel); site change (biplanar to retromammary-subfascial); excision of skin strip along IMF.



• **Case 8.5.1B** Preoperative/postoperative side view, right.



• **Case 8.5.1C** Preoperative/postoperative side view, left.

• BOX 8.3 Implant Exchange in Patients With Soft Tissue Issues Who Want Implant Exchange and Correction of Soft Tissue Problems

- Obtain biodimensional measurements and a diagnostic ultrasound imaging study (implant, capsule, and parenchyma).
- Obtain the previous operative report or implant information for implant dimensions.
- Determine the problem with the soft tissue (e.g., ptosis, traction rippling, inadequate soft tissue coverage; malposition, capsular contracture, double bubble, excessive animation deformity, wrinkles/folds in implant capsule).
- Select replacement implants based on existing implant dimensions: To go larger, pick a higher-projecting implant that will fit into the pocket; for smaller, select a lower-projecting implant.
- Round-to-round may require minimal capsule modification.
- For shaped-to-round, plan on capsulotomy to enlarge capsule for larger size.
- For round-to-shaped, plan on total capsulectomy and larger implant that will have tight fit (most complex).
- Surgical planning: Use inframammary fold (IMF) access; determine the sequence of soft tissue corrective steps versus implant exchange.
  - For ptosis, exchange implant first, then mastopexy.
  - For capsular contracture, perform a capsulectomy, possibly using acellular dermal matrix (ADM), and then implant exchange.
  - For a double bubble, perform inferior capsulorrhaphy to restore IMF support, verify pocket capacity with trial implant, and then exchange implants.
  - For malposition, correct malposition first, verify pocket dimensions with a trial implant, consider using ADM or absorbable mesh, and then exchange implants.
  - For traction rippling, determine pocket dimensions and perform an internal "popcorn" capsulorrhaphy, exchanging implants to more/most cohesive smooth round devices. An autologous fat transfer graft may be needed.
  - For excessive animation, perform a site change to the retromammary plane.
  - When there are wrinkles/folds in capsule, perform capsulotomy to increase pocket dimensions, then place trial implant; consider replacement implant with more cohesive gel; exchange implants.
- Surgical technique: Remove the old implant; measure pocket dimensions; trial size implant is required to verify pocket capacity.
- Implant insertion should be performed using the no-touch technique; irrigate the pocket with povidone-iodine (Betadine), change gloves, and then insert the device.
- Drains typically are required if capsulectomy is performed.

Patients Who Have Implant or Soft Tissue Issues Who Seek Implant Maintenance Surgery

There are a variety of implant and soft tissue–related issues that can occur after breast augmentation. Careful attention to determining what issues exist (sometimes it is more than one) is essential in planning revision surgery. For your own patients who have known implant information and a clinical diagnosis, planning for surgery is easier than trying to estimate the size of an unknown implant.

I cannot emphasize enough the importance of planning templates and physical measurements. Equally important is imaging of breast tissue and implant. DUS imaging assists the surgeon in planning for surgery. Implant integrity, capsular calcification, extracapsular gel, and the presence or absence of periprosthetic fluid can be evaluated before surgery. Revision cases such as these are more complex, take longer, and require more planning than a simple implant exchange.

Surgical planning strategy for soft tissue and implant-related issues is summarized in Boxes 8.3 and 8.4.

Appropriate Surgical Strategies for Implant-Related and Soft Tissue Conditions That Are Encountered at the Time of Implant Exchange

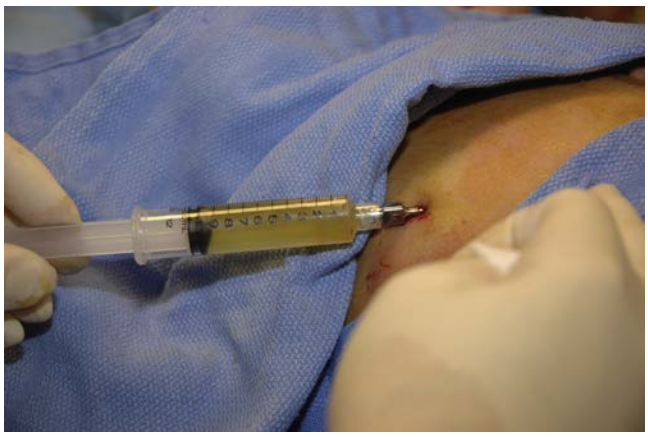
Periprosthetic fluid (PPF) requires ultrasound-guided needle aspiration. Evaluate to determine the cause: culture, cytology, CD30 testing (breast implant associated anaplastic large cell lymphoma [BIA-ALCL]). Treat accordingly per published PPF algorithms (reference BASPI and Jewell papers) (Fig. 8.3).[1]

Gel bleed/capsule calcification is often seen with older-generation implants at the time of implant exchange. Capsule calcification will be seen on DUS. Gel bleed and capsule calcification require capsulectomy (Figs. 8.4 and 8.5).

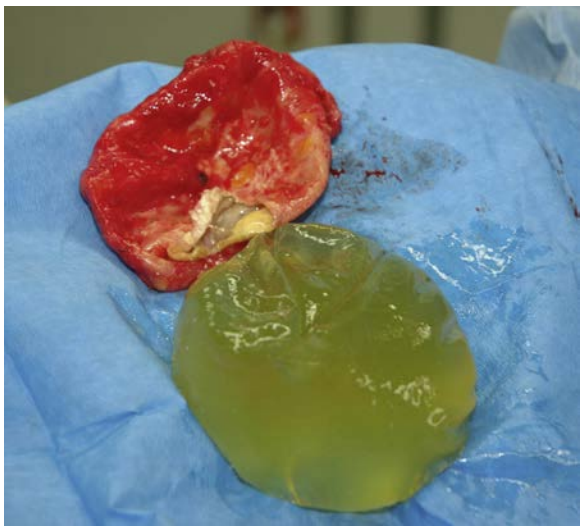
For **gel implant rupture (intracapsular),** plan to perform capsulectomy and removal of the gel/implant shell. I have found that in some cases, it is technically easier to separate the capsule from the breast tissue/chest wall by infiltrating some liposuction wetting solution that decreases bleeding and facilitates dissection. If tissue planes are indistinct or dense scarring seems to impede the capsulectomy, one useful strategy is to remove as much gel from within the capsule as possible by using Toomey syringes and larger-diameter liposuction tubing that are connected to a vacuum source. Once this has been accomplished, it is easy to perform the capsulectomy by using Allis clamps to provide traction. Gel removal can be messy, especially if there has been gel emulsification (gel mixes with body fluids and becomes semi-liquid). Although it is possible to remove gel from instruments and the operating field with isopropanol alcohol, remember that this is a fire hazard and take precautions by disabling electrosurgical cautery. Pay careful attention to dissection of capsule tissue off the ribs to avoid a pneumothorax. If extracapsular gel is encountered, remove as much as possible (Fig. 8.6).

• BOX 8.4 Implant Exchange in Patients With Implant Issues Who Want Implant Exchange

- Obtain biodimensional measurements.
- Obtain the previous operative report or implant information; obtain magnetic resonance (MR) or diagnostic ultrasound imaging to determine implant integrity/capsule condition/extracapsular gel and breast parenchyma thickness.
- Determine the implant problem (e.g., implant rupture, extracapsular gel, saline implant deflation, capsular calcification/gel bleed, capsular mass, double capsules, rotation of shaped implant, periprosthetic fluid).
- Determine if there is a soft tissue problem that is also present and plan to treat it.
- Select replacement implants based on existing implant dimensions: To go larger, pick a higher-projecting implant that will fit into the pocket; for smaller, select a lower-projecting implant.
- Round-to-round may require minimal capsule modification.
- For shaped-to-round, plan on a capsulotomy to enlarge the capsule for a larger size.
- Surgical planning: Use inframammary fold access; determine the sequence of soft tissue corrective steps versus implant exchange.
  - For a ruptured gel implant, perform capsulectomy, remove gel and capsule, and exchange implants.
  - For extracapsular gel, determine the location with MR or ultrasound first; perform capsulectomy, remove extracapsular gel sites, and perform implant exchange.
  - For capsular calcification/gel bleed, perform capsulectomy, then implant exchange.
  - For saline implant deflation, remove the saline implant/shell, perform capsulotomy if needed to enlarge the pocket, and exchange implants to gel or saline; if capsular contracture is present, a capsulectomy is required.
  - For capsular mass, perform a biopsy and exchange implants.
  - For double capsules, remove textured implants and convert to smooth round implants.
  - For shaped implant rotation, remove shaped implants and convert to smooth round implants.
  - If periprosthetic fluid is present, perform a preoperative workup to rule out infection, malignancy, or breast implant associated anaplastic large cell lymphoma (BIA-ALCL).
    - Infection: Remove implants, irrigate pocket with antimicrobial/anti-infectives, and insert drain. Treat with antibiotics to resolve the infection. Wait 6 months before implant replacement.
    - Malignant effusion: Consult with breast surgeon.
    - BIA-ALCL: Consult with oncologic surgeon for total capsulectomy with or without implant replacement.
  - If wrinkles/folds are present, perform capsulotomy to increase pocket dimensions, place trial implant, and then exchange implants.
- Surgical technique: Remove the old implant and measure pocket dimensions. A trial size implant is required.
- Insert the implant using the no-touch technique; irrigate the pocket with povidone-iodine (Betadine), change gloves, and insert the device.
- Drains are typically required if a capsulectomy is performed.



• **Fig. 8.3** Periprosthetic fluid.

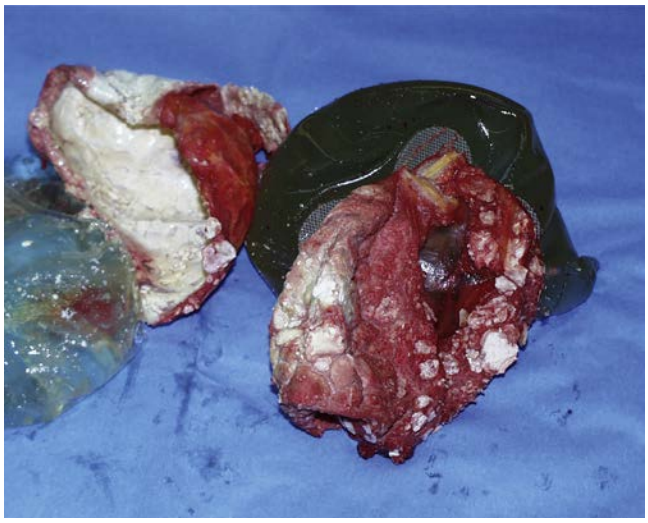


• **Fig. 8.4** Thirty-year-old implants with gel bleed.

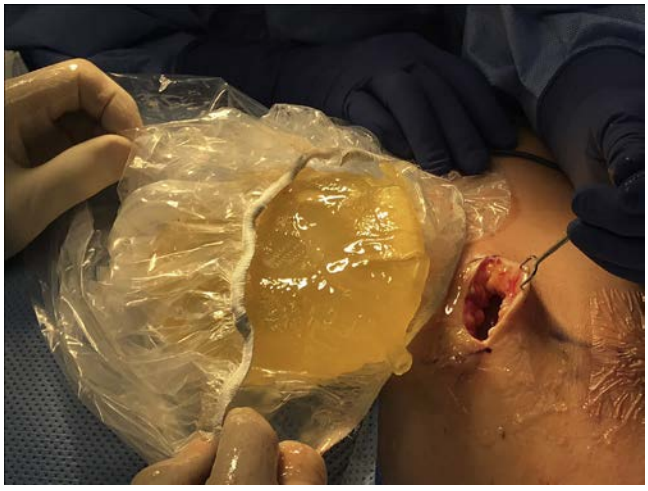
For **double capsules and implant rotation,** plan on a conversion to smooth round gel devices. If the capsule on the breast tissue is thin and supple, it may be left intact. Otherwise, a capsulectomy must be planned. When converting from anatomically shaped form-stable implant to smooth round implant, in many cases, it may be possible to leave a normal capsule in place and perform radial or concentric capsulotomy incisions to fit a round device. The use of sizer implants is recommended to verify pocket capacity (Figs. 8.7 and 8.8).

To correct **capsular contracture,** plan on a capsulectomy and implant exchange. In some cases, a site change (place implant in new plane) will be required. The use of acellular dermal matrix (ADM) for the treatment of capsular contracture is a useful strategy.

Correct **malposition** by capsulorrhaphy and techniques to tighten the capsule (popcorn capsulorrhaphy with



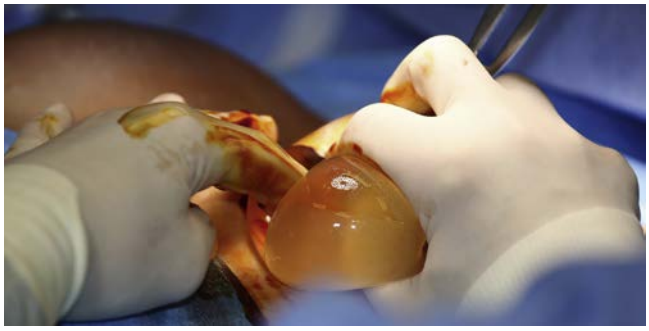
• **Fig. 8.5** Calcified capsules.



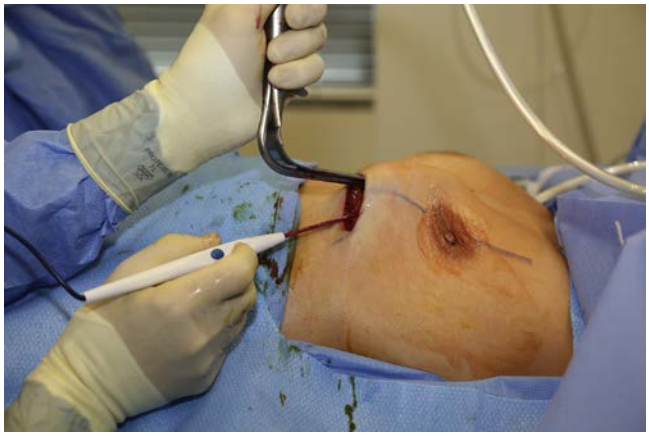
• **Fig. 8.6** Implant rupture with extracapsular gel.

electrosurgery). Implant malposition can involve more than one dimension (e.g., inferior and lateral), and it is important to be prepared to correct it. In many cases with saline-filled implants, inferior malposition occurs from a "water hammer" effect. Clinically, this is seen with a long nipple-to-fold distance and loss of upper pole projection. Correct this with an inferior capsulorrhaphy and place a gel-filled implant in the same pocket. Synmastia typically requires capsular flaps in my experience. Alloplastic soft tissue support with ADM or absorbable mesh may be required to reinforce capsule repairs.

Ptosis can occur after breast augmentation as a result of the breast falling off of the implant mound (waterfall deformity) or true ptosis where implant and breast tissue appear too low. Typically, a mastopexy is required (circum-vertical or Wise pattern). If there is an implant-related condition or other soft tissue problem such as capsular contracture or malposition, this increases the risk of serious adverse issues (skin and/or nipple–areolar necrosis) from diminished blood supply or thinning of tissues. A two-stage approach



• **Fig. 8.7** Sizer implant used to verify pocket capacity before permanent implant placed.



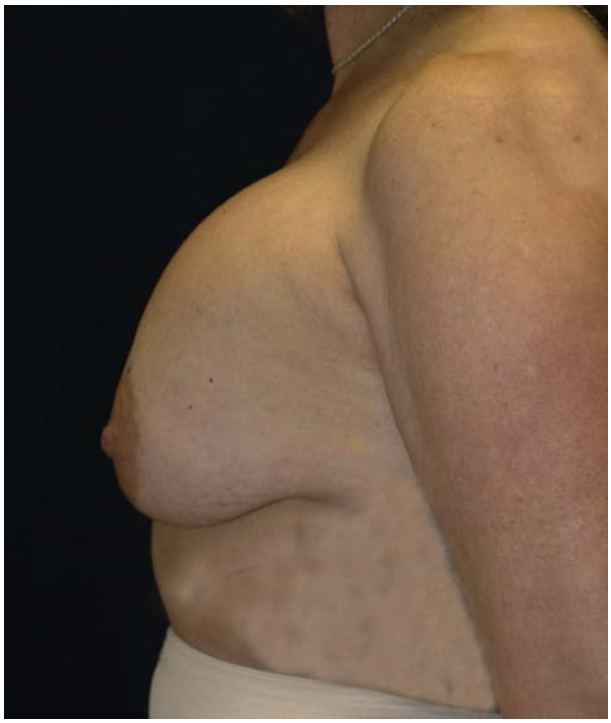
• **Fig. 8.8** Capsulotomy is used to enlarge pocket size.

may be a prudent choice to manage high-risk situations. In some situations of total muscle coverage, a lower pole constriction drives implants up toward the clavicles and accentuates ptosis. A site change to a retromammary-subfascial location may be required to correct this in addition to a mastopexy (Fig. 8.9).

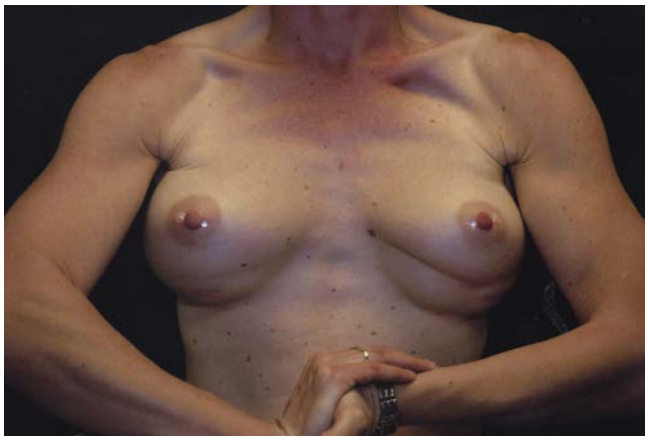
Double bubble can be corrected with capsulorrhaphy and release of old IMF. In some situations, a site change may be required to the retromammary location and radial scoring of the lower breast parenchyma. Absorbable mesh (Galaflex) can be used to reinforce the capsulorrhaphy (Fig. 8.10).

A constricted pocket can produce **folds** or **buckling** of the implant shell. This can contribute to premature shell failure because a fold becomes a wear point. Folds and buckles encountered with textured implants can become areas of **double capsules** or capsular calcification. Correction of folds and buckles involves a capsulotomy to enlarge the pocket and an implant exchange to a more cohesive gel device. If capsular masses are encountered, they should be removed and sent for histopathologic testing (Fig. 8.11).

Saline-filled implants are prone to **rippling** and side pleating, especially when overfilled at the time of insertion. Consider a popcorn capsulorrhaphy and placement of highly filled, newer-generation round implants that have a more cohesive gel formulation. Patients with extremely thin



• **Fig. 8.9** Waterfall deformity/ptosis.

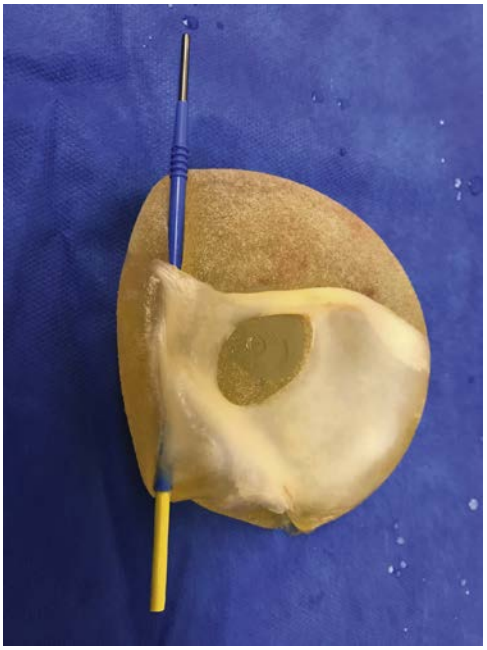


• **Fig. 8.10** Double bubble deformity caused by weight training (body builder).

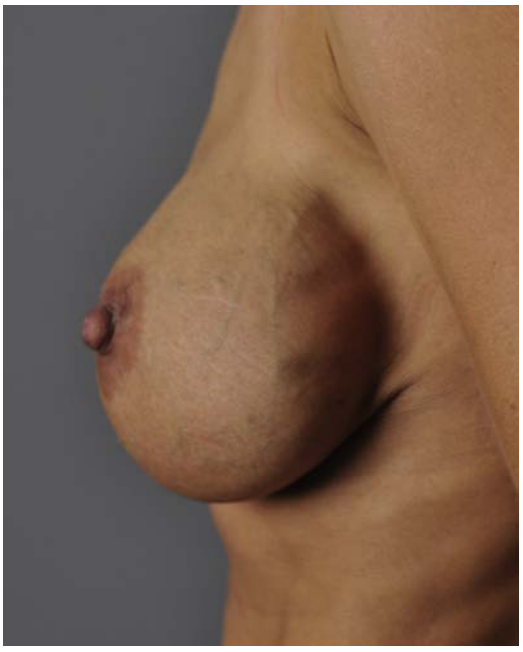
tissues may require autologous fat grafting to add thickness to tissues. Be certain to match the BD of the replacement implant with the pocket dimension (tight fit) to avoid a "flip over" if a replacement implant that is too small is placed. Rippling and inferior malposition often coexist with saline implants where there has been a water hammer effect that causes malposition and accentuates rippling (Figs. 8.12 and 8.13).

If the **implant pocket is too large,** consider a popcorn capsulorrhaphy to tighten the capsule (see Fig. 8.2). Suture capsulorrhaphy or capsular flap is another option.

If the **implant pocket is too small** (such as in the scenario of a patient requesting a larger replacement implant), a radial and limited circumferential capsulotomy (leaving the lower capsule intact between 5 and 7 o'clock) is required.



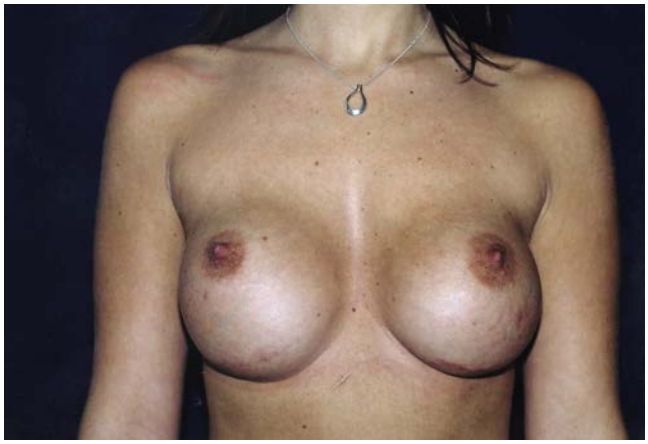
• **Fig. 8.11** Textured implant with implant fold/buckle and double capsule.



• **Fig. 8.12** Visible rippling/side pleating from overfilled saline implant.

The existing capsule actually functions as an internal bra cup to help maintain implant position. It has been my experience that overly aggressive inferior capsulotomy leads to loss of support for the replacement implant and subsequent inferior malposition (see Fig. 8.13).

When there is **inadequate soft tissue coverage**, autologous fat grafting appears to be useful in adding additional thickness to upper or lower pole areas. Modest gains in increasing soft tissue thickness are possible, but this may require several sessions of fat grafting.



• **Fig. 8.13** Water hammer effect from saline implants.

Reoperative Surgery Involving Macrotextured Breast Implants

There are many patients with macrotextured breast implants (round or anatomically shaped) who will require "maintenance" surgery or elect to change to newer generation smooth-surface round implants over concerns regarding BIA-ALCL. This is new with regards to addressing asymptomatic patient concerns over issues relating to macrotextured implants and surgical techniques. Other patients may elect to have their macrotextured implants and capsules removed over concerns that their implants are producing ill-defined systemic illness ("breast implant illness").

My approach to patients with macrotextured implants that seek revisionary surgery involves the usual physical measurements and implant history along with diagnostic ultrasound (DUS) to image the capsule and implant. I have found DUS very useful in these patients because it helps the planning for implant exchange surgery. DUS helps identify abnormalities such as implant rupture, double capsules, fluid, or calcifications that can impact surgical planning and length/cost of the surgical procedure. Conversion from macrotextured to smooth round is complex and it requires planning and intraoperative decisions to address potential malposition and reset of the IMF.

Implant exchange from macrotextured to smooth round can be simple in situations where there is a normal-appearing capsule and no other abnormalities are encountered. Minor pocket adjustments such as capsulotomy may be required if a larger implant is placed. In all types of implant exchange surgery, I utilize pocket irrigation with full-strength Betadine, glove change and funnel insertion device.

If abnormalities in the implant or capsule are identified, capsulectomy may be needed if the capsule is contracted, calcified, or if there is implant rupture with gel emulsification. In such situations, there may be the need for alloplastic soft tissue support and site change if breast tissue is thin and the need for the innovative use of absorbable barbed suture to shape the lower breast region following a total capsulectomy. Other patients may require a mastopexy to manage a loose skin envelope. For patients who have implants in the biplanar location, complete removal of capsule tissue that is adherent to the ribs and intercostal muscles may not be possible. A site change from biplanar to retromammary is useful. Stabilization of the IMF and correction of an overly large pocket after capsulectomy is required.

Documentation of operative findings, histopathology on capsule if abnormal, and photography of specimens should be part of the surgical procedure when converting a patient with macrotextured-surface implants to newer-generation smooth round implants.

Postoperative Care and Expected Outcomes

Postoperative care is straightforward with regard to activity restriction and avoidance of activities that would stress the surgical site. My personal preference is for patients to wear a spandex tube top or top with an internal shelf bra (tank top) until they are comfortable enough to resume wearing a molded cup underwire-style bra. The recovery from implant exchange surgery typically does not involve drains and is far more comfortable than the original breast augmentation. Most patients are able to resume all normal activities by 6 weeks after surgery. If more complex revisions are considered, such as correction of double bubble problems or malposition, a longer recovery is needed to avoid stressing the internal capsulorrhaphy.

Management of Complications

Complications are rare with regard to implant exchange surgery. Careful attention to technique, hemostasis, and biofilm mitigation are important ways to prevent complications. Accurate sizing of the replacement implants will prevent the possible complication of implant flip over in the pocket.

Secondary Procedures

Secondary/tertiary procedures are rare and infrequent. I typically excise the original scar from the primary augmentation and start with a new wound versus cutting through a mature scar and trying to repair it.

Conclusion

A primary breast augmentation, if properly planned and performed, can give a patient years of satisfaction with her result. Patients live with their breast implants for years and seek to maintain their result with implant exchange procedures for newer-generation gel implants. Implant exchange surgery offers them the opportunity to exchange older-generation implants for the newest ones and to correct issues that have developed after the primary breast augmentation procedure. Careful attention to planning of the

implant exchange surgery is needed because the complexity of the second procedure can be variable. The importance of obtaining information about the first surgery, physical measurements, and DUS imaging before surgery aids the plastic surgeon in providing the best outcome for patients undergoing implant exchange surgery and complimentary procedures.

PEARLS FOR SUCCESS

- Use a template system of physical measurements, patient concerns, and record of DUS findings to help formulate a course of action for the implant replacement surgery.
- Treat implant exchange surgery with the same attention to precision and finesse as you do primary breast augmentation (i.e., nipple shields, anti-infectives, glove change, insertion of device).
- Avoid reusing periareolar, axillary incisions. A new inframammary incision works best.
- If there are implant-related issues such as intracapsular gel rupture, or gel bleed/capsular calcification, a capsulectomy is necessary.
- Carefully evaluate periprosthetic fluid to rule out infection, intrinsic breast malignancy, and BIA-ALCL.
- ADM is a useful adjunct for capsular contracture.
- Implant malposition typically occurs in more than one direction. Be prepared to address this at the time of implant exchange.
- Ptosis correction at the time of implant exchange has risks of skin and nipple–areola complex necrosis. Simultaneous surgery on the inside and outside of the breast carries a higher risk profile than a mastopexy or internal breast capsule/implant surgery. Individuals who smoke should not have this type of surgery.
- It is useful to have some absorbable mesh (Galaflex) in the 5 × 10 cm size available when performing suture capsulorrhaphy procedures. Be certain to bury the knots in the sutures used for the capsulorrhaphy to allow for the mesh to be in contact with the capsule.
- When performing a site change from submuscular to retromammary location, separate the capsule and muscle from the back side of the breast for about 1.5 cm, then sew it to the chest wall. This will permit accurate pocket creation with the electrosurgical pencil and fiber-optic retractor (traction–counter traction).
- Familiarize yourself with the physical characteristics of various gel and texture options available for patients. Despite a variety of marketing claims regarding gel, rely on physical testing to determine gel performance when selecting replacement implants.

The use of montelukast, 10 mg daily, off-label to reduce the incidence of capsular contracture following primary breast augmentation or revision breast surgery (capsulectomy). appears to diminish recurrent capsular contracture, according to peer-reviewed scientific literature. I utilize this routinely for at least 1 year.

Recommended Reading

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9

Revision Breast Augmentation—Correction of Implant Malposition

MITCHELL H. BROWN

Introduction

Breast augmentation is one of the most common procedures performed by plastic surgeons. In the United States alone, it is estimated that more than three million breast implants have been inserted for primary breast augmentation since 2005.[1] It is recognized that breast implants are generally not once in a lifetime devices. Various implant outcome studies report reoperations or secondary surgery at rates as high as 36%.[2–7] As a result, there has been a steady increase in the number of reoperations being performed on patients with breast implants. It is important that any surgeon involved in the management of women undergoing aesthetic or reconstructive surgery with the use of breast implants become familiar with techniques used in secondary surgery. The presence of breast implants guarantees at least one or more operations to replace or remove them over the course of a woman's lifetime.

Having a defined and thoughtful approach to breast augmentation is important to minimize rates of reoperation. Multiple studies have described approaches designed to maximize outcomes and minimize the likelihood of complications and reoperations.[8–11] Decision making should be based on optimizing outcomes and preventing problems, both early and long term. Focus is placed in four main categories: patient education,[9] preoperative planning and implant selection,[8] precise surgical technique, and a defined process for postoperative care.[12]

Common causes for reoperation include capsular contracture, implant malposition, asymmetry, size change, and upgrades to newer types of implants. The incidence of each of these varies slightly based on the outcome study.[4,5,7] Causes for reoperation can be classified into three main categories. These are summarized in Box 9.1. Essentially, these are classified into: (1) problems related to the surgical procedure, (2) problems related to soft tissue changes, and (3) problems related to the implant. Understanding the true root of the problem is critical in designing an appropriate treatment plan. This chapter focuses on management of one of the most common indications for reoperation: implant malposition.

Indications and Contraindications

Most patients are candidates for revision breast surgery provided they have reasonable expectations. Often, previous surgery will have resulted in damage and deformity to the soft tissues that can be improved upon but not restored to normal. As stated earlier, any revision procedure has the potential for complications that can leave the patient with either ongoing or new problems. Patients must be prepared to accept the challenges of revision surgery and understand that there can be no guarantees of success.

Physical examination will focus on both abnormalities related to the implants and those related to the soft tissues. Previous surgery, scars, and soft tissue changes will increase the risks of infection, delayed healing, and tissue necrosis. Patients should be healthy, and any co-morbidities must be optimized before surgery. Given the elective nature of these procedures, active smokers should be avoided and patients must be counseled on the importance of smoking cessation before any revision surgery (Figs. 9.1A, B and 9.2A, B).

Patients with compromised soft tissues, especially when a capsulectomy is indicated, may be best treated initially with implant removal only. The need for a capsulectomy adds significantly to soft tissue trauma and vascular compromise. This is particularly true with subglandular implants. Secondary surgery may be performed at a later date and include implant replacement, mastopexy, or soft tissue augmentation with autologous fat transfer. Fig. 9.3A–D shows a patient who underwent four procedures for recurrent capsular contracture. After a fifth recurrence, she opted for implant removal. This was followed with two sessions of external tissue expansion using negative pressure and autologous fat transfer.

Preoperative Evaluations and Special Considerations

Implant malposition is rapidly becoming one of the most common causes for secondary implant surgery.[5–7] Malposition is defined as a wrong or faulty position of an implant. There may be a variety of factors responsible for a malposition; however, once it occurs, the fundamental issue is a problem with the implant pocket. The pocket may be too large, too small, or in the wrong position. Careful diagnosis of the underlying problem is important. Not all abnormal breast shapes are a result of a malposition. Changes to the soft tissues such as ptosis may result in an appearance that resembles a superior malposition. If the implant is sitting properly at the inframammary fold (IMF), implant position is not the problem and the soft tissues will need to be addressed. In addition, a capsular contracture can result in shifting of an implant to the area of least resistance. Although the implant will be malpositioned, the underlying cause is a capsular contracture.

History must focus on patient concerns and expectations. Although the surgeon may visualize deformity, asymmetry, or other abnormality, patients often view their problems in a different manner. The surgeon should not assume what it is that the patient wants corrected. A common example is correcting a contracted implant capsule with a resulting soft breast; however, the patient is disappointed by the loss of volume and upper pole fullness. This can be avoided through clear communication regarding concerns, goals, and expectations.

As a general rule, it is best not to repeat a surgical procedure for that patient that has already been shown to be unsuccessful. This follows the principle that if plan A did not work, do not repeat plan A. In more complex cases that require soft tissue manipulation, an understanding of previous use of pedicles and location of tissue excision will aid in developing a plan to minimize the risk of tissue necrosis.

It is useful to have a general plan for managing secondary implant problems. There are three main options for treating these patients. The first option is to do nothing. In the absence of an implant rupture, an undiagnosed mass, infection, or abnormal fluid collection, there is no absolute indication for surgical intervention. These patients have often undergone multiple procedures, and any subsequent

• BOX 9.1 Classification of Causes Resulting in Secondary Surgery

Related to the Operation

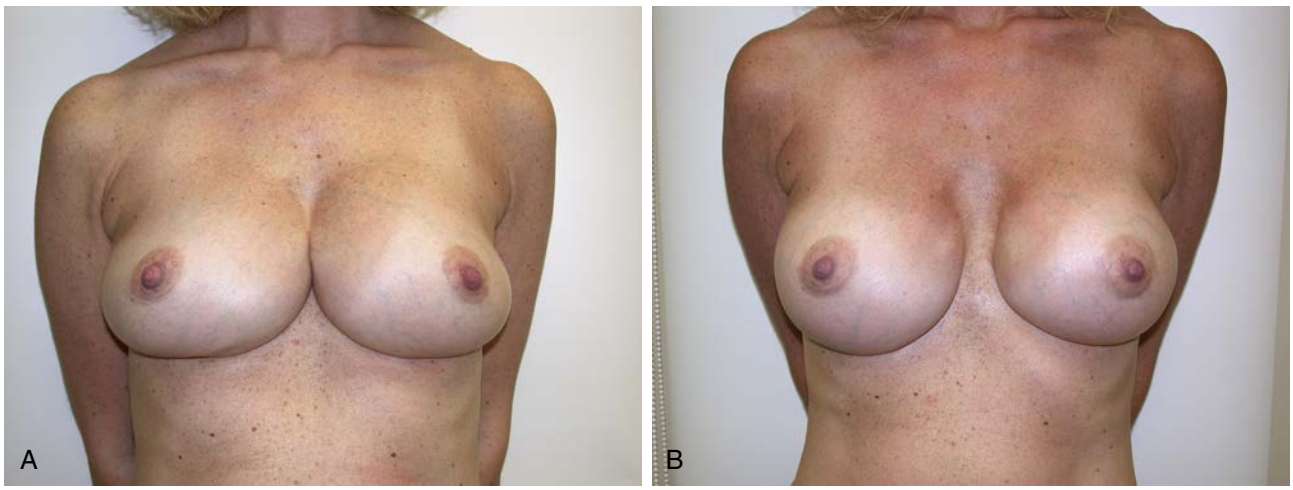
- Poor choice of initial procedure (implant versus mastopexy)
- Selection of incorrect implant
- Failure to minimize implant contamination
- Failure to optimize soft tissue cover
- Overdissection/underdissection of the pocket
- Overrelease/underrelease of muscle
- Traumatic pocket dissection
- Iatrogenic implant damage
- Postsurgical fluid collection

Related to Soft Tissue Changes

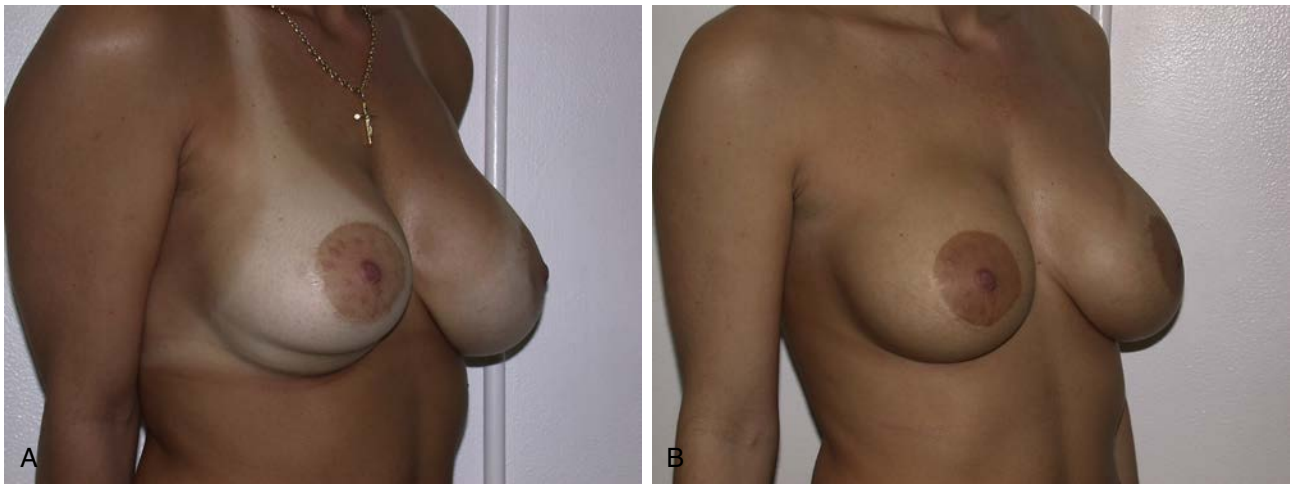
- Attenuation of tissues
- Development of ptosis
- Stretch of lower pole
- Atrophy of tissues
- Breast tissue/glandular hypertrophy

Related to the Implant

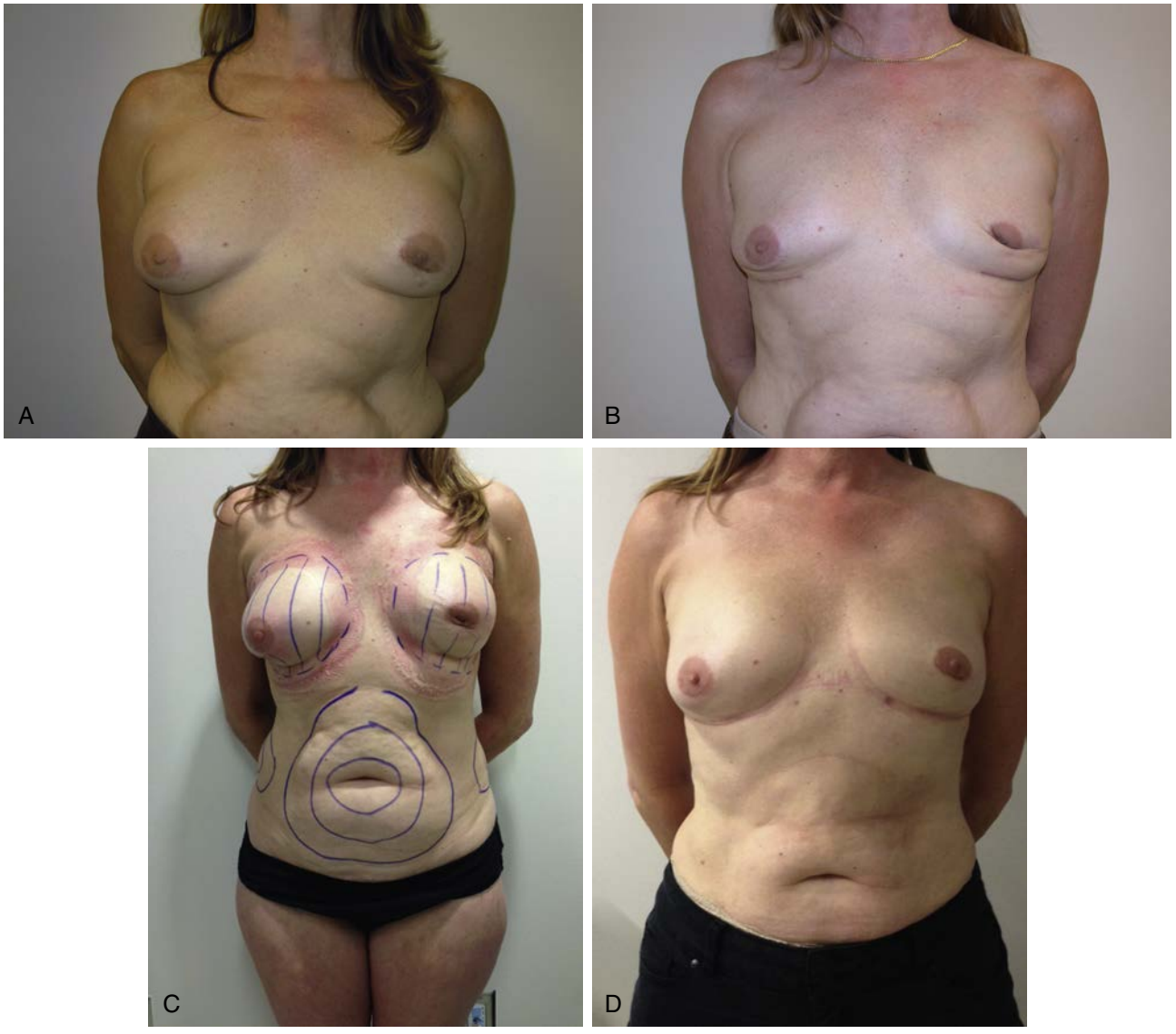
- Rupture
- Capsular contracture
- Malposition
- Rippling
- Implant edge visibility
- Palpability
- Rotation
- Seroma
- Double capsule



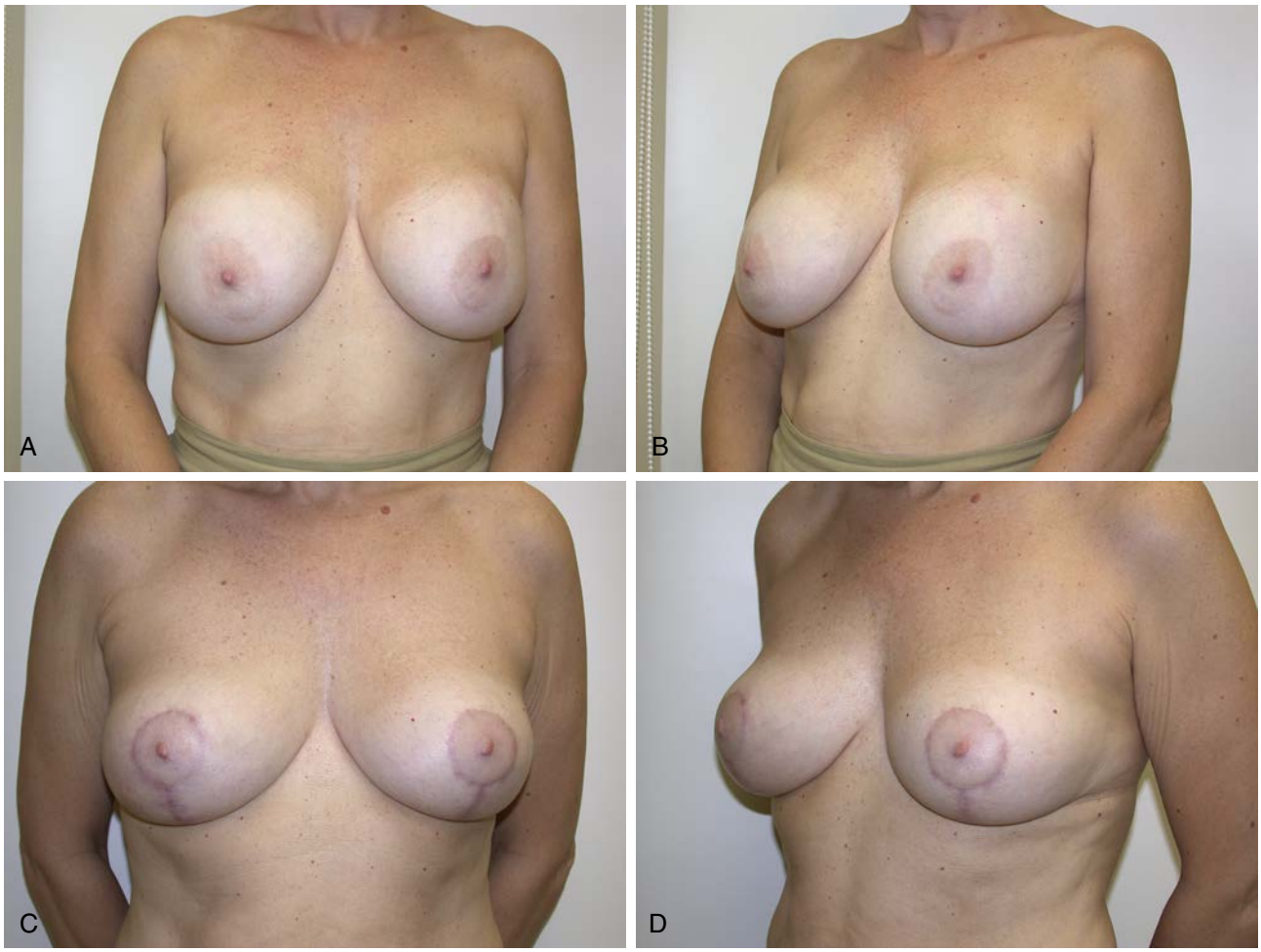
• **Fig. 9.1** (A) Synmastia, or medial malposition, in a patient with subpectoral implants and overdissection of the medial border of the pectoralis muscle. (B) Correction with downsizing of the breast implant and creation of a neosubpectoral pocket.



• **Fig. 9.2** (A) Inferior malposition in a patient with overrelease of the inferior origin of the pectoralis muscle and simultaneous circumareola mastopexy. The anterior pressure exerted from the mastopexy may predispose to the malposition. (B) Correction with inferior capsulodesis and suture repair and revision of areola scar.



• **Fig. 9.3** (A) Fifth recurrent capsular contracture. (B) After bilateral explantation and capsulectomy. (C) Immediately after external expansion and plan for fat grafting. (D) After second session of fat grafting.



• **Fig. 9.4** (A, B) Recurrent capsular contracture treated with explantation, capsulectomy, and mastopexy. Preoperative views. (C, D) At 6 months postoperative views.

operation will include the potential for an adverse outcome, possibly requiring yet another surgery.

The second option is removal of the implant with or without some degree of soft tissue modification. The only approach that will assure the patient of no future surgery related to implants is to remove the implants entirely. This may be performed alone or combined with procedures such as lipofilling, mastopexy, or reduction (Fig. 9.4A–D).

The third option is revision of the implant with or without some degree of soft tissue modification. This can be performed as a single stage or as a two-stage approach. A variety of techniques can be used for revising an unsatisfactory result. First, one must have a clear understanding of the diagnosis. The problem may be related to multiple issues, including malposition, contracture, stretch of soft tissues, or implant rupture. A key principle is to avoid repeating previous procedures that have failed.

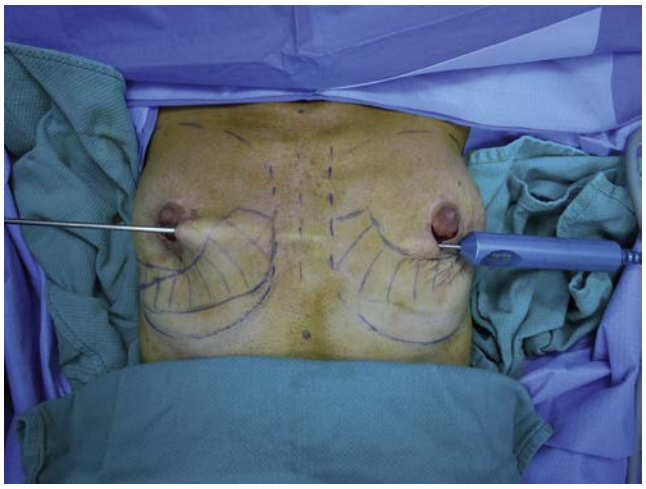
Everything that may contribute to a successful outcome should be considered. This may include implant replacement to newer generation implants, addition of internal support matrices, or the use of autogenous tissue, including fat transfer. Most of these patients have undergone multiple previous procedures, and all steps should be taken to try to make the next operation the last. On a cautionary note, patients receiving revision implants may present with unexpected intraoperative findings (Fig. 9.5). Surgeons should discuss this possibility in advance with patients and have a variety of tools available to manage any possible finding.

Surgical Technique

Prevention and Management of Implant Malposition

It is important to understand the factors that lead to malposition when discussing prevention and management. These can be divided into five basic categories: patient factors, procedure selection, implant selection, surgical technique, and postoperative care.

Patient factors relate to quality and quantity of breast tissue, musculoskeletal anatomy, and the quality of the skin envelope of the breast. Various skeletal abnormalities will predispose to implant malposition. A pectus carinatum deformity will tend to shift an implant lateral, whereas a pectus excavatum will predispose to medial displacement. A high IMF that requires lowering may lead to inferior



• **Fig. 9.5** An unexpected intraoperative finding in a malposition correction.

malposition, and a lax, atrophic skin envelope may lead to malposition in any direction.

Procedure selection affects malposition. Subglandular implant placement is more likely to result in medial malposition because of the lack of influence of the pectoral muscle, whereas a subpectoral pocket may result in implants shifting lateral, superior, or inferior because of excessive forces exerted by the muscle. Incisions made in the fold will be more likely to produce inferior displacement because of disruption of the fascial anatomy of the IMF. This highlights the importance of carefully repairing the fascia with sutures at the time of a primary breast augmentation, especially in patients who have short nipple-to-IMF measurements. A transaxillary approach may result in a superiorly placed implant if the muscle is inadequately released. Clinical trial data have demonstrated a significantly higher overall rate of malposition in implants placed through axillary incisions and implants placed in the subglandular pocket.[6]

Implant selection follows the principles of dimensional planning. Implants that are too large for the breast footprint will predispose to malposition, soft tissue stretch, tissue atrophy, and implant-related rippling and palpability. Implant surface characteristics also may play a role. Several studies have demonstrated a lower incidence of malposition in patients treated with textured devices.[4,5] This may be related to either tissue integration or a higher coefficient of friction between the device and the surrounding soft tissues. It should be recognized that the overall approach to the pocket is different when using a textured implant. In these patients, the pocket more closely matches the implant dimensions, resulting in less mobility of the implant under the breast tissue.

Surgical technique may be the most important factor in preventing implant malposition. Precise atraumatic dissection that closely follows the surgical markings is paramount. Prospective hemostasis will limit inflammation secondary to blood pooling in the pocket and assist in minimizing postoperative fluid collections, which can act to overexpand the pocket. Overdissection or underdissection of the muscle must be avoided. Care should be taken to ensure that the muscle is released symmetrically. Some surgeons prefer to use intraoperative implant sizers. When sizers are used, it is important to make certain that they are not allowed to overdissect a pocket, predisposing to eventual malposition.

Implant malposition is a problem of the pocket, and treatment can be divided into two main categories: (1) adjust the existing pocket or (2) change to a new pocket.

Implant Pocket Adjustment

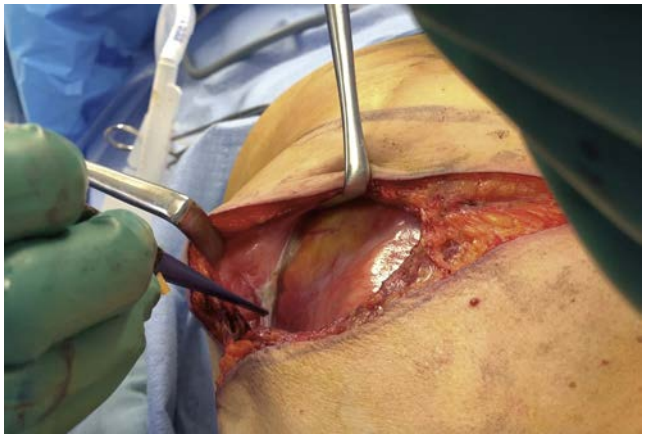
Surgical adjustment of an implant pocket can be achieved by capsulodesis, strip capsulectomy with suture repair, capsulorrhaphy, internal capsule flaps, or a combination of these techniques. It is often recommended to perform a mirror image capsulotomy opposite to where the capsule is adjusted to allow the implant to sit in the correct position and to minimize forces against the new repair. Fig. 9.6 shows an example of pocket adjustment using a popcorn capsulorrhaphy. The capsule is grabbed with forceps and cauterized until an audible "pop" is heard. This is an extremely useful way to tighten an overlying expanded pocket.

Soft tissue support matrices, whether synthetic mesh or biologic can be helpful with certain pocket repairs. When overlying tissue is thin or attenuated, matrices can add structural support. They also may be used to buttress an underlying repair or support the pectoral muscle in an inferior position when it has retracted or been overreleased. This method also provides improved definition of the IMF. Occasionally, the soft tissue damage is so extreme that tissue matrices must be used to completely rebuild the implant pocket (Fig. 9.7).

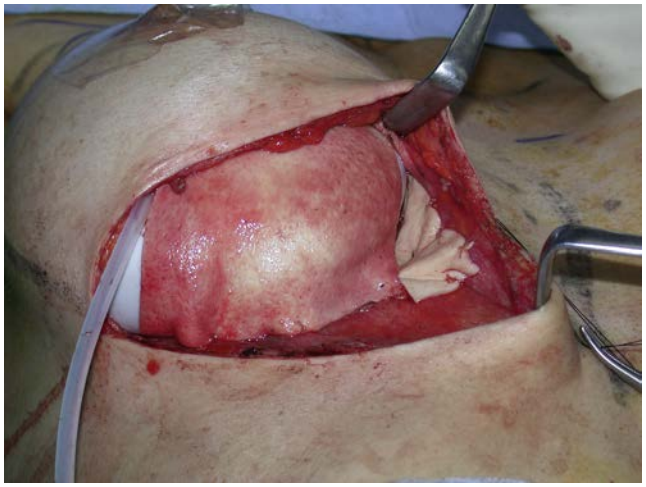
Lateral malposition is often treated with modification of the existing pocket. A capsular flap that is lifted off the posterior wall and hinged laterally is an excellent method of closing the lateral gutter and supporting the implant in a more medial position.

Implant Site Change

Changing the implant pocket (site change) effectively allows the surgeon to discard the old problematic pocket and create a new pocket to the appropriate and desired dimensions. When the implant is in a subglandular space, the most common pocket change is to a subpectoral position (Fig. 9.8). This technique works very effectively when managing synmastia or medial malposition. Once the implant has been moved, steps must be taken to keep the implant from moving back into the old pocket. This can be achieved by closing the old space with sutures, using a capsular flap that is hinged off of the inferior edge of the muscle as a pectoral extender, using a matrix as a pectoral extender or supporting the muscle over the implant with the use of percutaneous marionette sutures[13] (Fig. 9.9). Direct closure with sutures is



• **Fig. 9.6** Popcorn capsulorrhaphy to correct lateral malposition.

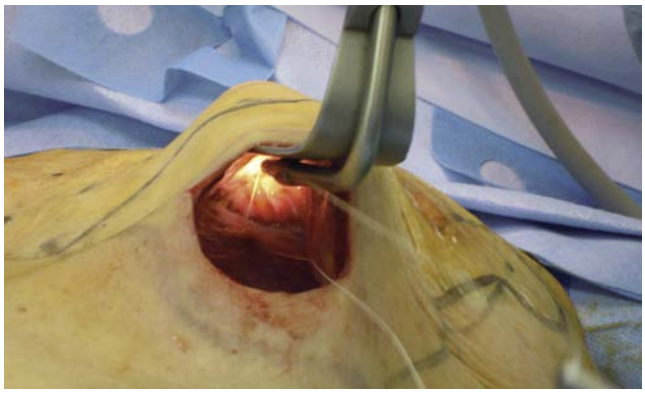


• **Fig. 9.7** Complete reconstruction of an implant pocket with acellular dermal matrix. Implant sizer is used to confirm accurate positioning.

• **Fig. 9.8** Pocket change from subglandular to subpectoral.

the preferred method provided that enough soft tissue exists to avoid visible puckering from the sutures. In cases in which soft tissues in the lower pole require augmentation, the use of a capsular flap or a structural matrix may be indicated.

When the original implant is under the muscle, site change can include subglandular or subfascial as long as there is adequate overlying soft tissue. Typically this is not the case, and it is best to maintain a subpectoral position. A neosubpectoral pocket can be dissected that sits superficial to the old capsule and deep to the pectoral muscle.[14] The old pocket is then closed with through-and-through sutures. This technique is effective in managing inferior and medial malposition.



• **Fig. 9.9** Closure of old subglandular pocket with sutures.

An interesting type of malposition occurs when an implant is placed under the muscle with inadequate muscle release along the IMF or the formerly used technique of total submuscular implant placement. This results in a superior displacement of the implant, which becomes particularly evident if there is also some degree of soft tissue ptosis (waterfall deformity). This requires a different type of pocket change: submuscular to dual-plane subpectoral. This is achieved by dissecting a space in the lower pole over the pectoral muscle and then dividing the muscle and the capsule at the level of the lower border of the areola. The implant will then fall inferiorly into this new dual-plane pocket.

Other procedures may be necessary to address contributing factors to a malposition. A capsulectomy may be indicated when dealing with contracture and soft tissue modification may be required when managing existing ptosis or asymmetry.

Postoperative Care and Expected Outcomes

Postoperative care includes effective support of the surgical site, patient education, and routine follow-up. There is no consensus regarding the use of postoperative garments, but it should be stressed that garments that are improperly fitted or worn can directly cause a malposition. The position of the garment should be checked before discharge and reassessed at the routine follow-up visits. Occasionally, a bandeau or chest band may be used to maintain lower pole position, especially in cases of a tight lower pole or pectoral muscle tightness after surgery.

It is important to have a routine process for managing patients in the postoperative period, especially with revision procedures. Surgery may be more complex, involving work on the soft tissues, the implants, or both. Each procedure will dictate a slightly different approach and priorities in managing the postoperative period. In most secondary

cases, drains are used. Patients are given instructions on how to care for the drains and ensure they do not fill with clots. A sterile dressing is placed around the drain site, and patients are instructed how to care for the dressing to minimize the likelihood of drain site infection. Patients are maintained on oral antibiotics until the drains are removed.

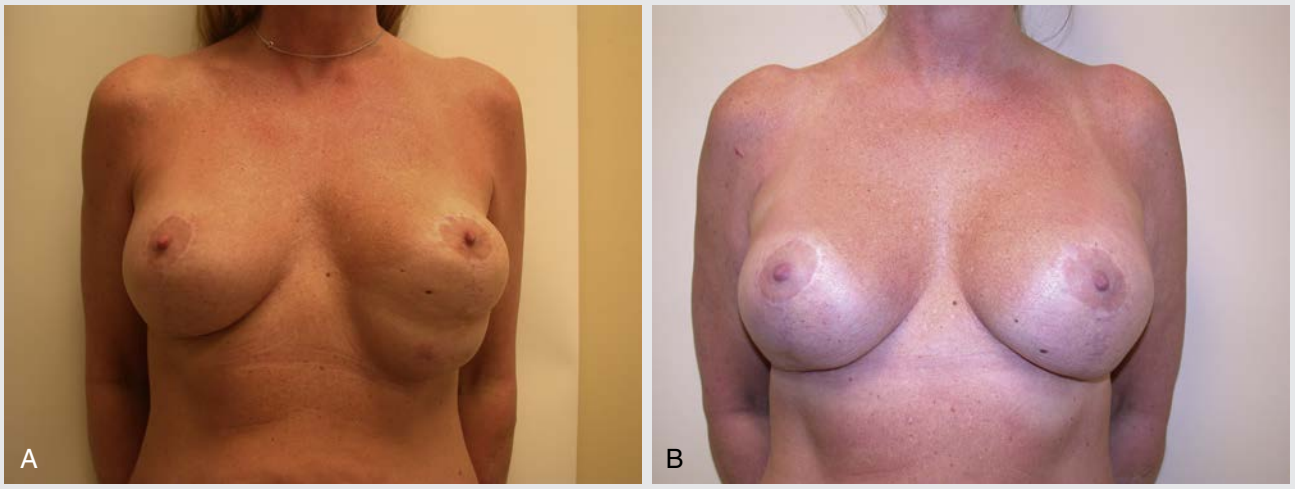
Specific bandaging may be necessary to support the implant position in cases of malposition. For example, when correcting synmastia, bandage or a bolster is often placed over the sternum to support the medial repair. Many surgeons place patients in a supportive bra for the first 4–6 weeks to encourage implant stability within the implant pocket. Postoperative activity should be tailored to the procedure. If a malposition is corrected and the implant is in a subpectoral position, the patient will be required to minimize pectoral activity until the new capsule has formed around the implant. Often, patients need to be given very clear instructions as to what it means to minimize pectoral contraction.

When smooth surface implants are used, displacement massage exercises are routinely used. This is started within a few days of surgery and is recommended to be performed several times a day. Patients must be shown exactly how to perform displacement massage, because most women are very cautious and tend to be too gentle. Postoperative massage with shaped implants or textured round devices is contraindicated.

CASE 9.1

This woman had previously undergone subglandular breast augmentation. She had a revision performed that involved conversion to a subpectoral pocket with release of the inferior border of the pectoral muscle along with a mastopexy. She presents with inferior malposition of the left implant. On examination, both implants are soft and mobile. The right implant is sitting in a perfect position. The left implant sits 6 cm inferior to the native IMF. The pectoral muscle can be palpated superior to the areola, demonstrating excessive release of the muscle.

Options for correction include repair of the existing implant pocket or removal of the implant from the existing pocket and creation of a new pocket in the correct anatomic position. In cases of inferior malposition, it is the author's preference to adjust the existing pocket. Options include inferior strip capsulectomy with suture repair, capsulorrhaphy or pocket repair with a capsular flap. In this case, the muscle has been excessively released. Support of the muscle position will assist in minimizing asymmetric animation. The patient was treated with a combination of inferior strip capsulectomy and suture repair along with insertion of acellular dermal matrix (ADM). The ADM was sutured to the inferior border of the pectoral muscle to act as a pectoral extender. It was sutured to the new IMF to support the implant position. Case 9.1A, B shows the patient's preoperative and 1-year views.

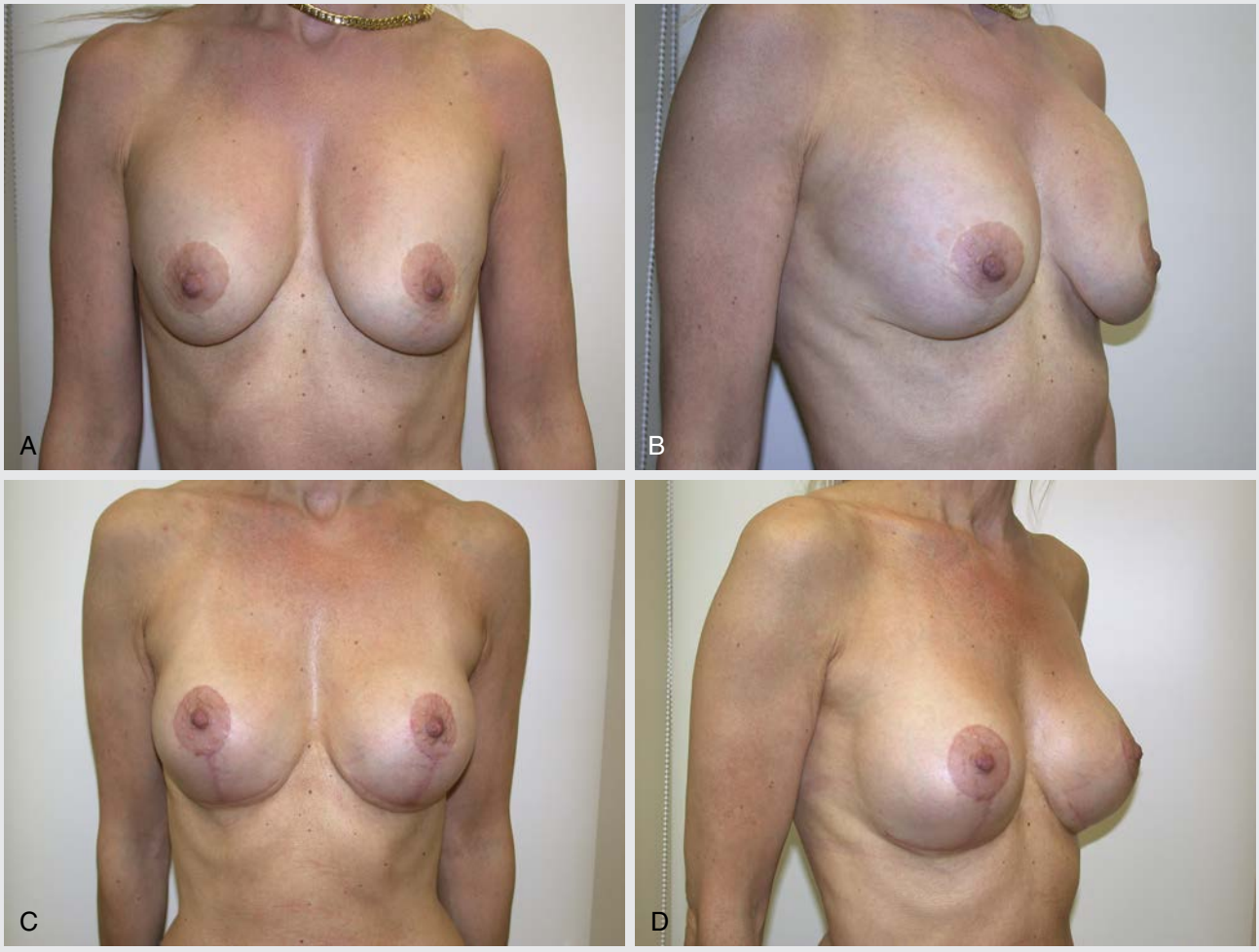


• **Case 9.1** Preoperative view of a left inferiorly malpositioned implant that was recently changed from a subglandular to a subpectoral pocket. (A). This was corrected with the use of acellular dermal matrix (ADM) as a pectoral extender to create a complete pectoral/ADM pocket for the implant and better definition of the IMF (B).

CASE 9.2

This patient underwent subpectoral breast augmentation and mastopexy. She presented 10 years later reporting long-standing fullness of the upper pole and sagging of the breast tissue. Examination reveals a sternal notch–to-nipple distance of 22.5 cm bilaterally and a nipple-to-IMF distance of 7 cm on the right and 8 cm on the left. Both implants are soft and mobile, and there is no evidence of capsular contracture.

The diagnosis is superior malposition that has resulted in failure of the implant to adequately fill the soft tissues in the lower pole of the breast. There are several possible explanations for the superior malposition; however, the most likely cause is inadequate release of the pectoral muscle. Correction can be performed by simple conversion from a submuscular pocket to a dual-plane pocket. Dissection is performed on the anterior surface of the capsule from the IMF up to the inferior border of the areola. At this point the anterior surface of the capsule and the inferior border of the muscle is divided horizontally and the implant is left to fall inferiorly into the new subglandular pocket. The upper pole of the implant will remain in the old pocket under the muscle, creating a dual-plane position. In this case, the mastopexy was revised after repositioning of the implant. Case 9.2A–D shows the patient's preoperative and 6-month views.

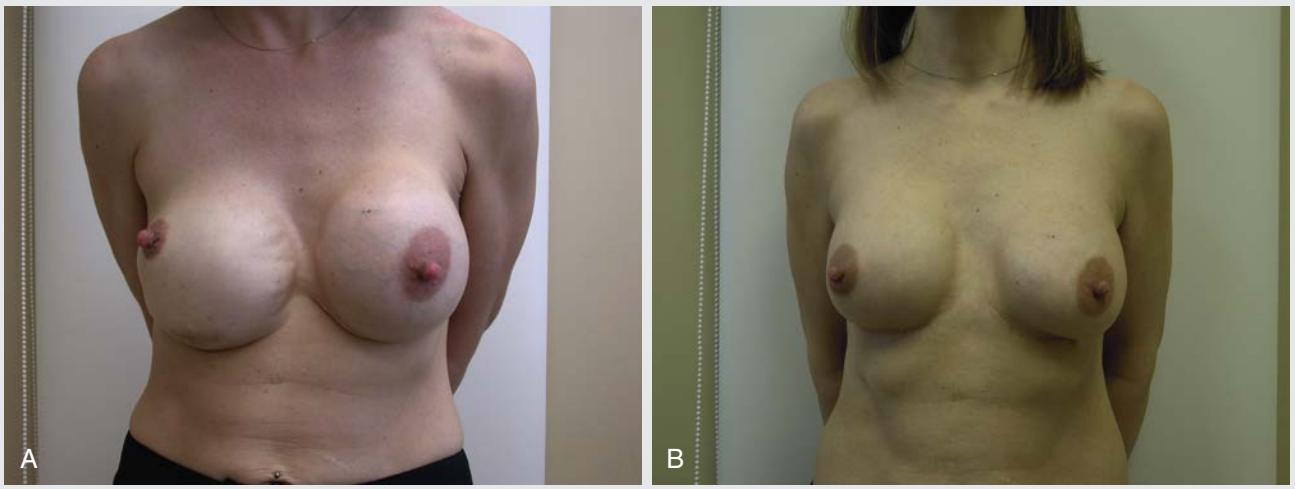


• **Case 9.2** Preoperative views of a superior malposition secondary to inadequate release of the inferior pectoralis origins. She also has recurrent overlying soft tissue ptosis (A, B). This was treated by conversion from total submuscular pocket to a dual-plane pocket and revision mastopexy (C, D).

CASE 9.3

This patient presented with a very difficult, complex secondary implant problem. Her history included seven previous procedures, starting with a routine subglandular breast augmentation. She has had several occurrences of capsular contracture and implant malposition. She has had the implants placed both above and below the muscle. At one point in time, she had skin excised along the right IMF, presumably in an attempt to correct inferior malposition. Her most recent surgery was performed 18 months earlier. On examination, the right implant appears to be in a subglandular pocket with no palpable pectoral muscle. The left implant appears to be partially subpectoral. There is bilateral Baker III contracture and inferior and medial malposition on the right. There is lateral displacement of the right nipple–areola complex, likely secondary to the implant malposition. The patient reports that before her initial augmentation, the nipple areola complexes were quite symmetric. Sternal notch–to-nipple distance was 17 cm on the right and 23 cm on the left. Nipple-to-IMF distance was 14 cm on the right and 8 cm on the left. Musculoskeletal examination was otherwise normal.

The patient was offered implant removal with possible reinsertion of implants at a later date. She requested one further attempt to correct her asymmetry and was prepared to accept the significant risks associated with a more complex revision. The surgical plan was different for each breast. On the right, the implant was removed and a capsulectomy performed. There was no usable pectoral muscle, and so the pocket was recreated with ADM placed medial to correct the synmastia and a second piece placed inferior to support the new IMF. On the left side, a capsulectomy was performed and the remaining pectoral muscle was advanced inferiorly and supported over the new implant with ADM used as a pectoral extender. Both implants were replaced with smaller round gel devices. Case 9.3A, B shows the patient's preoperative and 1-year views. Both breasts remain soft, with no recurrence of contracture. Implant position is stable with good correction of the medial and inferior malposition. There is some residual lateral displacement of the right nipple–areola complex; however, the patient has declined any further correction.



• **Case 9.3** Preoperative view of a complex multidirectional malposition. This patient has already had implants in both subglandular and subpectoral pockets and currently has a Baker grade III contracture with right medial and inferior malposition, rippling, and nipple asymmetry (A, *left*). This was treated with capsulectomy, acellular dermal matrix–assisted pocket creation, and implant replacement (B, *right*).

Case Examples

Management of Complications

Not all revision cases are the same. Expected outcomes depend on the individual case and particularly the complexity of the procedure performed. Healing will be prolonged, when compared to that with primary surgery. In routine primary breast augmentation, patients are often instructed that it may take 6 months to a year for them to see the actual final result of their surgery. Scars must heal, tissue must redrape and soften, and implants must stabilize in position. With secondary surgery, it will take even longer before the result reaches a plateau. It is probably best to wait at least a year before considering any revision surgery to be successful. Of course with capsular contracture, recurrence can occur at any time, even years after surgery.

With many patients, preoperative expectations will mold the patient's perception of the results. It is imperative that the patient have realistic expectations as to what is possible. Setting these expectations early will assist in how patients assess their outcomes. This is especially true with reoperative cases.

The complications from reoperative breast surgery are similar to those in primary cases. One specific risk in revision procedures that warrants special comment is potential compromise of the blood supply to the nipple–areola complex. This risk rises with increased complexity of previous surgery and planned surgery. The surgeon must take into

consideration previous sites of implant pocket(s) and previous pedicle elevation. In cases in which both implant revision and soft tissue reshaping is required, a staged approach should be considered. The likelihood for further revision surgery is greater in secondary cases than in primary augmentation. It is important to have a discussion with the patient in advance as to who will bear the financial responsibility for further surgery. Every practice will have its own approach, but setting the ground rules in advance will assist in limiting confusion and frustration after the fact.

All potential risks are more likely to occur in secondary procedures. Careful patient selection, intelligent surgical planning, and meticulous technique and follow-up care will help keep these complications to a minimum.

Secondary Procedures

The need for secondary procedures will be dictated by the success of the revision surgery. These cases require a different way of thinking regarding outcomes. It is not unusual to have left certain aspects of the revision to be addressed in a staged approach.

A common secondary procedure involves modification of the nipple–areola complex. This may be indicated for nipple placement on the breast mound, asymmetry of nipple position on the chest, or asymmetry with regard to areola shape or diameter. In complex revision cases, especially when including a capsulectomy, significant modification of the nipple and areola may be contraindicated because of risk of vascular compromise. In these cases, adjustments are made secondarily.

Patients undergoing revision frequently have damage to and atrophy of the soft tissues. When implants are used, this often results in contour irregularities, implant palpability, rippling, or asymmetry. Autologous fat grafting has become a very valuable tool for managing these problems. Fat can be injected in the periphery around the breast to assist with correction of asymmetry. Implant visibility and rippling is minimized with fat injected in the plane between the capsule (or ADM) and the overlying skin. The amount of fat injected should respect the graft-to-capacity ratio to avoid fat necrosis and scarring. When larger volumes of fat are desired, a period of pre-expansion using negative pressure suction may increase the capacity of the recipient tissues.

Conclusion

Secondary or revision breast implant surgery is inevitable in most plastic surgery practices given the number of women who have undergone breast implant surgery. First and foremost, every surgeon should have a prevention strategy that follows best practices for minimizing complications and reoperations. When faced with a secondary implant problem, treatment should follow the process of accurate diagnosis of the problem, developing reasonable expectations for the patient and, finally, creation of a plan that addresses the implant, the soft tissues, and any existing asymmetry.

PEARLS FOR SUCCESS

- Breast implant surgery that follows a defined process, including careful patient selection, preoperative patient education and surgical planning, precise surgical technique, and standardized postoperative care, will help prevent the need for secondary surgery.
- Before proceeding with revision surgery, it is important to have a thorough understanding of the problems that relate to patient expectations, soft tissue changes, implant characteristics, and implant-pocket relationships.
- All surgical revision procedures have an inherent risk-to-benefit equation. Minor revisions should be performed with caution, because there is always a possibility of leaving the patient with a more significant problem.
- Obtain all previous operative records, if available.
- Implant malposition is a problem of the implant pocket. Treatment requires either an adjustment to the existing pocket or a site change to a new pocket.
- For patients with saline implants, consider preoperative deflation to allow assessment of the soft tissues and asymmetry
- When surgery is required on both the implant and the soft tissues, revise the implant first and then tailor the soft tissues around the new device.

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10

Revision Breast Augmentation—Correction of Implant Malposition and Rippling

MICHAEL C. EDWARDS

Introduction

The best way to treat a complication, is to avoid it.

UNKNOWN EXPERT SURGEON

Breast augmentation is a common operation, and it has been estimated that there are currently 5–10 million women with breast implants in the United States alone, based on different surveys.[1] It is a requirement of proper informed consent that we inform our patients of the short- and long-term potential risks and possible complications of the procedure, not the least of which is that patients should expect to undergo additional revision procedures in their lifetime to maintain their outcome.

The patient undergoing breast revision will present to the plastic surgeon in a variety of ways. Many return to their original surgeon years later with still an acceptable outcome, yet want newer implants. Others may return after breastfeeding and desire a more youthful appearance of their breasts. Other patients will present after their 10th revision procedure elsewhere with a combination of tissue paper–thin tissues, striae/vertical skin pleating, oversized subglandular implant, and ptotic breasts. Many have unrealistic expectations of wanting to use the same periareolar approach and not wanting a breast lift. Every one of the patients seeking revision has a unique presentation, and it is our challenge to try to return their breasts to an aesthetic shape and softness.

This chapter will focus on evaluation and treatment of two of the more common reasons women seek breast revision: implant malposition and rippling. I will review the evaluation of implant pocket malposition and rippling and how to develop a surgical approach using straightforward techniques and recommended follow-up and postoperative care.

Preoperative Evaluation and Special Considerations

The patient interview is important for you to get to know the patient's breast history and thorough medical and surgical history. You should know all you can about a patient, especially anything that may affect intraoperative and postoperative care. The more information you have about previous breast procedures, including incision(s), dissection technique, vascular pedicles, and implant characteristics, the more successfully you can plan your revision procedure. Try to obtain the medical records from her earlier breast surgeries, if possible.

The examination consists of standard breast measurements and evaluation of overlying soft tissue characteristics followed by a complete set of breast photographs to include a supine view, an animated view, and provocative views such as those producing rippling, wrinkling, and thinness of soft tissue coverage of the implant. Saline-filled implants are more likely to produce both malposition and rippling/wrinkling. Also take an image from behind to look for shoulder height asymmetry or scoliosis. Diagnostic ultrasound examination should be part of the examination, because it is useful to determine implant integrity, extracapsular gel, calcification, possible implant flip-over, double capsules, and periprosthetic fluid.

The physical examination of the patient undergoing breast revision is vital, but one will not fully appreciate the extent of implant malposition until in the operating room with the implant removed to inspect the pocket and chest wall directly. The intraoperative evaluation helps verify your exact plan of repair. I have often found at surgery that the implant pocket may be more spacious than expected. The implant capsule may be of benefit to your repair ("internal bra cup") or may require partial or total removal if pathologic (i.e., calcified).

An effort should be made to determine as much as possible about previous surgical procedures such as scars, implant placement, and the size, style and type of implant. I have found cases in which operative notes informed me that previous submuscular implants were changed to a subglandular position, which changes my operative plan or at the least makes it more difficult. I choose to examine patients undergoing revision with them in the sitting upright position and then in the recumbent position. Measurements are taken and transcribed by staff, allowing the patient to demonstrate the aspects of their breasts that concern them with provocative maneuvers such as animation, bending over, or lying down. It is far better to see these issues before the procedure than to see them for the first time in the operating room.

If unable to determine the size, style, or type of implants currently implanted, it will be necessary to plan accordingly by the biodimensional process and bring along implants that can be chosen from to suit the patient's desires. It is very helpful in revision breast surgery to acquire and review previous operative notes if they are available. Properly chosen implant sizers allow the surgery to be conducted and implants chosen until almost time to close incisions.

It is common to use a different implant with a different gel formulation at the time of the revision, which may further add to the complexity of revision, especially if the base width of the new implant is narrower than the existing implant. I have found that the newer generation, highly filled gel implants are less prone to wrinkling and rippling compared to earlier generation gel implants or saline-filled implants.

Type of Malposition and Its Management

Inferior Malposition

Inferior malposition occurs when the implant sits lower than the desired inframammary fold (IMF) typically allowing the fold incision to ride up on the breast mound if this approach was used. This can be seen with any incisional approach and typically leads to a thinning of the lower breast tissue that can cause a "star-gazing" deformity (Fig. 10.1A, B), asymmetry, and increased implant visibility and palpability because of the thin nature of the stretched breast and upper abdominal wall tissue (Fig. 10.2A, B). A variant of inferior malposition is the double bubble deformity (Fig. 10.3A, B). This can occur when an existing IMF is lowered to try to centralize the nipple–areolar complex on the augmented breast or in the incomplete release in a tuberous or constricted breast.

The repair of a double bubble deformity typically involves re-establishing the native IMF or softening a tight fold in a constricted breast with radial scoring of the parenchyma. A capsulotomy in the upper pocket may be needed to achieve upward position of the implant that occurs with raising of the IMF. Although a double bubble is more commonly seen in a submuscular augmentation, I do not personally recommend a site change to subglandular placement as a primary treatment.

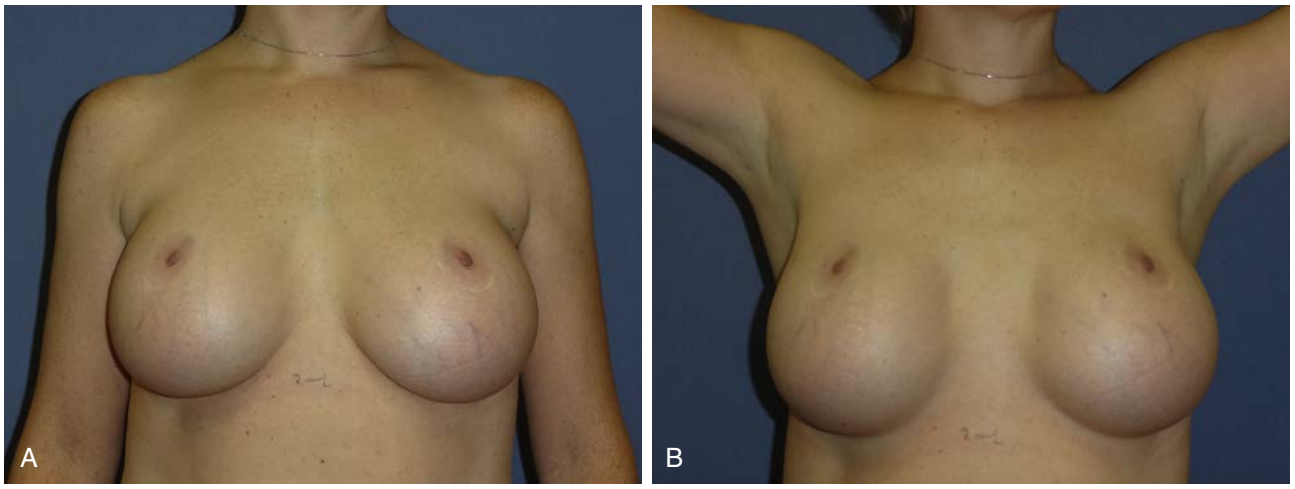
There also should be a distinction made between lower pole stretch and inferior malposition. Lower pole stretch occurs when the IMF is in the proper position, but the lower pole soft tissue is attenuated, leading to an increased nipple-to-IMF position. Repair of lower pole stretch will involve removal of breast skin in the IMF to shorten the nipple-to-IMF distance. It is possible that these can exist together but the approach to repair is different.

Repair of inferior malposition involves a repositioning of the IMF to a higher position with the goal being to centralize the nipple on the breast mound. Unless the transaxillary or transumbilical approach was used to place the implants initially, the original surgical approach can be used. My preference is through the IMF, which allows a clear view into the implant pocket for capsulorrhaphy with or without the need for additional support of a synthetic mesh or acellular dermal matrix (ADM) for support. If a mastopexy is planned, the vertical limb provides excellent visualization for repair.

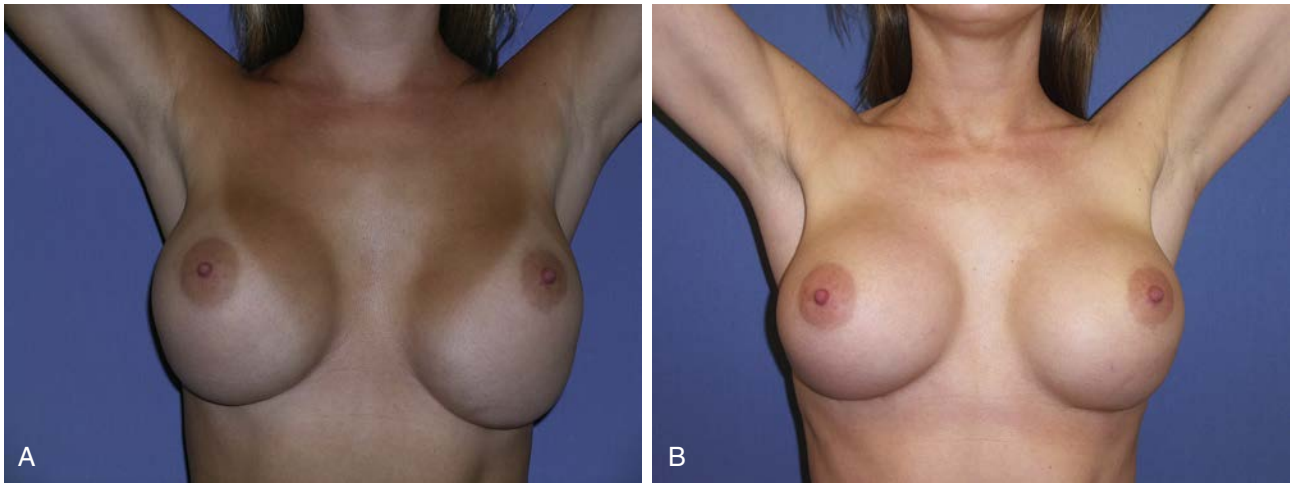
Preoperatively the surgeon must decide on the location to which the IMF should be elevated. If the implant characteristics are not going to change, you can estimate this position by pushing up on the lower implant to a point where the nipple–areolar complex is essentially centered on the breast mound. The new IMF is marked and then measured from the nipple. If the patient desires a smaller volume implant, the preoperative measurements remain important but the final design of the new IMF can best be planned with an implant sizer in place intraoperatively. For an IMF approach, the incision is placed on this new IMF line just lateral to the breast midline.

There are basically four described techniques to elevate the IMF: (1) capsulorrhaphy; (2) neosubpectoral pocket, as described by Maxwell and Gabriel[2] (Fig. 10.4A, B); (3) capsular flap (see Fig. 10.7); and (4) resection of a strip of capsule with suture approximation of the raw edges. The latter is discouraged because of an already weak characteristic of the capsule and is mentioned only for completeness.

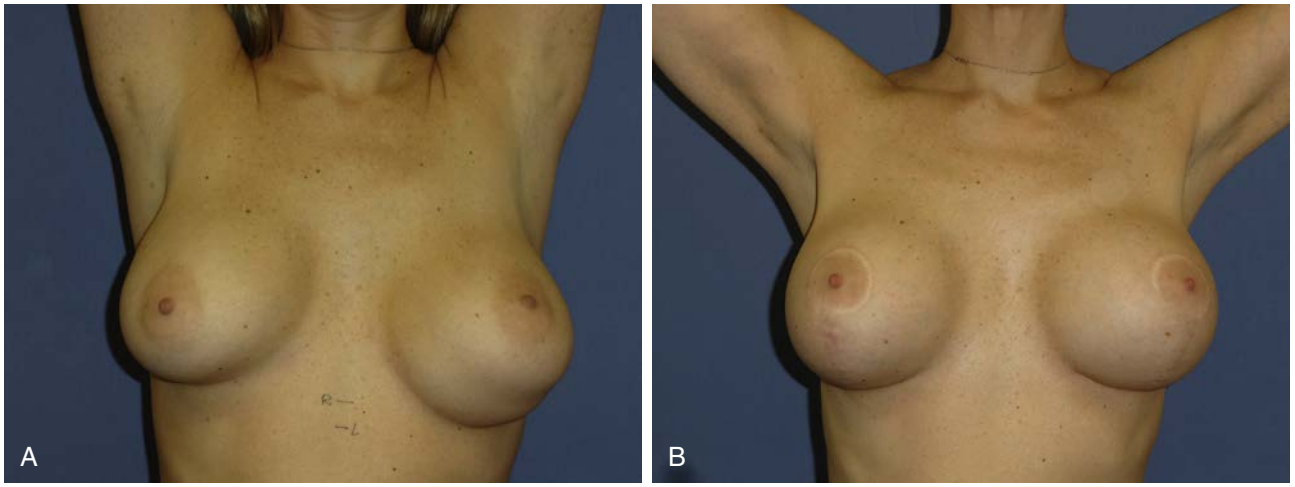
If the malposition is purely inferior, with the implant removed, tack the posterior capsule to chest wall with three interrupted 3-0 Ethibond sutures at the 6-o'clock position. It is important to inspect the capsular surface to be closed and either gently abrade with a lap sponge or treat with intermittent cautery to encourage adhesion of the two surfaces. This technique is described with a ball-tipped cautery in an effort the decrease the surface area of the capsule to in effect tighten the pocket.[3] Next, the sizer is placed at this point to determine if you are pleased with the elevation of the fold and evaluate if the superior pocket needs to be opened to ensure there is no undue tension on the inferior repair. The sizer is then removed, and under direct lighted vision, a running permanent suture of the plastic surgeon's preference is placed, grasping the capsule anteriorly and posterior capsular tissue posteriorly to include a purchase of



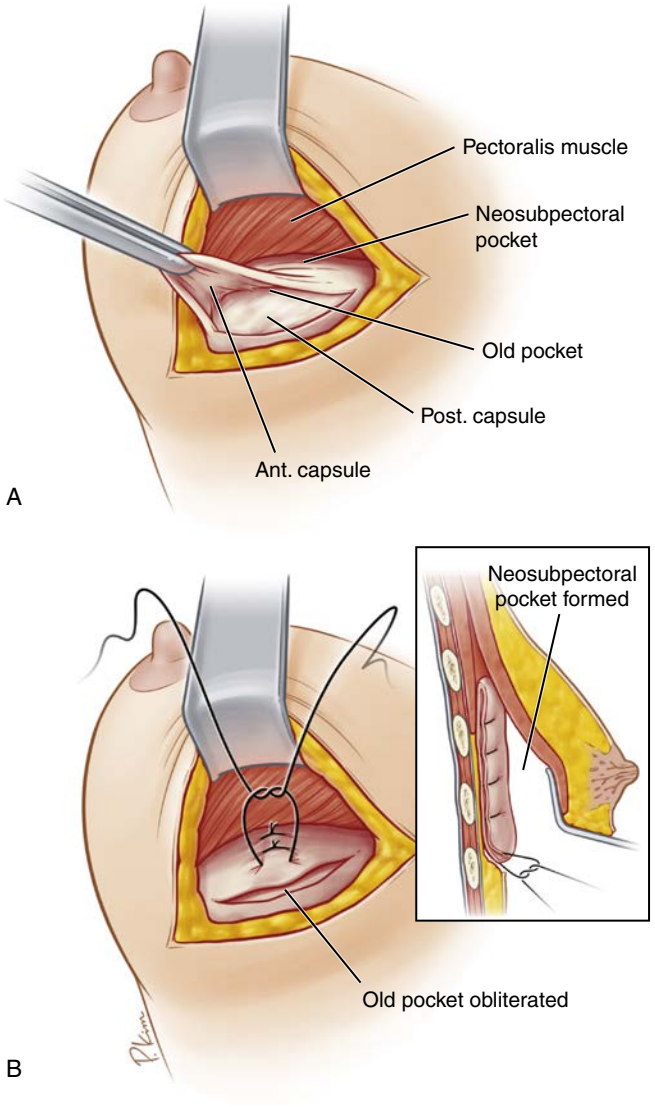
• **Fig. 10.1** (A, B) Star-gazing deformity seen in a 35-year-old patient with large-volume saline implants placed elsewhere through hemiareolar incisions.



• **Fig. 10.2** (A, B) A 28-year-old woman seen before and 4 years after repair of bilateral inferior implant malposition with capsulorrhaphy through the IMF. Note the thinned lower breast tissue preoperatively from recruited abdominal skin.



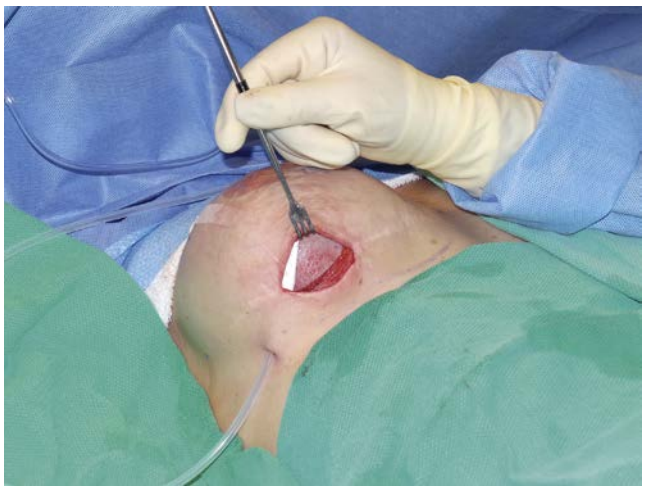
• **Fig. 10.3** (A, B) A 38-year-old woman seen before and 14 months after treatment of double bubble deformity and inferior implant malposition by inferolateral capsulorrhaphy and mastopexy with 475-cc gel implants.



• **Fig. 10.4** (A, B) Illustration of neosubpectoral pocket creation (Maxwell-Gabriel). Ant., Anterior; Post., posterior. (After Maxwell, P.G., Birchenough, S.A., Gabriel, A., 2009. Efficacy of neopectoral pocket in revisionary breast surgery. *Aesthet. Surg. J.* 29 (5), 379–85, Figs. 10.2B and 10.3A.)

perichondrium for substantial support when possible. I prefer a softer, braided suture such as 3-0 Ethibond. The anterior breast tissue is classically thin and vigilance is necessary to avoid dimpling or puckering. Once the capsulorrhaphy has been tapered to its endpoint the suture is then run back on itself for strength. The implant sizer is again placed to determine the position and smoothness of the repair.

By reducing the volume of the three-dimensional capsular space, you will be able to determine by bimanual palpation how much capsulotomy will be required anteriorly to allow some degree of implant mobility and breast softness. I commonly place a third and subsequent fourth row of capsulorrhaphy sutures for support. Evaluation of your repair should be accomplished by bringing the patient to an upright position with the arm boards brought down to the patient's sides. This view will allow you to see if there is flattening or overcorrection of the IMF. Once the fold repair



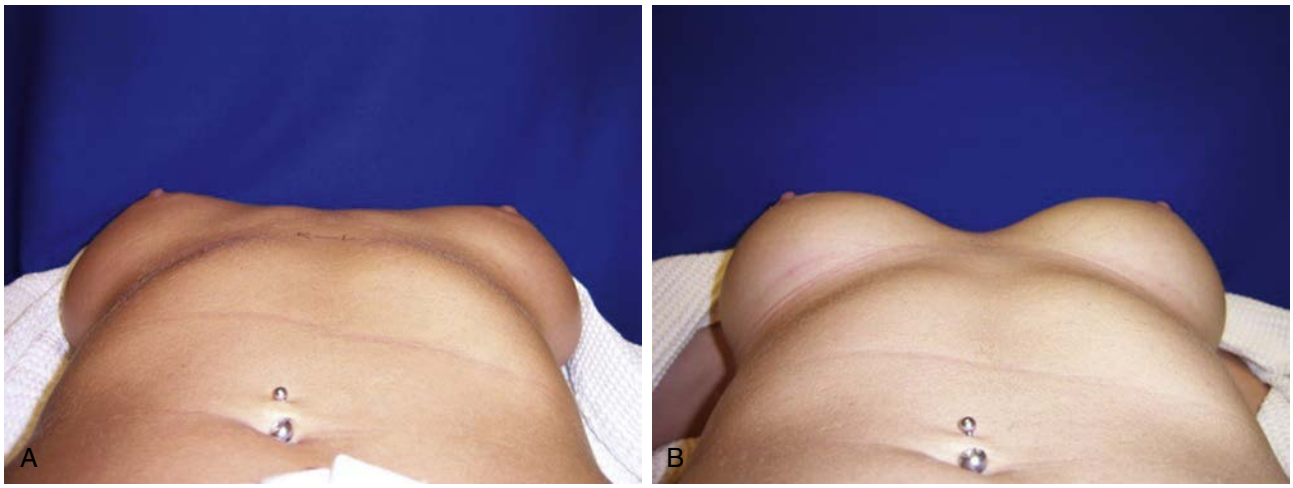
• **Fig. 10.5** Strattice acellular dermal matrix in place after total capsulectomy and site change.

is determined to be satisfactory, the pocket is irrigated, the surgeon's gloves are changed, and the new implant is placed with minimal skin contact, preferably with an insertion sleeve. Closure of the incision is in three layers with absorbable monofilament sutures.

The barbed suture is another option for fold repair. Reported advantages of this technique over traditional suturing techniques is said to include speed in execution and better tissue control with even distribution along the deep suture line and tension-free epidermal closure.[4] In a study of wound complications with barbed sutures it was reported the barbed sutures were associated with significantly higher rates of minor wound complications, specifically if a two-layer closure was used.[5] Readers are encouraged to become familiar with any new technique they adopt to include the risks, benefits, and potential complications.

In some cases of weak or thinned tissue in the face of previous failures of repair, you may choose to support your repair with an ADM or a synthetic absorbable mesh (GalaFLEX). Regardless of what you choose to use, it is your responsibility to know the product, the technique, and how to care for it postoperatively. Placing these materials directly against the capsule internally is possible, but you are more likely to have integration if a new raw surface is provided after partial or total capsulectomy (Fig. 10.5).

External support of the internal repair is mandatory, and patients are instructed to wear a supportive postoperative bra at all times for the first 6 weeks. Patients should not immerse their incisions for 4 weeks, and physical activity is restricted per her surgeon's recommendations. These patients undergoing revision should be seen frequently through their early recovery so that you can guide their recovery massage and garment wear and encourage activity restrictions. My choice for revision surgery uses smooth, round implants exclusively and recommends implant displacement exercises starting 2 days after the drains have been removed. It is critical to modify these exercises to protect any dimensions of repair.



• **Fig. 10.6** (A, B) A 28-year-old woman shown before and 1 year after lateral capsulorrhaphy using the same 375-cc smooth, round gel implants placed 1 year previously by transaxillary approach elsewhere.

Lateral Malposition

It is important to lay the patient undergoing breast revision supine in the examination room to check for unrecognized lateral displacement that would otherwise be an unexpected finding in the operating room (Fig. 10.6A, B). The primary cause of lateral malposition is overdissection laterally at the time of initial augmentation. Poor implant selection in dimensions and volume can also lead to overexpansion laterally. At the initial augmentation, we must be conservative in the lateral dissection and rarely does it need to extend beyond the anterior axillary line. With a sizer or permanent implant in place, this lateral pocket can be modified by cautious cautery or gentle digital dissection. The lateral pocket will suffer the most when an oversized or too-wide implant is placed.

Although there are talented plastic surgeons achieving satisfactory results with the transaxillary route, I commonly find lateral malposition after a primary transaxillary augmentation in revision cases. The takeaway is that if you perform this technique, view your postoperative patients in a supine position after 6 months to assess your incidence of lateral malposition.

The patient seeking breast revision will many times present with a combination of lateral displacement in addition to inferior malposition. The choice of the new implant is critical in the repair because you do not want a wider implant pressing against the repair.

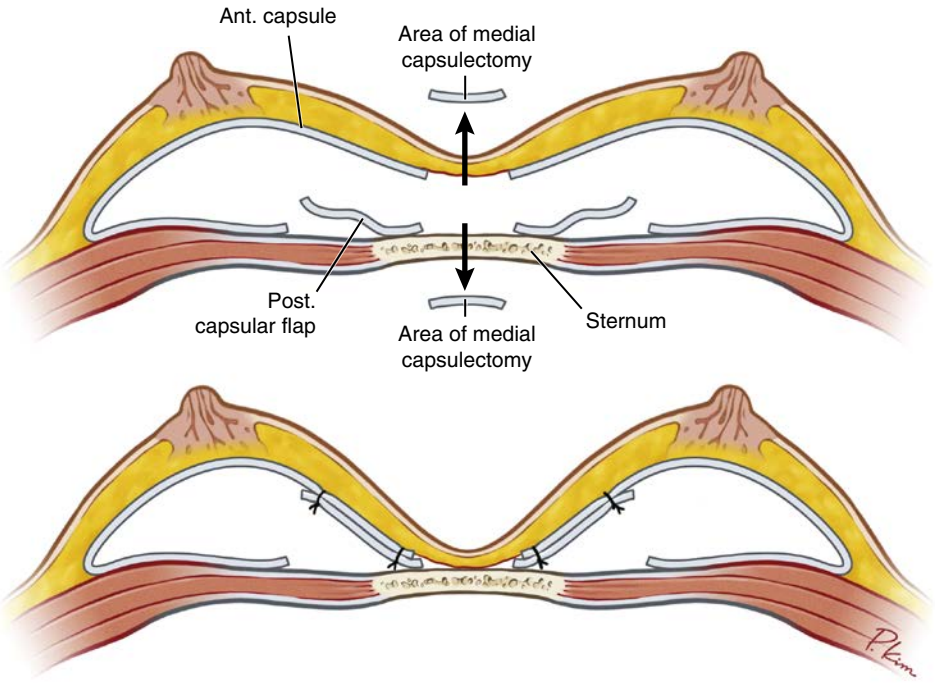
As with inferior malposition the use of capsulorrhaphy is a powerful tool, whether the malposition is purely lateral or a combination of inferolateral in dimensions. I find it helpful to use the lateral border of the pectoralis minor as a medial landmark to follow when securing the lateral capsule to the chest wall. If the tissues are thin or attenuated, you may want to support your repair with ADM or synthetic mesh.

The single or double capsular flap is a technique initially described by Parsa et al.[6] (Fig. 10.7) can be employed in medial or lateral malposition cases; however, the existing capsule must be supple yet substantial enough to support the repair. This procedure is described as marking the area to define the new limit of implant excursion and then elevating the proximal capsule to just short of that mark, knowing there will be additional stretch depending on the quality of the capsule itself. To not stress your repair, it is wise to consider downsizing the volume of the implant for this procedure.

The neosubpectoral pocket procedure (see Fig. 10.4A, B) is described and illustrated by Maxwell and Gabriel,[2] among others, and allows the implant to remain in the dual-plane position while the extent of the new pocket is carefully dissected just short of what is thought to be needed because of expected tissue stretch. Contraindications to this technique include the presence of a thin or wispy capsule, gross silicone contamination, calcified capsules, or a thickened capsule necessitating capsulectomy. Another key to the success of this procedure is to be sure to completely close the previous implant space with mattress sutures (see Fig. 10.4B).

Medial Malposition (Synmastia)

Medial implant malposition is fortunately less common although perhaps the most difficult to repair. As with most malposition complications with augmentation, the best way to treat it is to avoid it. Congenital synmastia is a natural congenital fullness over the sternum that can give the appearance of malposition or synmastia after surgery and should be recognized and discussed preoperatively. There is not a good reproducible means of treating this other than possibly liposuction or direct excision, although the literature is limited. In the series reported by Spear et al.,[7] 18 of 20 women presenting with synmastia had their implants placed in a submuscular position. Of these patients, 8 of 18 had undergone failed repair and 10 had undergone more than one attempted repair. In addition, they reported

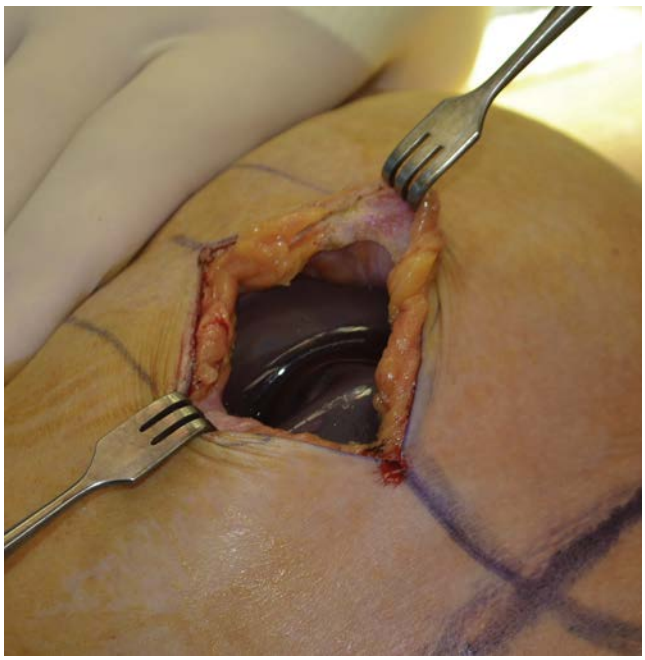


• **Fig. 10.7** Illustration of a capsular flap in the treatment of synmastia. The concept applies to lateral malposition as well. *Ant.,* Anterior; *Post.,* posterior. (Redrawn from Parsa, F.D., Koehler, S.D., Parsa, A.A., Muraiu, D, Daher, P., 2011. Daher, P. Synmastia after breast augmentation. *Plast. Reconstr. Surg. 127 (3),* 63e–4e, Fig. 10.1 and 10.2 [correspondence].)

that 12 of the 20 patients had excessively large or too-wide implants used.

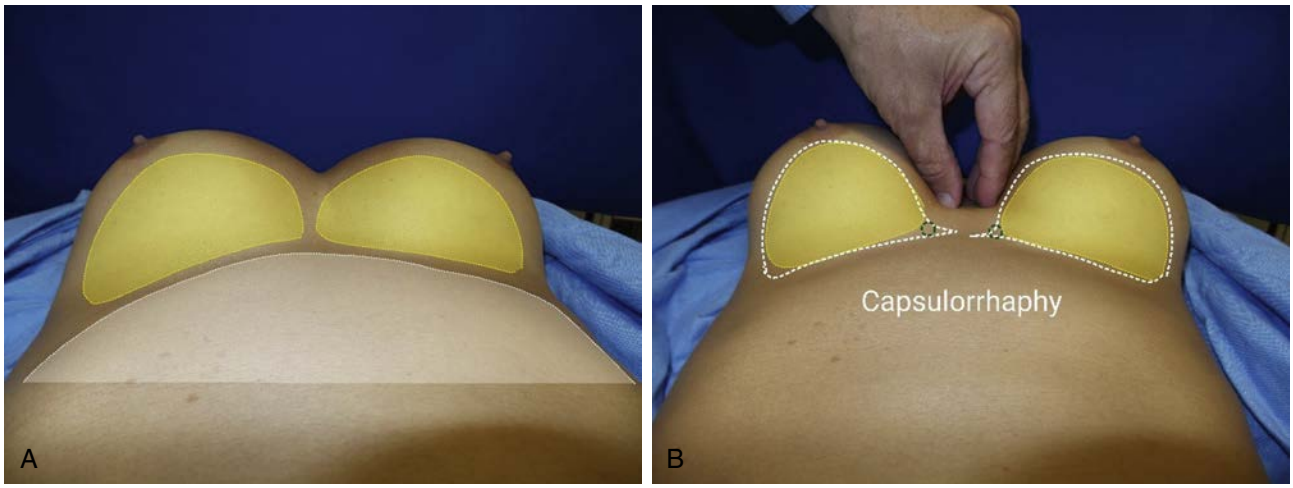
As summarized by Jewell,[8] there are straightforward methods to be employed in primary augmentation that will serve to decrease the occurrence of synmastia. It makes sense that use of an implant that has a base diameter wider than the patient's breast base width will at the least contribute to lateral malposition in addition to potentially disrupting medial sternal muscle and fascial attachments. It also has been shown that the volume of an implant can exert the same deleterious effects on pocket dimensions. It is imperative on the plastic surgeon to use the base width in the planning of surgery and to be intimately aware of what the implant manufacturers have provided to match the soft tissue characteristics, breast dimensions, and patients' desires with the proper implant.[9] Fig. 10.8 illustrates a patient referred to the author for revision showing the effects of an implant that is too wide for the breast and hemithorax. Note the folding of the implant in the otherwise soft capsule.

If synmastia is recognized in the early postoperative period, it is appropriate to allow maturation of the implant capsule because this capsule will play a role in revision. There is no downside to having the patient wear a synmastia thong-style bra during this time of capsule development, although the likelihood that this alone will correct the malposition is low. The options for treatment are capsulorrhaphy with or without mesh or ADM support, site change, or pocket redefinition with capsular flaps.

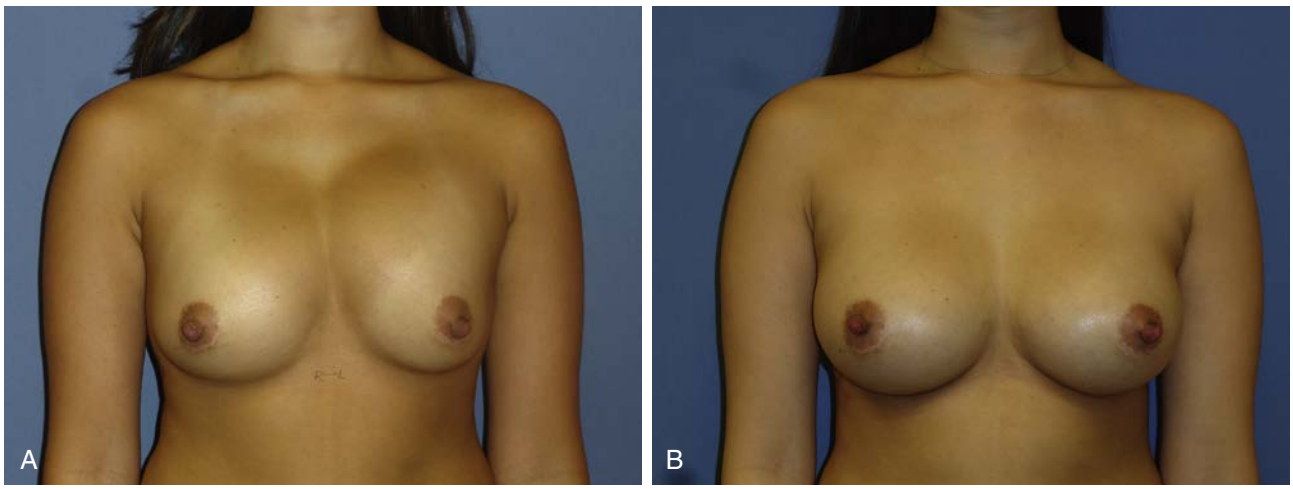


• **Fig. 10.8** Intraoperative view of implant showing infolding of the implant in the absence of a thickened capsule.

Use of modern technology such as TouchMD (Cedar City, UT, United States) and Canfield 3-D (Parsippany, NJ, United States) imaging will serve you well into the postoperative period (Fig. 10.9A, B). The more informed you can make your patient before any surgery, the smoother the



• **Fig. 10.9** (A, B) Simulation of repair of synmastia using TouchMD technology. I find illustrations such as this very helpful in educating patients preoperatively about their malposition and the recommended repair.

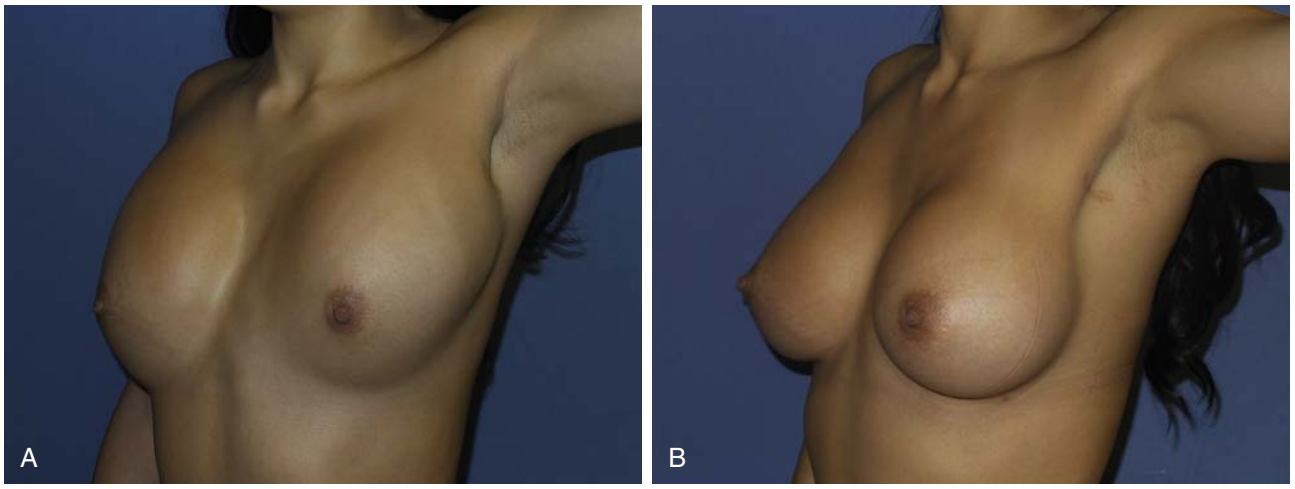


• **Fig. 10.10** Upper sternal synmastia in a 31-year-old woman seen before and 6 months after implant exchange, medial capsulorrhaphy, and focused capsulotomy. Initial 375-cc implants were placed by hemi-areolar approach (A). Repair was performed through an inframammary approach with 450-cc high-profile implants. Note the improved lower pole appearance and closure of the synmastia defect (B).

recovery process will be because of the time it takes for a result to be achieved.

Capsulorrhaphy also can be used for correction of synmastia. The sternal midline is marked, and I aim for a plication of 1.5 cm from the midline at the midsternum. If the implant is in the submuscular position, I start the capsulorrhaphy at the 2-o'clock or 3-o'clock position in the right breast or wherever there is a defined beginning of the defect. Guided by external marks, the running capsulorrhaphy suture takes small deliberate bites of anterior capsule to engage the perichondrium or periosteum for support of the repair. The assistant should be vigilant to look for dimpling or puckering, requiring backing out of that suture. One of the most challenging portions of this repair is the inferomedial breast, where you will find you do not need as much closure at the risk of flattening this important landmark for proper breast aesthetics. If there is accompanying inferior malposition, the suture is run encompassing the inferior defect and turned back on itself. Almost invariably the remaining anterior capsule is tight after capsulorrhaphy, leading to a flatness of the breast shape. These areas or tightness are marked externally with a sizer in place on the breast skin and then treated with open capsulotomy in a controlled fashion to not only improve the shape of the breast but also to relieve any tension on the repair. If you are comfortable with the technique, a capsular flap may provide additional insurance against recurrence. You will need to be familiar with your options because in a complex case such as this, remaining flexible is key to obtaining the best result.

The neosubpectoral pocket procedure[2] (see Fig. 10.4A, B) allows better definition of the medial fold. It is critical to measure carefully the extent of the desired new pocket and evaluate further dissection with an implant sizer in place that represents the implant to be used. In the patient with a wispy or flimsy capsule, there will not be enough integrity to



• **Fig. 10.11** A 27-year-old woman seen before and 1 year after revision for superior implant malposition after transaxillary breast augmentation performed elsewhere (A). In this case the pectoralis muscle costal attachments were completely intact. (B) An improvement in shape and softness was achieved.

support the new implant placement, and other techniques should be explored or the repair supplemented with either ADM or mesh.

Superior Malposition

Superior malposition (Fig. 10.10A, B) is more commonly seen in the face of capsular contracture, whether the implant is above or below the pectoralis muscle, if there is an attachment of the posterior capsule to pectoralis fascia. In this case, treatment is to address the capsular contracture, but you must be careful in the inferior and lateral dimensions to not cause a new displacement in another dimension. The cause of superior implant malposition in the soft breast almost invariably is related to an incomplete release of the IMF or the costal attachments of the pectoralis major muscle. I commonly see this in patients who have had their implants placed by a blind transaxillary approach in which the inferomedial pocket, especially in the dual-plane placement, is incompletely released and therefore suspending the implant. Repair of this malposition requires closure of the axillary space to encourage the implant to remain in the newly reshaped inferior implant pocket whether by suturing technique or a site change procedure.

Once recognized, this malposition requires release of the lower pole suspending tissues, and often the costal attachments of the pectoralis must be divided as you would in a primary dual-plane breast augmentation. An implant sizer allows you to visualize the effect of your release with the patient in an upright position with arms at her side. Once this is accomplished, you need to decide if closure of the superior lateral or axillary pocket is necessary (Fig. 10.11A, B). It is important to note that individual suture tacking will provide an isolated focal point of implant injury leading to implant failure and should be avoided.

Other Techniques Used for Treatment of Implant Malposition

Neosubpectoral Pocket

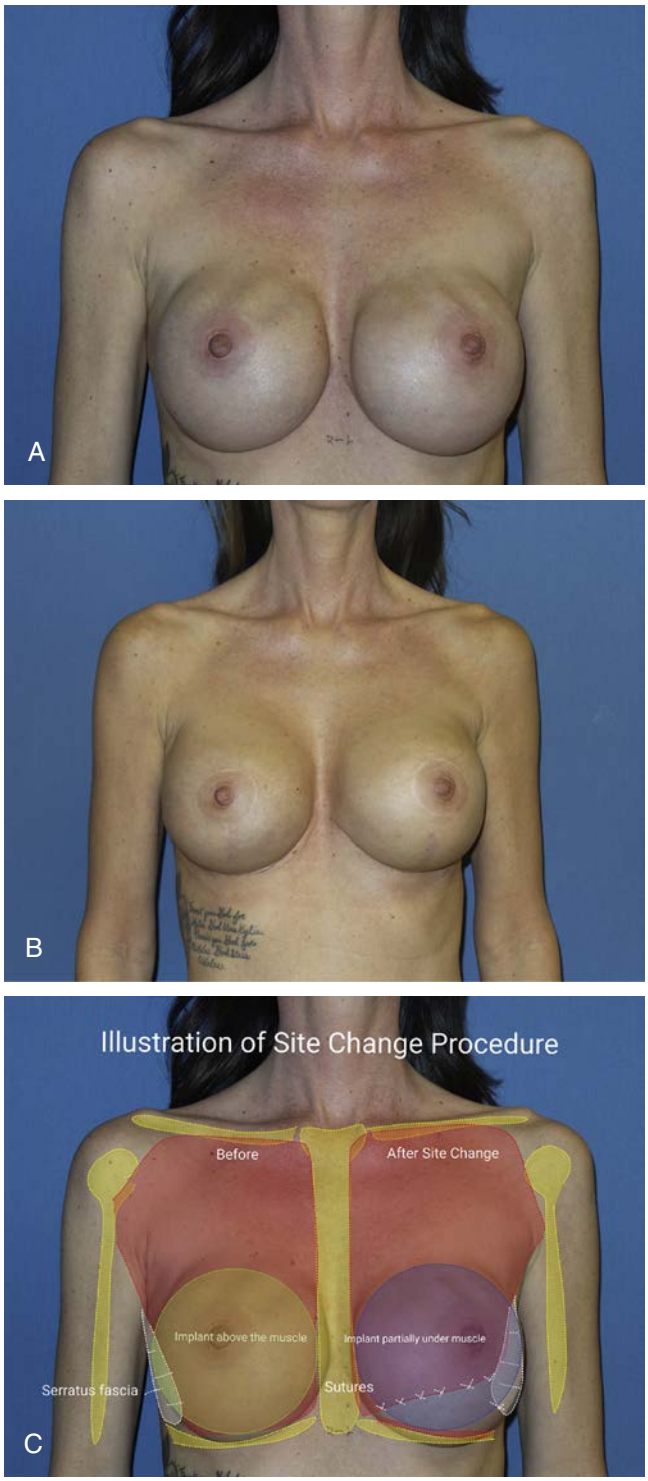
The neosubpectoral pocket procedure (see Fig. 10.4A, B) is described and illustrated by Maxwell and Gabriel,[2] among others, and allows the implant to remain in the dual-plane position while the extent of the new pocket is carefully dissected just short of what is thought to be needed because of expected tissue stretch. Contraindications to this technique include the presence of a thin or wispy capsule, gross silicone contamination, calcified capsules, or a thickened capsule necessitating capsulectomy. Another key to the success of this procedure is to be sure to completely close the previous implant space with mattress sutures (see Fig. 10.4B).

Additional postoperative care includes external support of the repair with an appropriate postoperative bra for at least 6–8 weeks with activity restrictions as described previously. It is helpful to encourage patients to sleep in a soft yet supportive sports bra until 2 months after surgery or longer.

Site Change Procedure

The site change procedure (Fig. 10.12A–C) is a technique I use frequently because of a high volume of patients undergoing revision presenting with subglandular implants, rippling, and thin or compromised coverage. Preoperative counseling should include the benefits of improved coverage and that there will be some degree of animation postoperatively, as in a submuscular implant in primary surgery, and a more natural upper and inner breast appearance, decreased risk of capsular contracture, and less rippling because of better coverage.

The intraoperative decision to remove or keep the implant capsule depends on many factors. If there is a thickened



• **Fig. 10.12** A 46-year-old woman seen before and 1 year after removal and replacement, inferior capsulorrhaphy, site change, and mastopexy. Note the improved appearance of the upper inner breast shape and contour with an increased implant volume from 450 cc to a 550-cc full projecting gel implant. This is a common request in the author's geographic region, although the use of a smaller implant could be easily argued. (A) Before saline implant deflation; (B) 1 year after surgery; (C) use of TouchMD in patient education about a site change procedure.

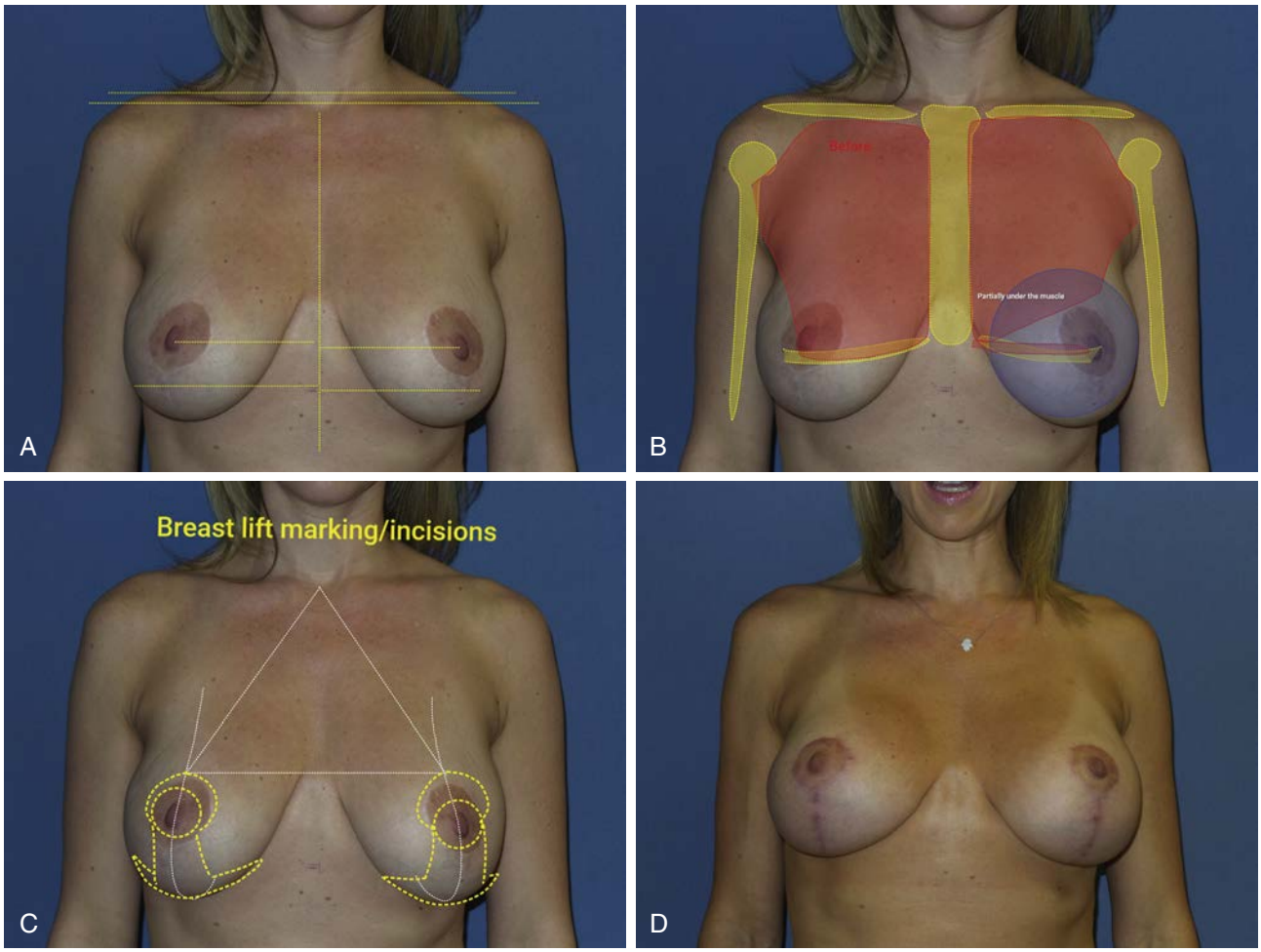
capsular contracture or silicone spillage from an intracapsular disruption of a gel implant, it is preferable to perform a total capsulectomy. If the capsule can be salvaged, it may lend to improved stability of the repair by providing a mature surface to suture to close off the malposition defect, if it exists, and to be able to secure the caudal edge of the pectoralis muscle anteriorly. If you are satisfied with the IMF position, release the pectoralis 1 cm above the IMF transversely from the medial sternal border to the lateral aspect of the muscle. This exposure will give the ability to develop a submuscular pocket superiorly to the third intercostal space, medially to the lateral subpectoral border of the sternum, and laterally to the axillary line. In the lateral dissection it is critical to raise the fascia of the serratus muscle to maintain lateral support (Fig. 10. 13A–D).

If the capsule is thin and has been left in place on the anterior surface of the pectoralis major, it typically needs to be treated by a checkerboard capsulotomy to allow the muscle to expand over the implant to avoid a "bowstring" deformity of a tight muscle edge. You may find it simpler to remove this capsule so as to not interfere with a smooth expansion of the muscle over the new implant. Finally, secure the central edge of the caudal pectoralis to the anterior capsule or breast parenchyma where it appears to meet under minimal tension. Depending on the incision used, you may be able to place the additional interrupted sutures with the sizer in place. Otherwise, you can place marks on the undersurface and secure the sutures with the sizer removed. It is adequate to place sutures every 1–1.5 cm. My preference is not to run this suture continuously because of a potential banding effect seen through the overlying thin breast covering.

The last maneuver is to incrementally release the lateral border along the serratus fascia with the sizer in place. This is best accomplished with a long, flat, yet firm retractor (Tebbetts Spatulated Breast Retractor, Spiral Surgical, Scottsdale, AZ, United States) to hold the sizer medially out of the way. Do not overdissect this lateral border to try to maintain the integrity of the "mesentery" of the lateral pectoralis and serratus fascia. After the implant sizer is properly positioned, supported, and covered, attention can be directed to other procedures, such as a mastopexy, if required. Drains are placed and patients advised to wear a sports bra for the first 2 months depending on the patient. A traditional bra with underwire is allowed when comfortable.

Soft Tissue Impact

The thinner patients are, the more likely they are to experience implant palpability or visibility regardless of implant fill or position above or below the muscle. This highlights the importance of selection of the proper implant in terms of dimensions, volume, and cohesivity of filler material. It is well-documented both in the literature and the author's personal experience that a subglandular or subfascial implant is more likely to exhibit rippling or traction folds than an implant placed partially under the pectoralis major muscle. I encourage the reader, when treating the patient with compromised coverage, to consider not only the early result or ease of operation but also what the patient will experience into the future with the effects of the implant on the soft tissues and natural aging of tissues.



• **Fig. 10.13** (A–D) Use of photography and TouchMD to evaluate, record, plan, and educate the patient preoperatively and document process.

Acellular Dermal Matrix or Autologous Fat Grafting

Rippling in the lower lateral breast over the implant may require additional adjuncts such as an ADM or autologous fat graft (AFG). Although I commonly place ADM at the time of a revision breast surgery, I recommend a secondary procedure 3–6 months after surgery for fat grafting. This is a powerful tool in both revision breast surgery and breast reconstruction. By allowing time to heal after the first procedure, a plane will develop between the ADM and tissues to allow a place for placement of the fat graft. Every patient should be informed that we are restricted in how much fat can be grafted at one sitting to allow vascularization. Some fat will not survive, but allowing at least 3–6 months to pass before a second session of fat grafting helps ensure a better chance of graft take.

Postoperative Care and Expected Outcomes

Fluff gauze is placed over the breasts, and a soft front-fastening bra is covered for the first postoperative night with an elastic wrap. On the first visit the dressings are taken down to assess the patient and then a light dressing held in place by the cotton bra is replaced. Other than Steri-Strips, tape is avoided to minimize blistering from swelling that may occur.

Postoperative care includes drains and supportive dressings to encourage maintenance of your repair. This can be aided using an implant stabilizing or bandeau strap in the postoperative period to encourage the implant to maintain its lowered position. Standard postoperative instructions apply, including in my practice no physical activity for 6 weeks.

Additional postoperative care includes external support of the repair with an appropriate postoperative bra for at least 6–8 weeks with activity restrictions, as described previously. It is helpful to encourage patients to sleep in a soft yet supportive sports bra until 2 months postoperatively or longer if they will.

All revision breast surgery is performed on an outpatient basis unless combined with other facial or body procedures. Ambulation, hydration, and spirometry are encouraged at least three times per day, and our patients are seen frequently in the office for follow-up.

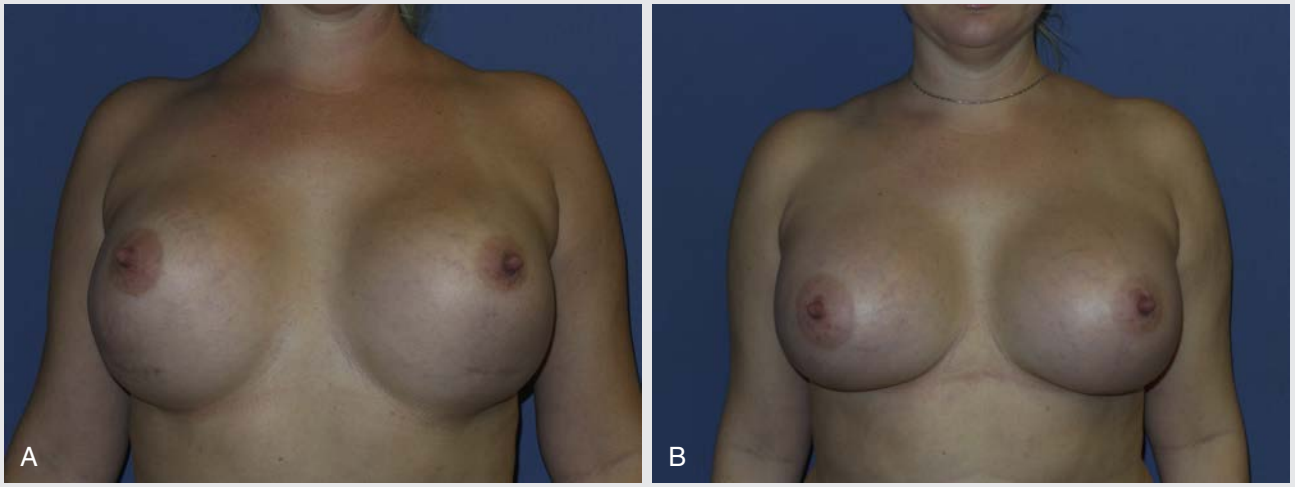
Case Examples

CASE 10.1

A 39-year-old woman requested revision (Case 10.1A). She initially underwent breast augmentation with 350-cc gel implants at 22 years old through the IMF in a dual-plane position. She developed a capsular contracture and underwent removal and replacement with larger, 425-cc implants through the IMF. She developed inferior implant malposition. She wore a 34DD bra and had difficulty finding a bra to fit well. She desired an improvement in shape and an increase in bra size. On physical examination, a "star-gazing deformity" was noted and the nipple-to-IMF measured 13.5 cm. The nipple-to-IMF scar measured 9.5 cm and was chosen as the point of plication. Baker grade II capsules were noted, and only inferior malposition was seen. It was thought that re-establishment of the IMF scar into the fold would provide an improvement in breast shape and volume. Under general anaesthesia the implants were removed intact and the upper submuscular pocket opened with cautery. Capsulorrhaphy was then performed starting at 4 o'clock in the right breast and extending to 7 o'clock (suture technique).

An implant sizer in the upright position demonstrated a pleasant change in the position of the nipple on the new, fuller breast mound after focal anterior open capsulotomy. A third and subsequent continuous fourth row of plication sutures were placed, followed by a synthetic mesh sling for support of the capsulorrhaphy. A mirror image repair was performed in the left breast.

The patient was seen 1 year after surgery wearing a 34DDD bra pleased with her result.

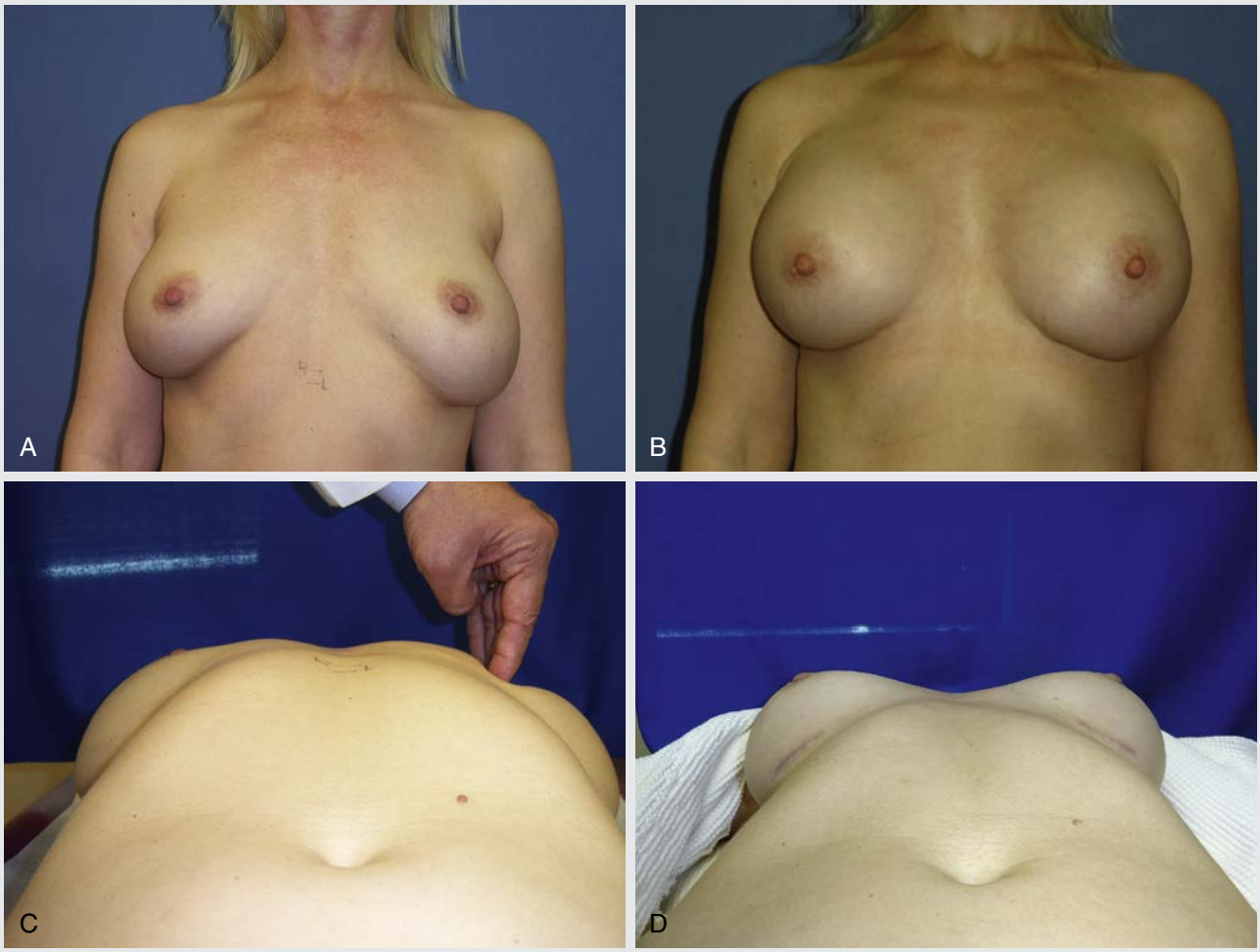


• **Case 10.1** Example of inferior malposition repair. (A) Preoperative and (B) 1 year after inferior capsulorrhaphy with mesh support and new 475-cc gel implants.

CASE 10.2

A 43-year-old nulliparous woman was seen requesting revision (Case 10.2A–D). She initially underwent breast augmentation with style 168 440-cc to 460-cc implants filled to approximately 450 cc 10 years previously through transaxillary incisions in a dual-plane pocket. She presented to the author a right-side deflation wearing a 34DD bra. She desired an improvement in shape, position, and symmetry and an increase in bra size. Case 10.2C illustrates the convex and asymmetric nature of her chest, which yielded a higher risk for lateral malposition. While the patient was supine, the implants were displaced to the posterior axillary line bilaterally with the extent of the malposition. Based on the measurements obtained with placement of the existing implant into an aesthetic position, capsulorrhaphy was planned through an IMF approach 4 cm from the nipple. Capsulorrhaphy was performed starting at 2 o'clock in the left breast extending to 7 o'clock, with open capsulotomy from 7 o'clock to 9 o'clock. A third and fourth row of continuous suture plication was completed, allowing a marked improvement in shape and position of her high-profile 475-cc smooth, round gel implants. The patient was placed in a fully supportive bra for essentially all of the time for 2 months other than when showering. She was encouraged to wear underwire-style bras as much as possible to stabilize the IMF capsulorrhaphy and unload the tissues of biomechanical stress. The patient was seen at 14 months after surgery wearing a 34DD bra and was pleased with the persistence of her result.

CASE 10.2—cont'd



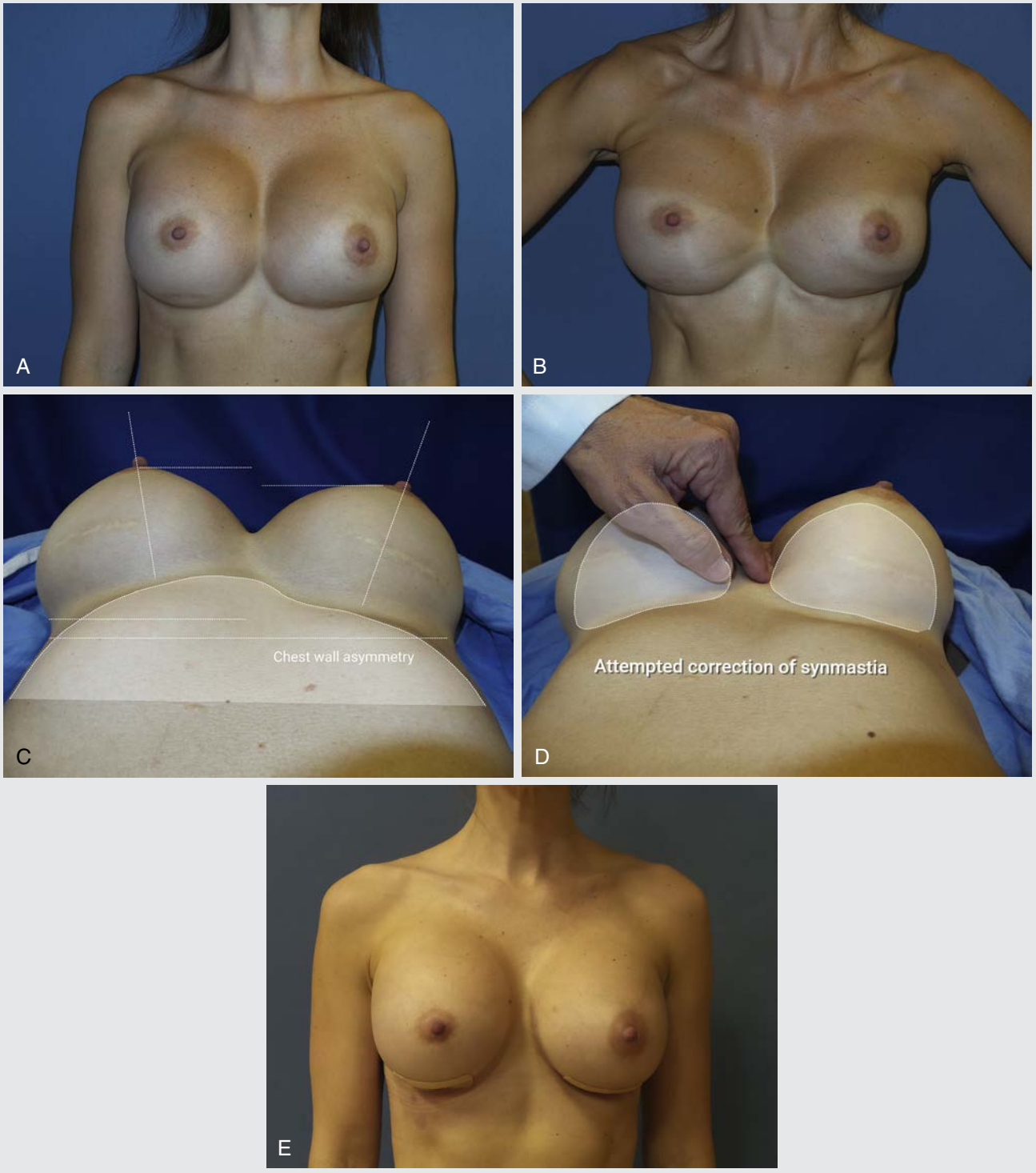
• **Case 10.2** Example of lateral malposition repair. (A, C) Preoperative repair, (B) 14 months postoperatively, and (D) on-table result.

CASE 10.3

A 37-year-old nulliparous, very physically fit woman was seen requesting revision (Case 10.3A–E). She initially underwent breast augmentation with a 375-cc gel implant on the right and a 320-cc implant on the left 9 years previously through IMF incisions in a dual-plane pocket. Records indicate she underwent an additional four procedures for various issues, with her last implant placed being 700 cc on the right and 650 cc on the left. These implants were 14.4 cm and 14.8 cm wide, respectively. The patient's measured base width was 13 cm. She states her breasts are larger than she likes and most important to her is the synmastia that is illustrated at the time of surgery. Preoperatively she wore a 34DD bra and wanted to refine the space between her breasts, improve breast shape overall, and have a smaller breast size. On examination, Baker grade II capsules were noted bilaterally, with tenting of the midline sternal thin skin. A key aspect of the physical examination was seen with her in a recumbent view. By noting the marked asymmetry in her chest wall a discussion took place with the patient about expectations and planned treatment. Once the implants were removed through the IMF incisions, bimanual palpation revealed the true extent of the synmastia and underlying chest wall deformity. The midline was marked and planned capsulorrhaphy marked 1.5 cm from the midline at the sternal midpoint bilaterally. The capsulorrhaphy extended from the sternal midline 180 degrees around the base of the breast to 7-o'clock in the right breast with mirror image treatment in the opposite breast. The difficulty with the midline plication was due to the canted nature of the sternum requiring careful suture placement in this running suture. Once the capsular space was made smaller by the capsulorrhaphy, contralateral capsulotomy was carried out to allow careful tension-free lateral positioning of the new implants. With the use of saline-filled sizers the choice was made to use a high-profile 600-cc smooth, round gel implant on the right and a 550-cc implant in the left. This choice was made by viewing the patient in a recumbent and semi-sitting position with arms at her side intraoperatively. The patient is seen 1-year postoperatively with silicone scar dressings in place. She now comfortably wears a 34D bra, is pleased with the persistence of her result, and has comfortably returned to her fitness regimen.

Continued

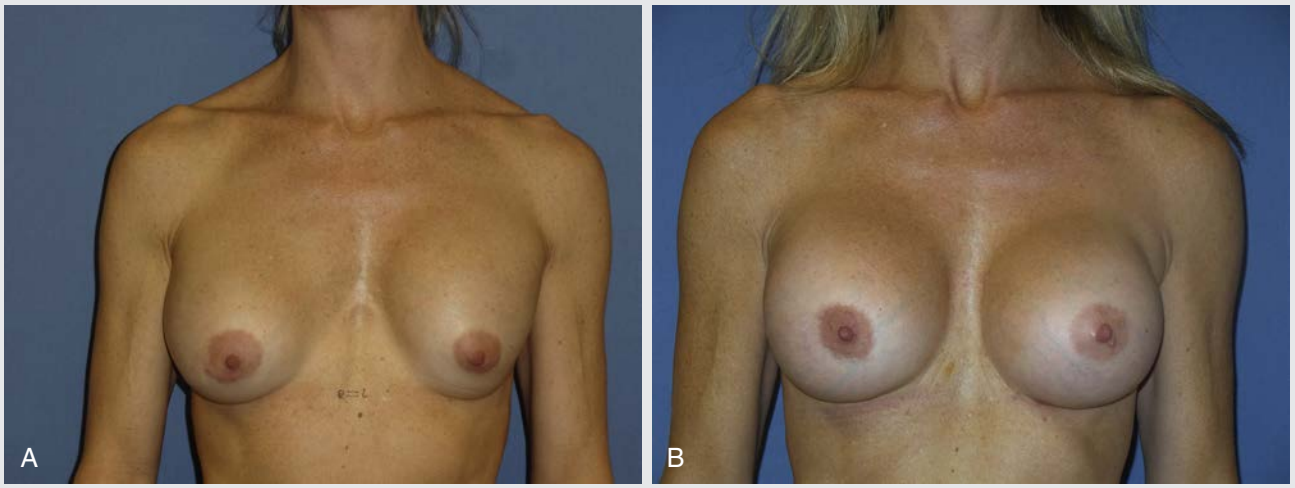
CASE 10.3—cont'd



• **Case 10.3** Medial malposition and synmastia. (A–C) Preoperative implant malposition. (D) Simulated repair and chest wall asymmetry, highlighted with the aid of TouchMD. (E) Result at 2 years.

CASE 10.4

A 44-year-old woman initially underwent breast augmentation with 304-cc smooth, round gel implants 2 years previously through transaxillary incisions in a submuscular pocket. She states her implants always have been too high and separated and she would like to improve her shape and increase volume. She wears a 36C bra and desires an improvement in shape, position, and symmetry and an increase in bra size. Case 10.4A illustrates the superior and lateral malposition present since the initial procedure 2 years previously elsewhere. She is very physically fit and would benefit from repositioning of her implants in an inferomedial direction. Through the existing IMF scars, each implant was removed and the anatomy of her existing pocket evaluated. The implants give the appearance of a transaxillary approach that failed to descend. The capsules were opened medially with the assistance of implant sizers as a guide, after which superior and lateral capsulorrhaphy was performed in the author's preferred technique. Once again, the implant sizers in supine and upright positions verified adequacy of repair and 425-cc smooth, round gel implants were placed. The patient is seen in Case 10.4B at 1 year after surgery wearing a 32D bra.



• **Case 10.4** Superior malposition case example 2 years after augmentation elsewhere. (A) Symmetry and implant malposition. (B) Result at 1 year with inferior release, superior and lateral capsulorrhaphy, and new 425-cc smooth, round gel implants.

Management of Complications

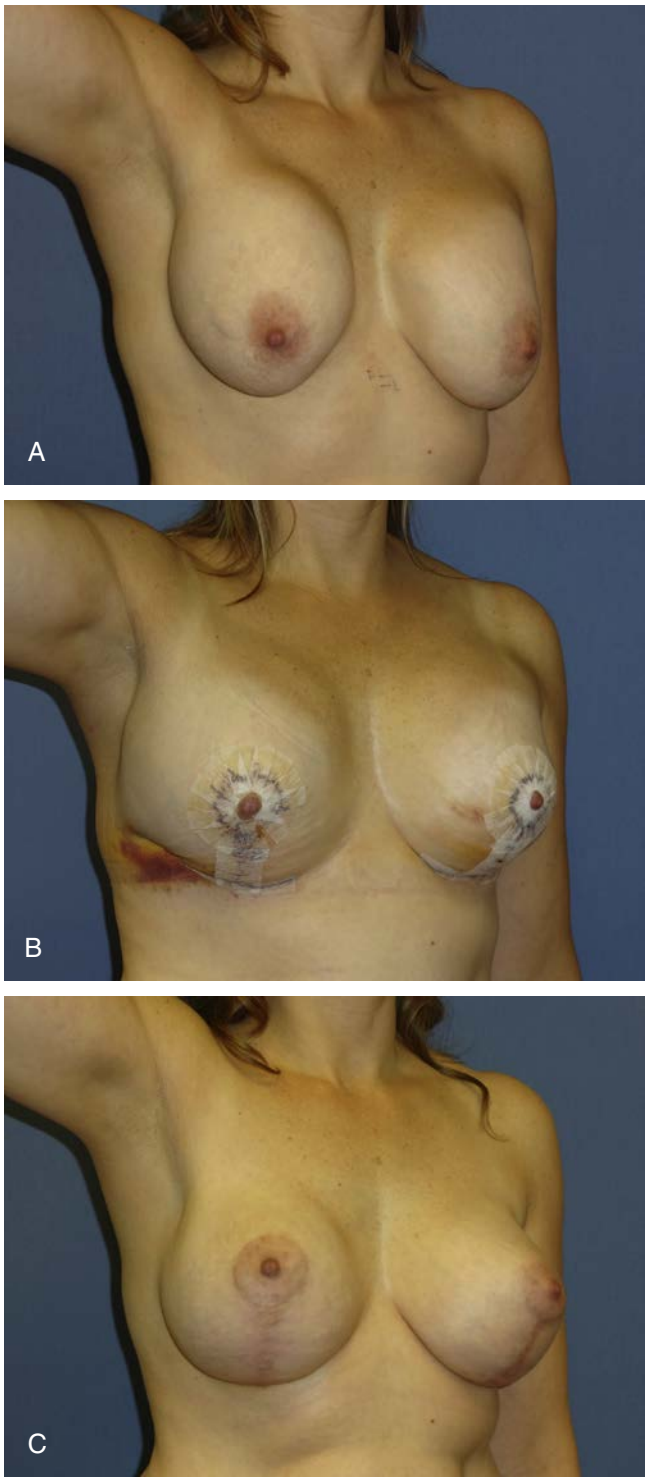
With any revision procedure it should be made clear to the patients that although our goal is to provide a satisfactory result, the possibility of a revision being desirable may occur and should not necessarily be thought of as a complication. We cannot predict how a given patient will scar, and there may be a need for treatment such as corticosteroid injection or scar revision. Nipple and areolar height differences may also occur and can commonly be treated in an outpatient or office-based setting. Complications that may require a return to the operating room, aside from the thankfully rare hematoma, include an unappreciated overtightening of the capsule. Fig. 10.14A and B is a patient seen on postoperative day 1, when inferior and lateral capsulorrhaphy were performed with removal and replacement, site change, and mastopexy. Ecchymosis and exaggerated puckering were noted that was not expected to resolve in a satisfactory manner with observation. She was returned to the operating room for a release, and a stable 6-month result is seen in Fig 10.14C.

Secondary Procedures

Even in the best of situations, patients may require additional surgery. I have found the use of ADM helpful in breaking the cycle of reoperation for recurrent capsular contracture.

Conclusion

Recognition and treating implant malposition and implant rippling and wrinkling are skills any plastic surgeon that performs breast surgery should be comfortable performing. It is certainly easier to avoid these complications by not creating them, but you will meet many patients who have had surgery with very well-intentioned plastic surgeons who may be in another state or retired. It is then your turn to guide the patient seeking care to the proper procedure. Some patients will be reasonable about expectations, and, thankfully, only a few will not. If you do not think you can meet a patient's stated expectations, you will be best-served to not let your ego get in the way and wish them the best. It is my hope that the reader will gain some insight into one way to look at these revisions, realizing there are many ways to reach the goal.



• **Fig. 10.14** (A, B) Inferior and lateral capsulorrhaphy, removal and replacement, site change, and mastopexy were performed. Ecchymosis and exaggerated puckering were noted that were not expected to resolve in a satisfactory manner with observation. She returned to the operating room for a release. (C) A stable 6-month result.

Pearls for Success

- Thorough preoperative evaluation is essential.
- Review old records if possible.
- Conduct an unhurried consult process.
- Ensure thorough informed consent is obtained.
- Emphasize realistic expectations.
- Make frequent use of intraoperative sizers.
- Perform photographic documentation.
- Use meticulous technique.
- Conduct compulsive follow-up.

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11

Revision Breast Augmentation—Capsular Contracture

M. BRADLEY CALOBRACE AND CHET MAYS

Introduction

Capsular contracture has for decades been the most common complication associated with aesthetic and reconstructive breast surgery.[1,2] Although the exact mechanism or cause is still unclear, many causes have been implicated, the most feasible include hypertrophic scarring, the infectious theory, or potentially both. The hypertrophic theory implicates that either blood or seroma fluid surrounding a breast implant induces the capsular contracture, and the role of a myofibroblast in this process has been implicated by some.[3,4] The infectious theory has the most supporting evidence and has become the predominant theory, implicating low-level bacterial contamination and the formation of a biofilm around the breast prosthesis, either introduced at the time of implantation or seeding of the implant space from a transient bacteremia.[5,6] The exact cause is most likely multifactorial.[7] The significance of this pathologic process cannot be overstated because capsular contracture has consistently been the leading indication for revision after placement of breast implants, ranging from 15%–30%, and accounts for nearly 50,000 reoperations annually.[1,2,8]

The management of an established capsular contracture may include some non-surgical efforts, but failure to resolve the contracture will generally necessitate surgical intervention.[9] There are many proposed approaches to management, but the best data support implant exchange and new pocket creation as significant to reducing recurrence.[10] The management of the capsule may include a capsulotomy, a total capsulectomy, a near-total or partial capsulectomy, a pocket exchange from subglandular to submuscular, creation of a neosubpectoral pocket, or even implant removal with or without a capsulectomy. The use of acellular dermal matrix (ADM) in treatment of established or recalcitrant capsular contracture has been associated with some of the lowest rates of recurrence.[11]

In this chapter the authors will describe their preferred approaches of a capsulectomy with or without pocket exchange, a neosubpectoral pocket with collapse of the capsule below the new implant, and the selective use of ADM.

Indications and Contraindications

Capsular contracture is a clinical diagnosis made on symptoms and physical examination. Early capsular contractures by definition occur in the first year. It has been thought that most capsular contractures occur in the first year, but long-term breast implant data confirm that capsular contracture based on multiple causes, including seeding from a distant site or silicone leak, may develop any time after breast implant placement. Capsular contractures have classically been graded by the Baker classification (Table 11.1).[12]

Surgical intervention is usually reserved for Baker grade III and IV capsular contractures, because these are characterized by visible deformation of the augmentation result and potentially discomfort and pain.[3]

When treating an early capsular contracture as it is evolving, appropriate non-surgical management may be appropriate. This may include manual displacement and massage, oral consumption of a leukotriene inhibitor (Singulair) and/or vitamin E, and the use of external ultrasound therapy. Once a contracture is well-established, this non-surgical approach is less effective.

TABLE 11.1 Baker Grades of Capsular Contracture

Grade I	Breast is soft and looks natural
Grade II	Breast is slightly firm but looks normal
Grade III	Breast feels and looks firm
Grace IV	Breast is hard, is painful, and looks abnormal

Reproduced from Spears, S.L, Baker Jr., J.L., 1995. Classification of capsular contracture after prosthetic breast reconstruction. Plast. Reconstr. Surg. 96, 1119–1123.

Surgical intervention is best if performed after the capsular contracture has stabilized. Intervening during the evolution of a capsular contracture is ill-advised, because the inflammatory process makes surgical intervention more challenging and there is a greater risk of recurrence. If possible, surgical intervention is performed when the capsular contracture has stabilized for 3 months. If the breast deformity and associated pain preclude delay, intervention may proceed earlier but potentially may be more challenging secondary to the inflammatory process

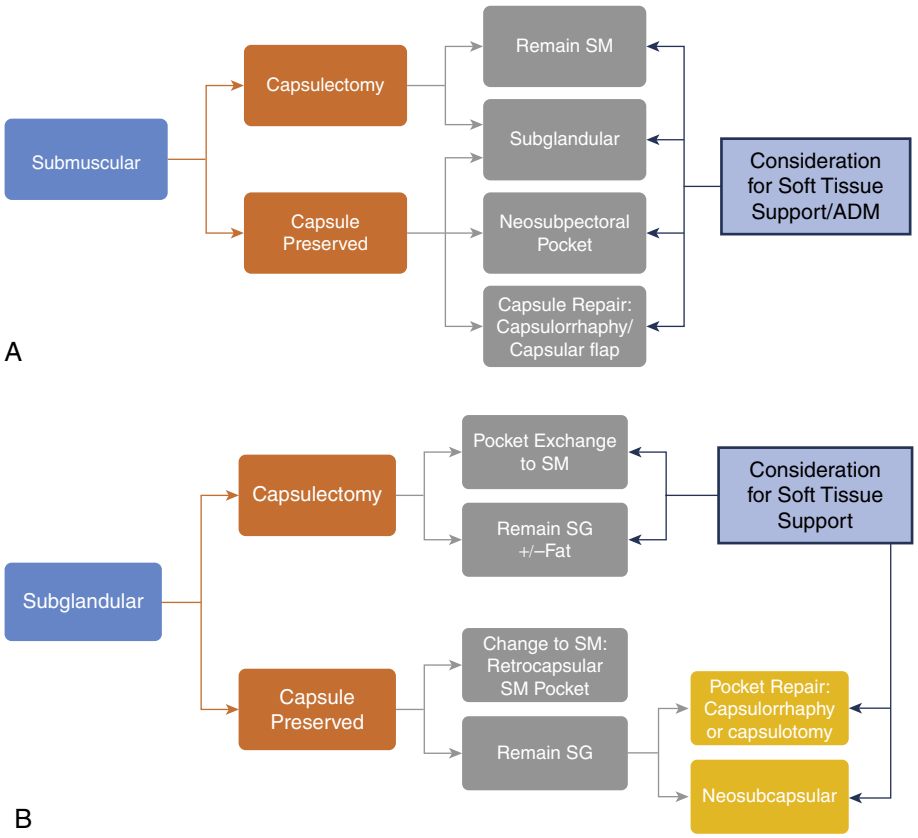
Preoperative Evaluation and Special Considerations

The approach to treatment of the capsular contracture is determined by a host of influencing factors. It is first important to recognize the duration of symptoms and the natural history of the evolving capsular contracture. Efforts to manage it non-operatively and determining when it is necessary and optimal to proceed with surgical correction will provide the best chance for success.

The approach to correction is multifactorial, but generally begins with the decision whether to retain the capsule or to remove it. When retaining the capsule, a capsulotomy has been successfully used by many surgeons but with a rather high recurrence rate.[13] If the infectious theory is thought to be the culprit in development of the capsular contracture, it is worrisome to leave the contaminated capsule in place. Another approach when leaving the capsule would be to create a neosubpectoral pocket, effectively creating a fresh new pocket and isolating the implant from the potentially contaminated capsule. More commonly, a total capsulectomy is performed to remove the entire capsule or a partial capsulectomy in some selected cases in which removing the entire capsule was deemed too challenging or dangerous, especially with removal of adherent capsule from the underlying chest wall.

Additionally, it is important to determine pocket placement for the new breast implant. When subglandular, a pocket exchange to a submuscular pocket is commonly performed to create a new pocket. The submuscular pocket is associated with lower capsular contracture rates, provides often much needed additional soft tissue coverage over the implant, and creates a pocket with potentially less bioburden from overlying breast tissue. For all secondary breast cases, we developed an algorithm to guide our pocket decisions for these difficult cases (Fig. 11.1A, B).

Finally, preoperative planning must include a decision on the management of the breast implant. Although some surgeons have approached the management of capsular contractures with keeping the same implants in place, there



• **Fig. 11.1** Algorithm showing pocket decisions: Submuscular. *ADM*, Acellular dermal matrix; *SG*, subglandular; *SM*, submuscular.

• BOX 11.1 Characteristics Associated With Less Stretching of the Lower Pole

- Textured implants
- Cohesive implants
- Shaped implants
- Silicone compared with saline implants
- Lower profile implants
- Smaller implants
- Tight, firm breast skin

are good data to support improved outcomes with implant exchange.[10] However, it is understandable that there may be no need to change the implant if one is simply performing a capsulotomy for treatment. We think that isolating the implant from the old capsule, creating a new pocket, and exchanging the implant during the revisional procedure are all hallmarks for success in treatment of established capsular contractures. Smooth and textured devices have been used successfully and are often a personal preference. The more cohesive smooth or textured fifth-generation devices with optimal fill can provide improved stability in the upper pole compared to the less cohesive implants. Textured implants are often used in our practice because of the reduced capsular contracture rates (especially in the subglandular pocket) and the positional control and reduced soft tissue stretch the implant provides in what is often an unstable pocket, especially after a capsulectomy (Box 11.1).

Surgical Technique

Relevant Surgical Anatomy

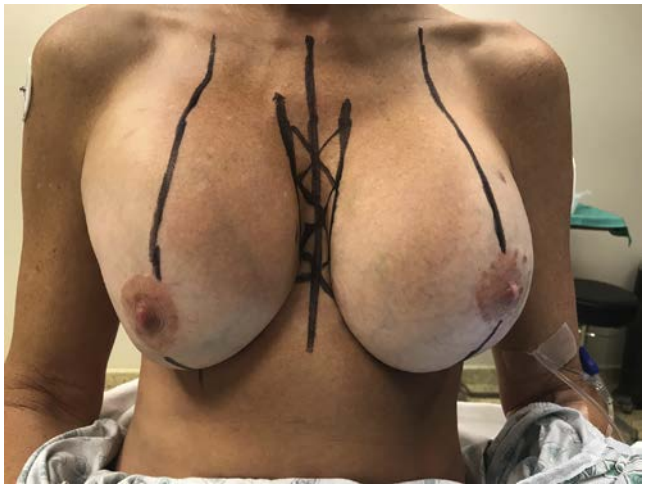
When approaching any revision breast surgery, such as the treatment of capsular contracture, additional changes have often occurred to the breast. There is often additional soft tissue thinning and atrophy associated with the implant and tight capsular contracture. This is often more profound with a long history of implantation, increased duration of untreated capsular contracture, subglandular implant placement, and presence of oversized implants. The breast has a rich blood supply from multiple sources, including the internal mammary artery perforators, the lateral thoracic arteries, and the thoracoacromial, anterolateral, and anteromedial intercostal perforators.[14] Previous breast procedures could alter the blood supply, including the location of the augmentation scars, biopsy scars, alterations secondary to a previous mastopexy, and the breast implant pocket location. If a concomitant mastopexy is performed at the time of capsular contracture treatment, an understanding of the remaining blood supply is even more imperative to prevent devascularization and nipple loss.

Preoperative Markings

With the patient in the upright position, the midline and the current inframammary folds (IMFs) are marked. In capsular contracture, the IMFs are often elevated with the contracted implant. In unilateral capsular contracture, the new IMF position on the side of the capsular contracture should be marked at the same level as the opposite unaffected side. If bilateral capsular contractures exist, IMF placement should be based on a biodimensional approach determined by the implant selected. Although many techniques exist, we determine IMF position in cases in which IMF position needs to be altered based on a formula that uses implant dimensions of projection and height.[15] It is important to take the measurement of the IMF at rest and on stretch. The stretch measurement for determining the ideal IMF position is as follows[15]:

Ideal Nipple to fold Distance = ½ implant projection
Under maximal stretch + ½ implant height

A line is then drawn vertically 1.5 cm from the midline, marking the extent of dissection medially. This provides a 3-cm intermammary space to avoid overdissection and medial implant displacement postoperatively (Fig. 11.2).



• Fig. 11.2 Preoperative markings of the patient with bilateral capsular contracture. The midline of the chest is marked. Marks are made at 1.5 cm on each side of the midline giving a 3-cm intermammary distance shown as the *crosshatched lines* indicating the "no-go" zone to prevent synmastia.

Intraoperative Markings

Once the patient is under anesthesia and has been prepped for the operative procedure, all markings are confirmed and retraced if necessary. The incision location is confirmed and marked for the appropriate distance. The incision can be placed through the scar used in the primary case if inframammary or periareolar. If the original incision was periareolar and an inframammary scar is selected, the new incision is placed at the planned IMF position.

TABLE 11.2 Breast Local Anesthetic Injection Concentrations

0.5% lidocaine plain	25 mL
0.5% lidocaine/1:200,000 epinephrine	25 mL
0.5% bupivacaine/1:200,000 epinephrine	25 mL
Injectable saline	25 mL
0.25% lidocaine, 0.125% bupivacaine, 1:400,000 epinephrine	100 mL

Reproduced from Calobrace, M.B., 2015. Teaching breast augmentation Clin. Plastic. Surg. 42 (4), 493–504.

Details of the Procedure

Capsulectomy (Total or Subtotal)

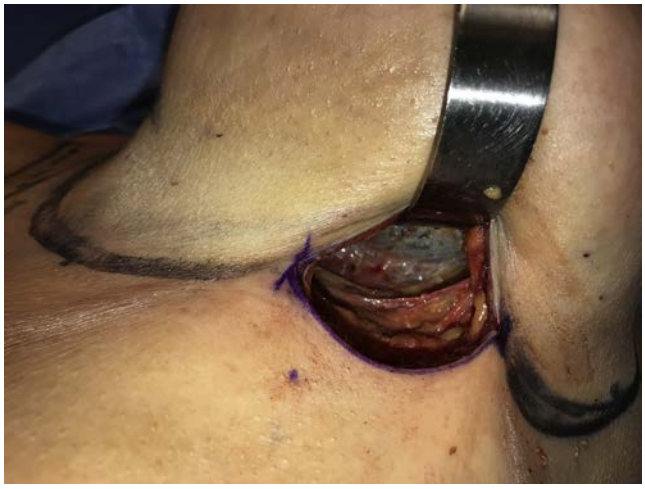
Total and subtotal capsulectomies are considered the gold standard treatment of a capsular contracture and are the most common techniques employed by the authors. A capsulectomy can be performed on subglandular or submuscular capsular contractures.

The capsulectomy is typically performed under general anesthesia. The operative field is injected with 50 cc per side of local anesthetic of 0.25% lidocaine, 0.125% Marcaine, and 1:400,000 epinephrine (Table 11.2).[15]

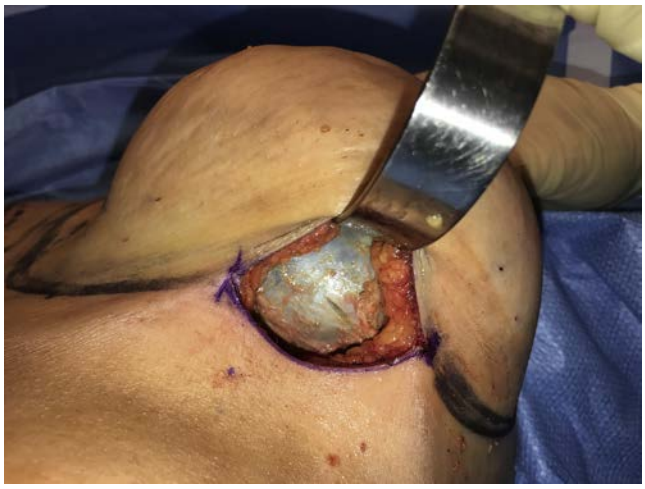
The incision is made generally in the inframammary location, with incision length at least 5 cm for adequate visualization. The dissection is then performed using electrocautery. Dissection is performed through the breast tissue until the capsule is encountered (Fig. 11.3). The dissection then proceeds anteriorly and posteriorly, defining the extent of the capsule. Dissection is carried along the capsule, but great effort is made not to enter the capsule. The dissection anteriorly is generally easier than the posterior dissection, especially if the pocket is submuscular. However, when the implant is subglandular with extremely thin skin envelopes, which may have significant atrophy from a long-standing capsular contracture, great care must be taken to stay directly on the capsule, preserve as much anterior tissue as possible, and not inadvertently injure the skin (Fig. 11.4). If the capsule is only thickened but not calcified or containing silicone particles from ruptured implants, it may be appropriate to leave the anterior capsule intact to support the overlying skin envelope (subtotal capsulectomy); it is balancing the risk of injury or significant stretch of the overlying skin versus the benefit of removing the entire diseased capsule. During the dissection, great effort is taken to keep the breast pocket as bloodless as possible, because blood can be a catalyst for future capsular contracture.

During the posterior dissection of the capsule, a decision must be made on whether the entire capsule can be safely removed. When the implant is subglandular and the implant and capsule are lying on the pectoralis and serratus muscles, the dissection posteriorly is much easier and the entire capsule is typically removed (Fig. 11.5). When the pocket is submuscular, this dissection can be tedious along the intercostal muscles and ribcage, and an inadvertent violation into the pleural space is possible. Hydro-dissection under the posterior capsule with tumescent fluid can be invaluable in facilitating this dissection. Alternatively, the entire capsule may be removed except for a small segment of the most adherent capsule along the chest wall (subtotal capsulectomy). The surface of the capsule can be cauterized aggressively in an attempt to destroy any residual bacteria or biofilm present on the residual capsule.

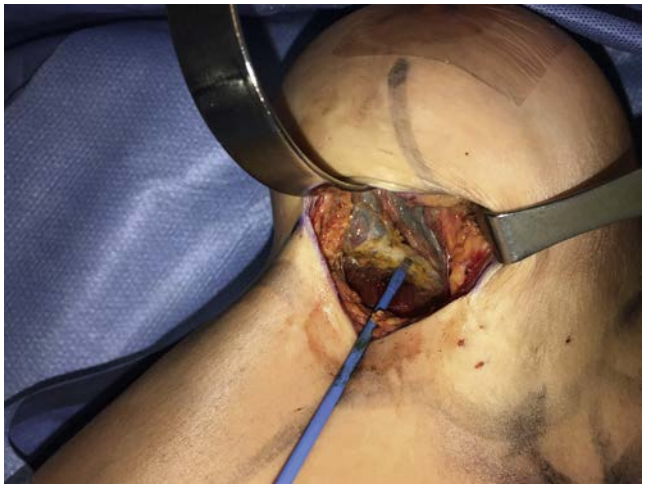
It is optimal to perform the entire capsulectomy and remove the capsule intact with the implant and silicone contained within the capsule without exposure to



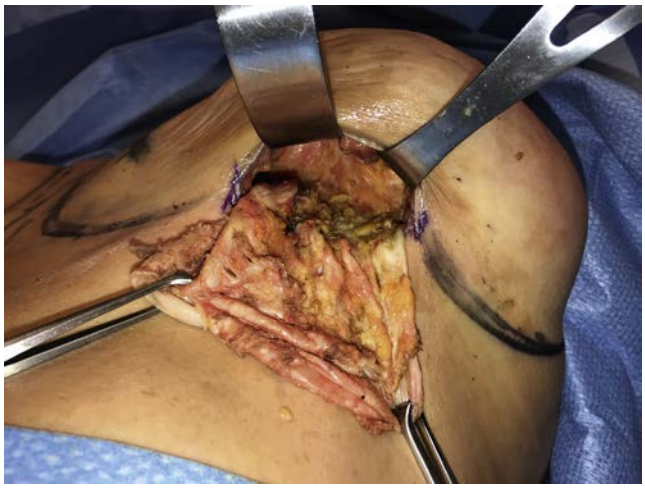
• **Fig. 11.3** Intraoperative photograph showing the approach to the capsule using the patient's prior inframammary incision and dissecting down through the breast tissue until the capsule is encountered.



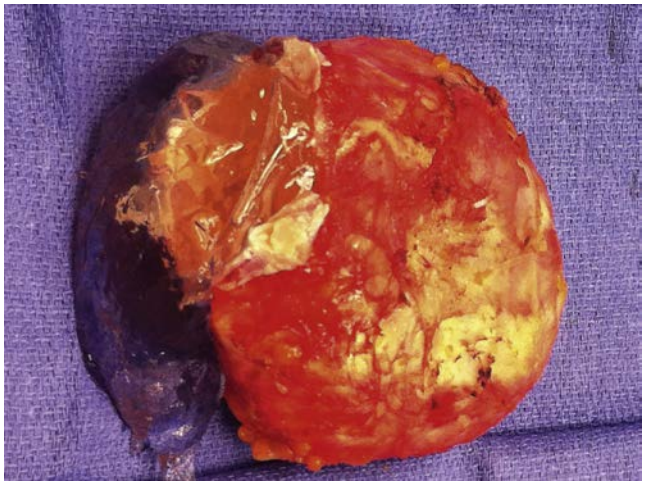
• **Fig. 11.4** Intraoperative photograph showing anterior dissection of the breast tissue off of the intact capsule. Care is taken not to rupture the capsule or implant prematurely.



• **Fig. 11.5** Posterior dissection of the capsule off of the underlying muscle in the subglandular pocket is generally easier compared to resection of the posterior capsule in the submuscular pocket off of the underlying chest wall.



• **Fig. 11.7** The implant has been removed from the capsule, and a complete capsulectomy has been performed through the IMF incision. Removing the intact capsule is important to prevent contamination of the pocket. Two Allis clamps are retracting the thickened capsule



• **Fig. 11.6** An intact calcified capsule with a ruptured implant is shown. This is an example of a capsule in which none of the capsule could be left because of the extensive calcification and ruptured implant leading to contamination.

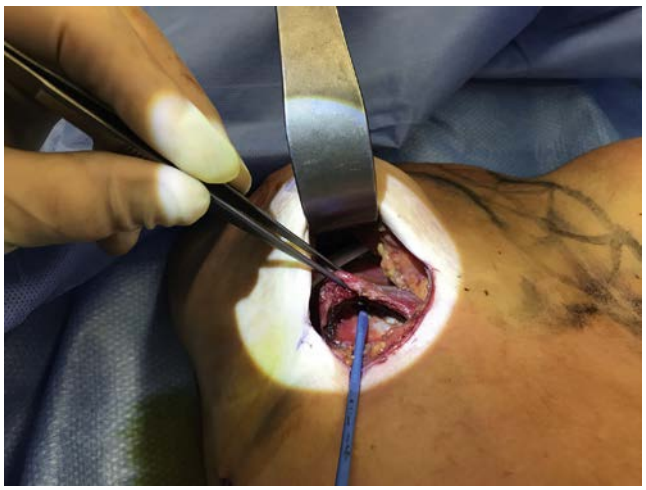
the pocket (Fig. 11.6). However, during the dissection around a pathologic capsule, visualization in the most superior aspect of the pocket may be challenging. This visualization is often easier when the approach is periareolar. When required, a larger inframammary incision may be employed or it may necessitate entering the capsule and removing the implant and silicone products before completing the capsulectomy. Every attempt should be made to contain the contents as much as possible and avoid excessive contamination of the dissected pocket.

Once removed, the capsule is opened and visualized to determine the status of the implant and evaluate for any pathologic condition, such as a mass, that requires further evaluation (Fig. 11.7).

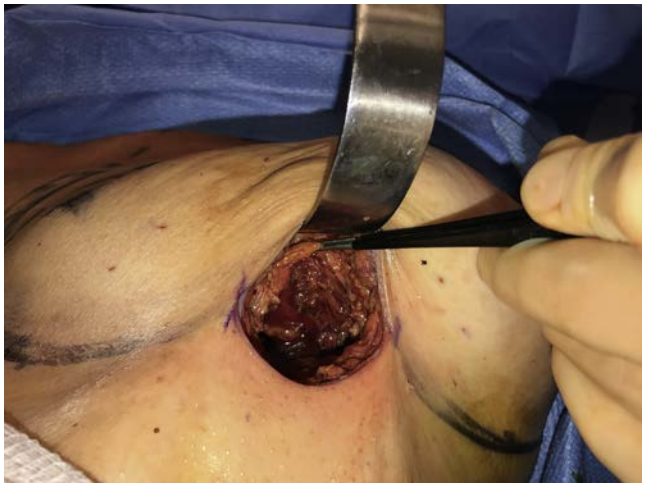
After the capsulectomy, the pocket is carefully evaluated for adequate hemostasis. Dissection of the pocket is then carried out to create the appropriate pocket for implantation of the new device. This often requires further dissection along the medial and superior border under the muscle to create an adequate pocket. The lateral pocket is often much larger than one would suspect after removal of the capsule. This can be challenging to correct, but 2-0 Vicryl sutures are often placed along the lateral gutter as pocket control sutures to narrow the lateral pocket.

If the patient has a subpectoral pocket, it is maintained for the augmentation. If the pocket is subglandular, every effort is made to create a subpectoral dual-plane pocket for the new device. This provides additional coverage, an uncontaminated virgin pocket, and a pocket associated with a lower capsular contracture recurrence rate. In creating the new subpectoral pocket it is important to keep the lateral pectoralis fully intact with its lateral attachments to the serratus muscle. Therefore, rather than open the pocket at the lateral pectoral border, the dissection begins medially along the caudal border of the pectoralis muscle and a subpectoral pocket is created (Fig. 11.8). Dissection is carried out along the medial and superior borders, and then dissected along the lateral border under the overlying pectoralis and serratus, maintaining a controlled lateral pocket.

Once the pocket is created and irrigated, the device is placed into the pocket with an insertion sleeve to minimally disrupt the newly created pocket. The caudal muscle of the pectoralis is then dissected medially and laterally to allow appropriate positioning of the implant and re-draping of the overlying breast envelope. Once the positioning has been confirmed in the upright position, the patient is placed supine and the caudal edge of the pectoralis muscle is attached to the overlying breast tissue with four or five 2-0 Vicryl sutures to stabilize the pectoralis dual-plane position and to close off the old subglandular pocket (Fig. 11.9) This will prevent the implant migrating out of the



• **Fig. 11.8** After performing the complete capsulectomy a pocket change from subglandular to submuscular is performed. The submuscular pocket is approached medially at the pectoralis costal margin, being sure to leave the serratus attachments in place as the pocket is dissected.



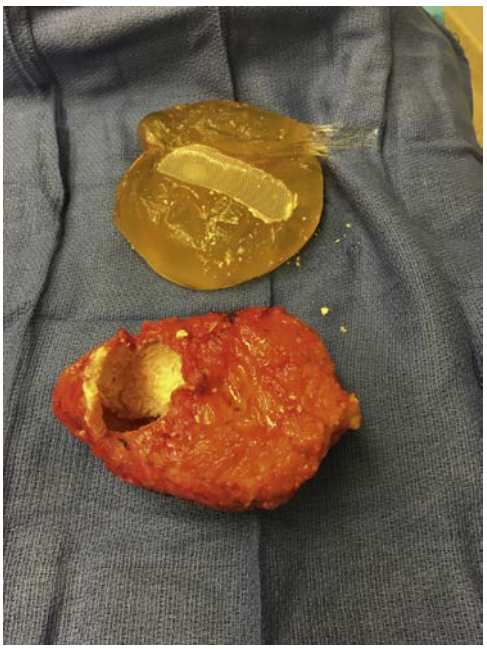
• **Fig. 11.9** Once the pocket change has been performed and the new pocket is dissected, the previous pocket needs to be closed off with interrupted Vicryl sutures to prevent the implant migrating into the old pocket. Shown here is the previous subglandular pocket being closed by tacking the pectoralis major muscle to the overlying breast tissue.

new subpectoral pocket into the old subglandular pocket postoperatively.

Details of the Procedure

Neosubpectoral Pocket

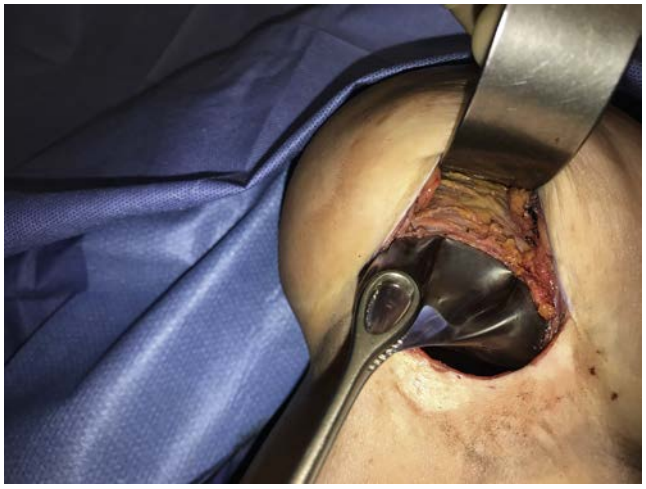
A neosubpectoral pocket is possible only when the implant and capsular contracture are submuscular. It creates a new virgin pocket that is well-controlled in all dimensions, which can be extremely beneficial when placing a shaped device or when pocket control is prioritized. It requires retention of the capsule, and thus it is not appropriate if the capsule has extensive pathologic



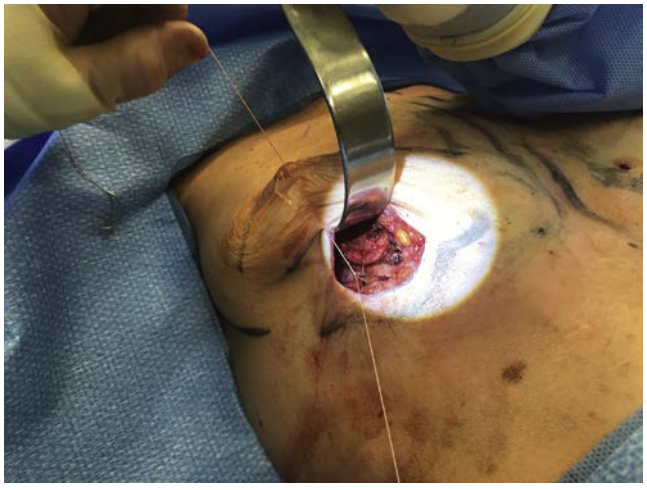
• **Fig. 11.10** Shown here is a calcified capsule after capsulectomy with the ruptured implant. The extensive calcification of the capsule prevented a neosubpectoral pocket creation because no leaflets of the capsule could remain.

issues, including calcifications, silicone particles, or a thickening or mass that requires evaluation (Fig. 11.10). It is not generally used with suspected implant ruptures, especially with older designed implants, because capsule removal may be necessary to remove all of the silicone.

In developing a neosubpectoral pocket, the initial dissection is identical to capsulectomy dissection. One of the significant advantages of the neosubpectoral pocket is that it eliminates the posterior dissection of the capsule, thus eliminating the challenges associated with achieving a total capsulectomy and avoiding inadvertent injury. The anterior, medial, and lateral dissection proceeds just as it did in a capsulectomy. Dissection with cautery is directly adjacent to the capsule, creating a plane between the anterior capsule and overlying breast. As the dissection proceeds cranially, the caudal edge of the pectoralis muscle is identified. It is then imperative to avoid dissection superficial to the muscle, but rather elevate the muscle with the breast tissue and create the plane between the anterior capsule and the pectoralis muscle. Visualization will usually become impaired as the dissection proceeds cranially because of the implant and firm capsule. This often necessitates opening the capsule and removing the implant and/or any contents within the capsule (Fig. 11.11). The pocket is copiously irrigated with antibiotic povidone-iodine (Betadine) solution. To assist in further dissection, a few 2-0 Vicryl U sutures are used to secure the anterior capsule leaflet to the posterior chest wall and capsule. Sutures are placed in a quilting fashion to obliterate the old breast pocket (Fig. 11.12). The remainder of the submuscular



• **Fig. 11.11** A capsulotomy has been performed, and the intact implant is removed to facilitate visualization of the dissection for a complete capsulectomy.

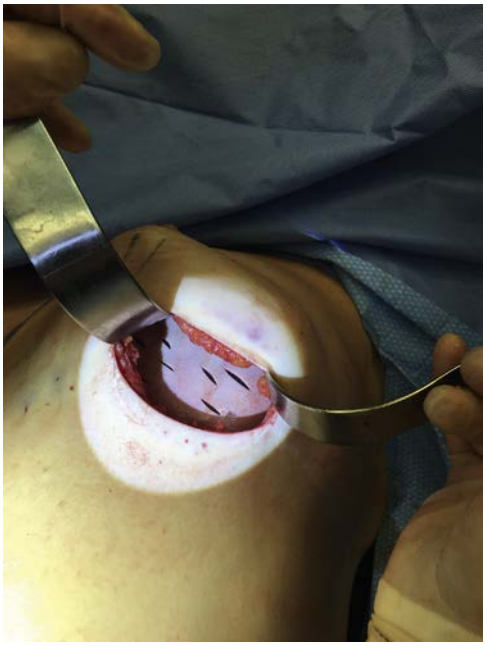


• **Fig. 11.12** In neosubpectoral pocket creation the anterior leaflet of the capsule is sutured to the posterior chest wall to obliterate the old pocket.

pocket is then created, with the extent of pocket dissection dictated by implant choice for re-augmentation. Once the pocket has been created, the remainder of the anterior and posterior capsule quilting sutures are placed. It is important when suturing to the posterior capsule to incorporate deeper tissue in the bite to ensure stability of the entire capsule on the pocket floor. Failure to secure the two capsules together creates a potentially unstable pocket, increasing the risk for implant malposition postoperatively. Typically, a total of 10–15 quilting sutures are placed. The new submuscular pocket is then irrigated with povidone-iodine containing antibiotic irrigation, and the new implant is placed with the insertion sleeve.

• BOX 11.2 Summary of Indications for Use of Acellular Dermal Matrix

- Recurrent capsular contracture
- Unstable pectoralis, especially after pocket exchange
- Excessive superior migration of pectoralis muscle
- Wrinkling
- Lower pole thinning
- Lower pole laxity and/or ptosis



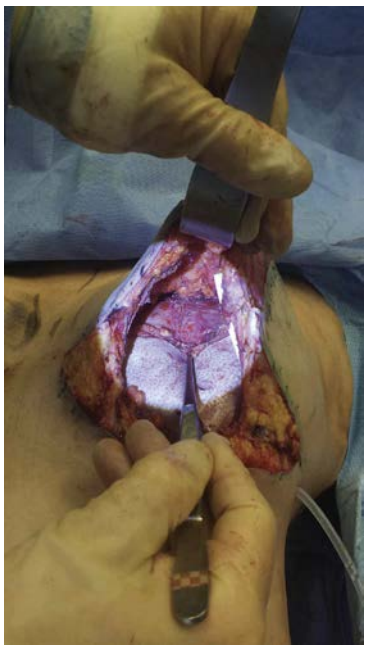
• **Fig. 11.13** A fenestrated piece of ADM is used for neosubpectoral pocket creation to allow egress of fluid and improve adherence to the overlying tissue to aid in incorporation.

Details of the Procedure

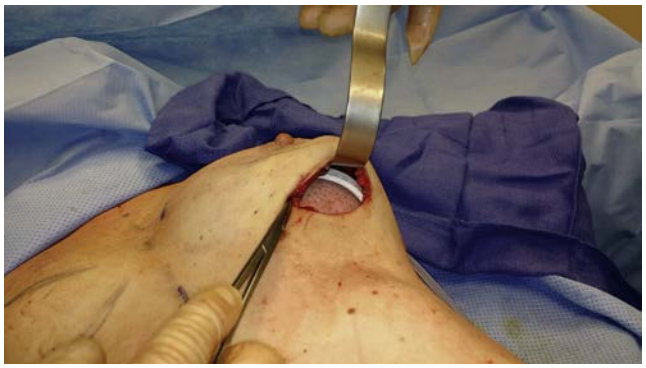
Acellular Dermal Matrix Placement With Capsulectomy or Neosubpectoral Pocket

The final variation in performing either a neosubpectoral pocket or capsulectomy, whether subpectoral originally or conversion from subglandular to subpectoral, is the decision on whether to place ADM in the inferior aspect of the breast pocket. ADM has been associated with extremely low capsular contracture recurrence rates.[12] However, its routine use has not become widespread because of many issues, including significant additional expense, longer operative times, more technical challenge, and the potential for additional complications, including failure of ADM adherence, seromas, and/or infections. In our practice, we use ADMs selectively, but routine use may be justifiable based on the extremely low recurrence rates. Our relative indications for the use of ADM are summarized in Box 11.2.

A fenestrated contoured piece of ADM is typically used to facilitate inset (Fig. 11.13). When placing the ADM, the caudal edge of the muscle is grasped with a clamp and



• **Fig. 11.14** ADM is sutured to the caudal edge of the pectoralis major muscle to create the neopectoral pocket. Any overlap of the ADM is trimmed to improve the contour and aid with incorporation of the ADM.



• **Fig. 11.15** Drains are mandatory when ADM is used to remove excess fluid to improve the ADM-implant and ADM-skin interface. If fenestrated ADM is used, one drain placed in the ADM-skin interface is sufficient to remove the excess fluid.

pulled inferiorly. The straight edge of the ADM is then sutured with a few interrupted Vicryl sutures or occasionally with a running suture. A sizer is often used to determine the appropriate orientation of the ADM in the pocket. The goal is to have the ADM attached to the caudal pectoralis edge, draped over the lower pole of the implant, and secured along the margins of the breast pocket. The implant is then placed under the ADM into the pocket through an insertion sleeve in preparation for final graft inset. The ADM is sutured with 2-0 Vicryl to the IMF to reinforce the IMF and keep the ADM firmly positioned over the lower pole of the implant (Fig. 11.14). Any excess or overlap of the ADM is trimmed to ensure optimal opposition to the overlying breast tissue for maximal graft adherence and incorporation.

Drains are routinely placed after capsulectomy to reduce any blood or fluid collection postoperatively that may increase the risk of capsular contracture recurrence. When ADM is used, a drain is mandatory (Fig. 11.15). Because perforated ADM is used, one drain has been satisfactory to drain both sides of the ADM (the skin-to-ADM interface and the ADM-to-implant interface). If nonfenestrated ADM is used, two drains might be advisable to avoid seroma formation and potential non-adherence of the graft. Patients are placed in a breast band at the end of the procedure to hold the implant downward against the lower pole ADM as a buttress for graft against the overlying breast.

Details of the Procedure

Final Closure

At completion of either a capsulectomy or neosubpectoral pocket with or without ADM, the incisions are then closed in three layers; deep parenchymal or superficial fascia sutures with 2-0 Vicryl, interrupted dermal sutures with 3-0 polydioxanone (PDS) or Monocryl, and a running 4-0 Monocryl subcuticular suture. Steri-Strips are placed over the incision. Contour tape is then placed along the lateral breast border and IMF. A chlorhexidine eluting dressing is placed at the base of the drain as it exits the skin, and the drain is secured with 2-0 nylon. The breasts are wrapped with gauze and an elastic wrap.

Postoperative Care and Expected Outcomes

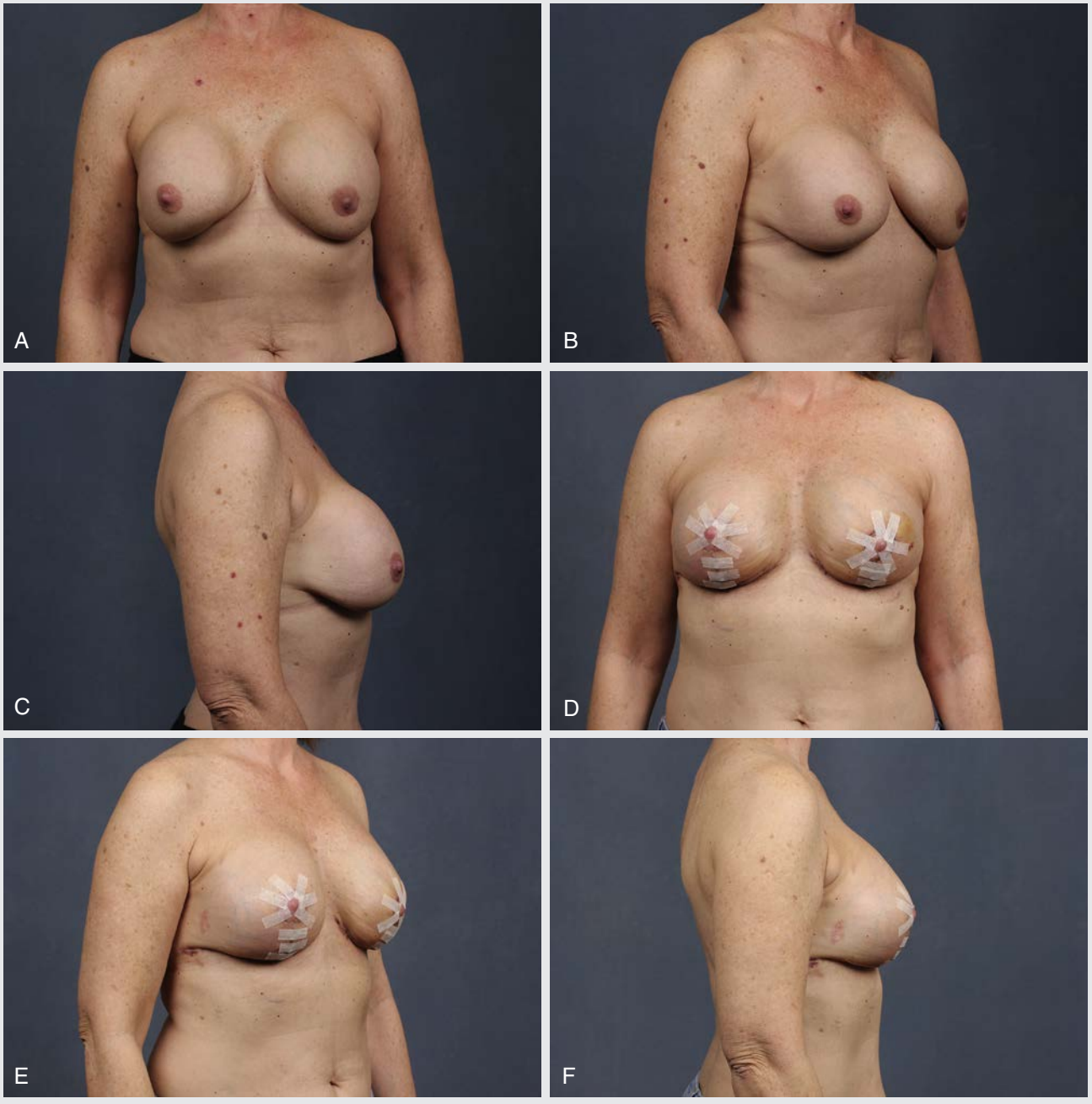
Patients are instructed to leave all dressings on for 24 hours. The wraps are then removed, and a sports bra is worn for the following 4 weeks. Patients are allowed to shower after 48 hours. The contour tape is removed at day 4–7. The Monocryl ends are clipped as they exit the skin 2 weeks postoperatively. Drains are stripped daily and are removed when the output is less than 30 cc daily, which is generally about 1 week. Even if drainage exceeds 30 cc per day, drains are removed by 2 weeks unless ADM was used. Drains are retained longer if required with ADM because of concerns about seroma and adequate graft adherence and integration. A breast band is placed at the time of surgery when textured implants and/or ADM is used. These are discontinued at 2 weeks or shortly after the drain is removed.

Patients are allowed to resume activities of daily living almost immediately. Exercise is usually allowed at 4 weeks, with heavy lifting at 6 weeks. The timeline is sometimes adjusted if ADM is used and there has been a protracted period of drainage. If smooth implants are used, massage is started once the drains are removed and no fluid collections have developed. With textured implants, massage is avoided and only range-of-motion exercises are performed, including shoulder rolls and arm reaches about the head.

Case Examples

CASE 11.1

A 57-year-old woman presented with a history of subglandular Siltex textured silicone implants since 1985. She developed hardening of the breasts with worsening ptosis over the past few years. She presented with a Baker grade IV capsular contracture and grade 1 ptosis (Case 11.1A–C). She underwent bilateral total capsulectomies of calcified capsules with pocket exchange from the subglandular to the submuscular position (Case 11.1E, F) with a mastopexy She achieved correction of her ptosis with soft, proportional breasts with harmony of her breast parenchyma and the underlying submuscular implants (Case 11.1G–I) .



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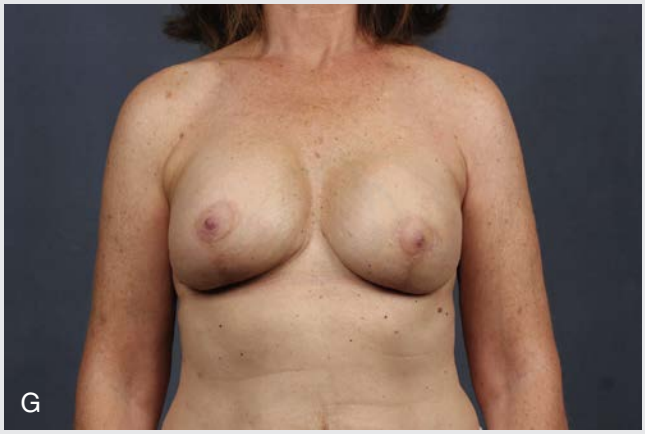
CASE 11.1—CONT'D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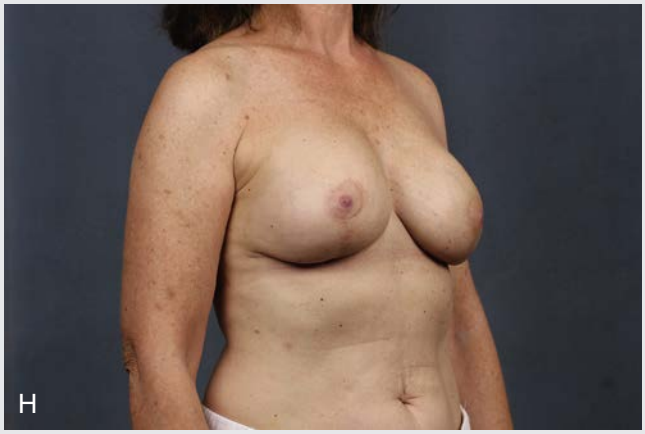
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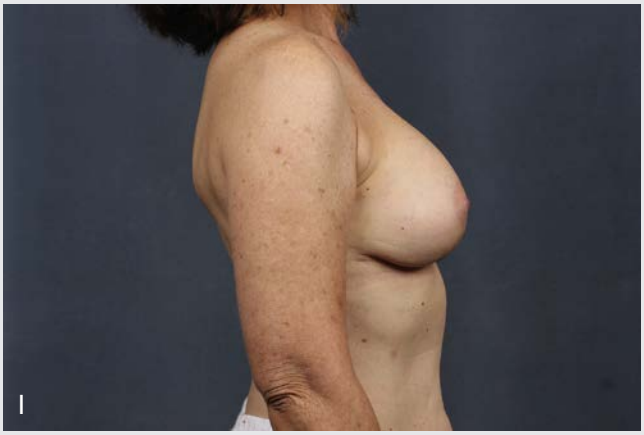
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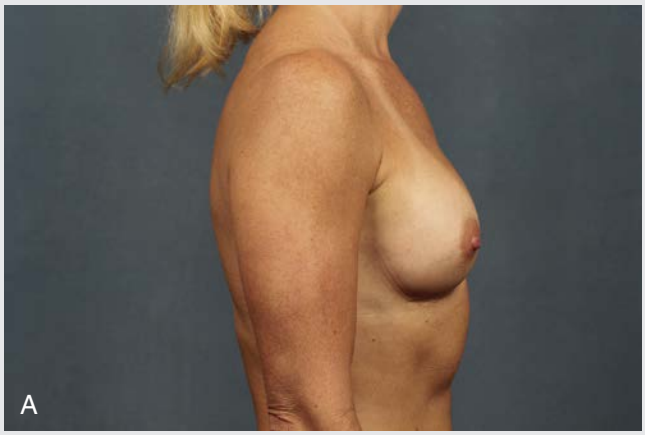
CASE 11.2

A 48-year-old woman presented with 28-year-old submuscular silicone implants associated with bilateral capsular contractures, Baker grade IV on the left and grade III on the right. She also had significant animation deformities, worse on the left (Case 11.2A–D). She had a B cup breast size and desired a C cup. She underwent bilateral subtotal capsulectomies with dual-plane conversion to provide more of the inferior pole of the breasts to achieve subglandular placement. Capsulectomies were selected because of the intraoperative finding of bilateral intracapsular implant ruptures. The posterior wall residual capsule was cauterized. Sientra 435-cc moderate profile textured implants were placed with an IMF resection of skin. She achieved a soft, mobile C cup result with excellent implant position as seen in her 4-month postoperative photographs (Case 11.2E–G).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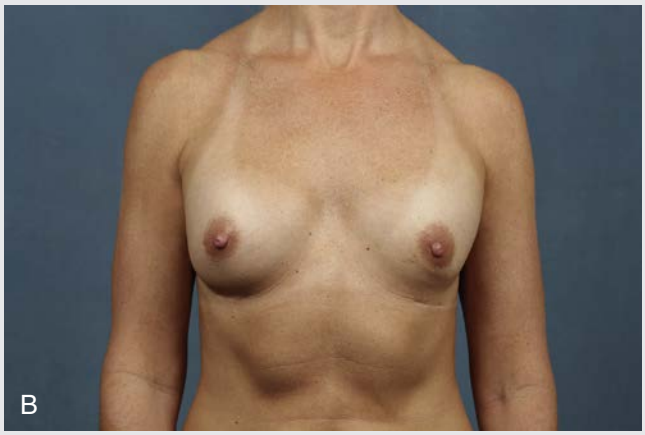
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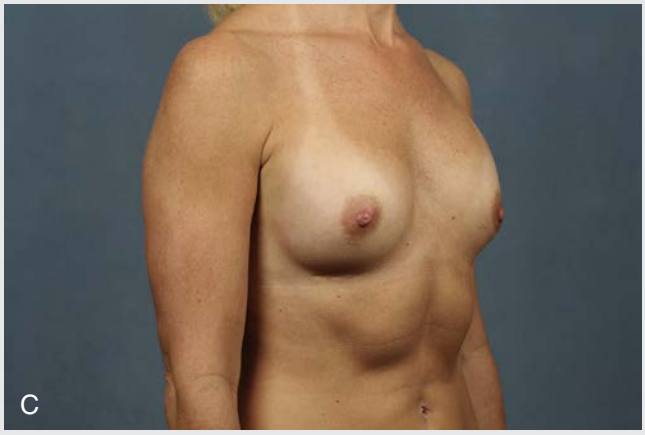
CASE 11.2—CONT'D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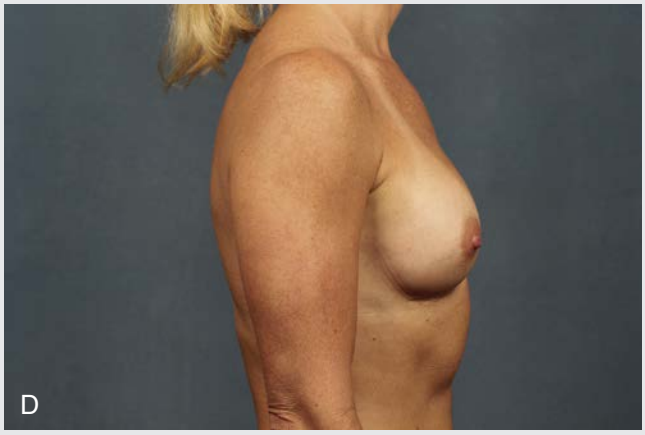
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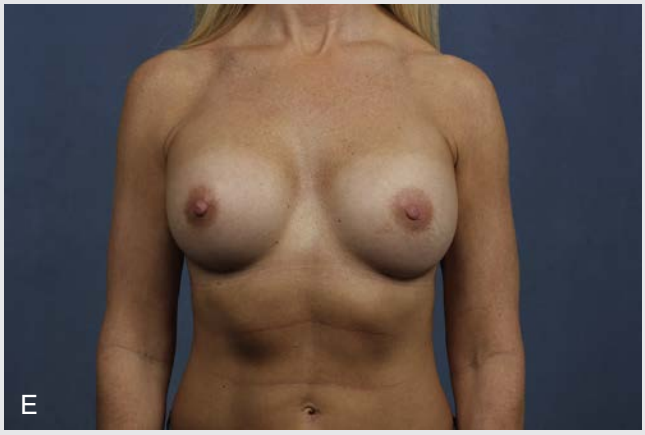
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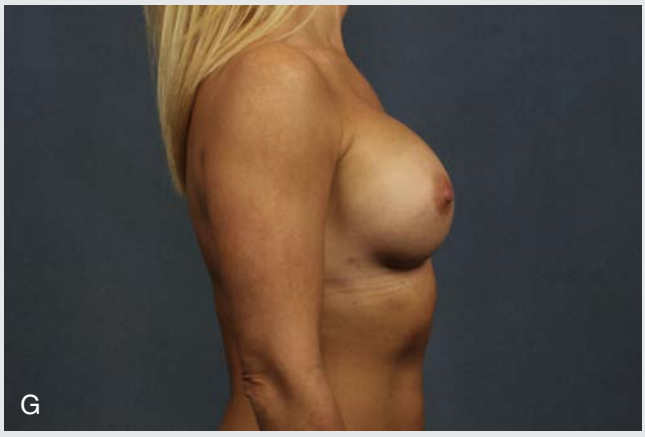
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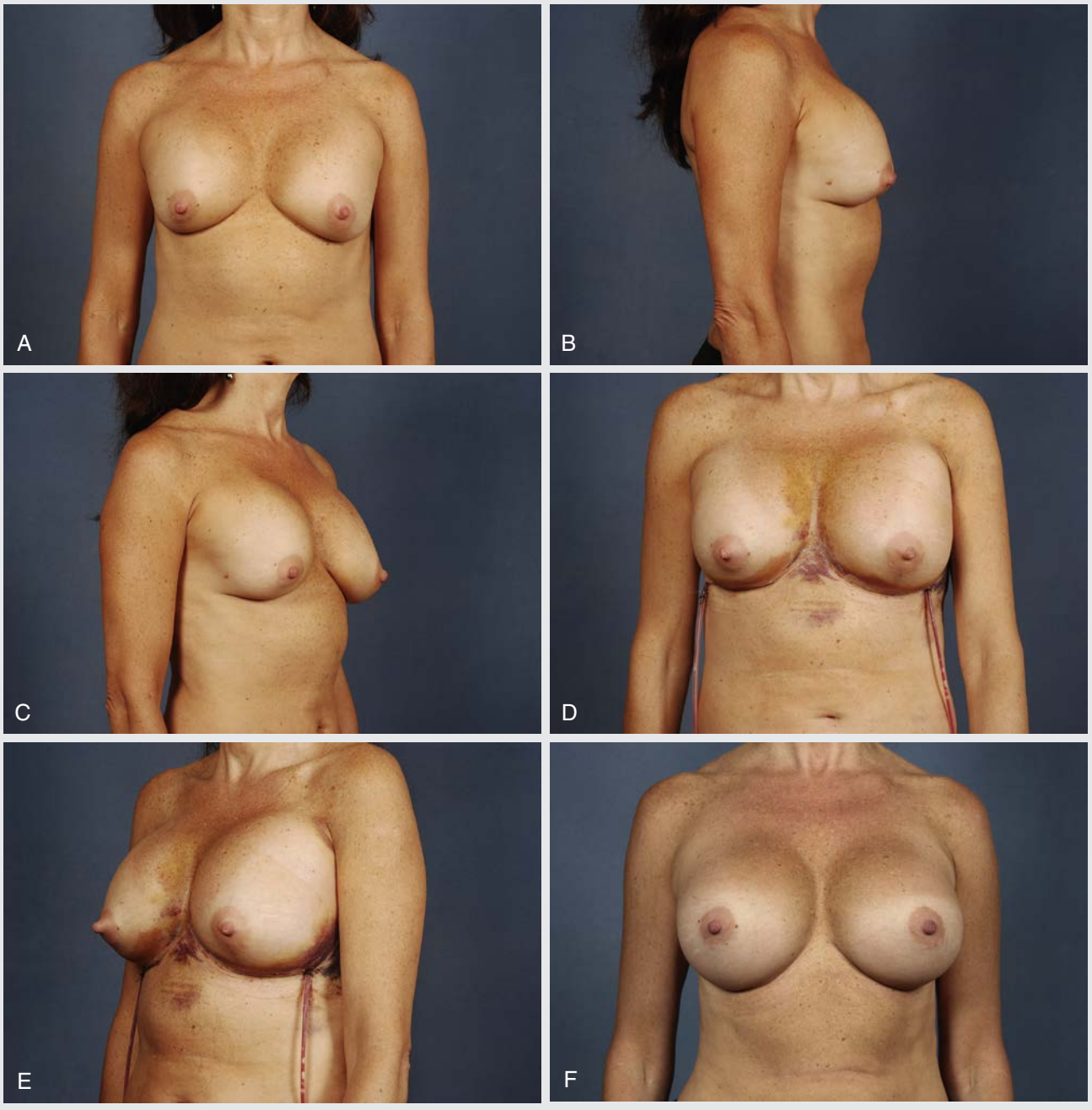
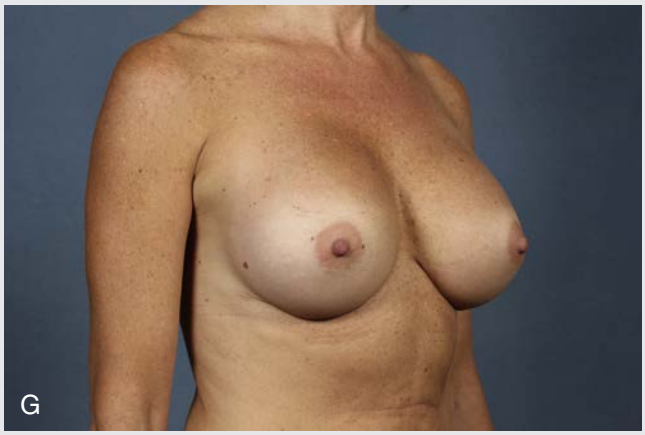
CASE 11.3

A 49-year old woman with Baker grade III bilateral capsular contractures with significant superior malposition with waterfall and animation deformities (Case 11.3A–C). To treat her capsular contractures, a neosubpectoral pocket was performed to allow maximal control of the pocket position and prevent the superior malposition that is possible if bilateral capsulectomies were performed. A dual-plane conversion was used and new high-profile 550-cc smooth gel silicone implants were placed to achieve the patient's desired full D result. She developed a hematoma of the left breast 5 days postoperatively and subsequently experienced the early development of a left capsular contracture at 6 months. She was treated with ccapsular contracture protocol with vitamin E, Singulair, and antibiotics for a 3-month course. She had full resolution of her symptoms without surgical intervention, as is seen here in in 1-year postoperative photographs (Case 11.4D–H).



CASE 11.3—CONT'D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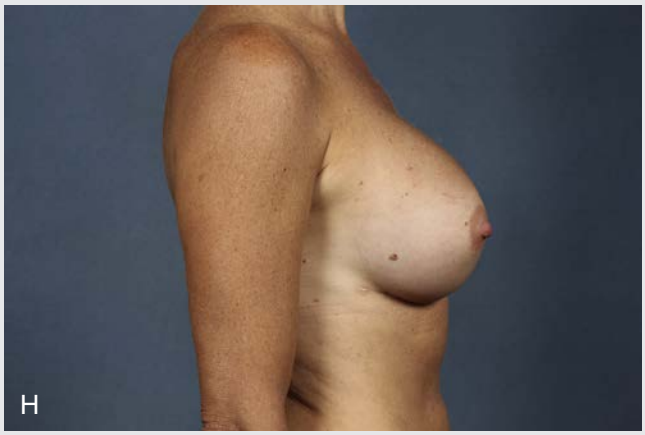
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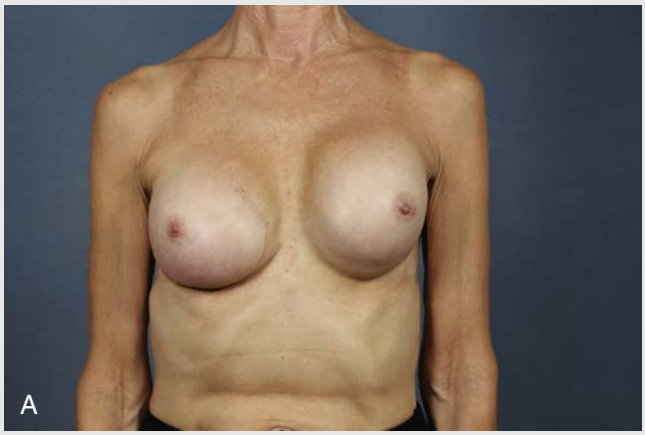
CASE 11.4

A 66-year-old woman with a 20-year history of silicone augmentation with multiple revisions over the first few years after augmentation (Case 11.4A–C). She noticed worsening breast hardness and right breast wrinkling in the medial upper pole over the past few years. No old records were available in planning the surgical approach. At the time of surgery, the right implant was subglandular with an associated tight capsule, whereas the left capsule was thickened and positioned submuscularly. On the right, a total capsulectomy with pocket exchange from subglandular to submuscular was performed. On the left, a neosubpectoral pocket was performed. Mentor smooth moderate-profile implants, 375 cc on the left and 400 cc on the right, were used to reduce the risk of postoperative wrinkling. Because of the unstable pectoralis on the right and associated wrinkling, ADM (Strattice, LifeCell Corp.) was placed from the caudal muscle edge bilateral to the IMF. Her 9-month postoperative photographs demonstrate resolution of her capsular contractures with soft, mobile implants and absence of wrinkling. Case 11.4D–I, at 1-year follow-up, shows resolution of capsular contractures and improvement in the breast mobility.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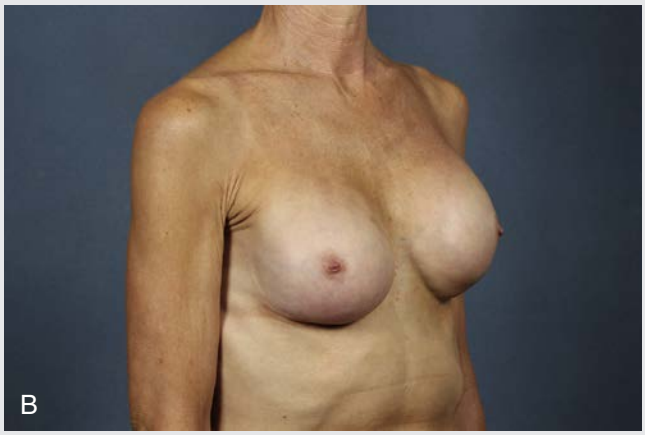
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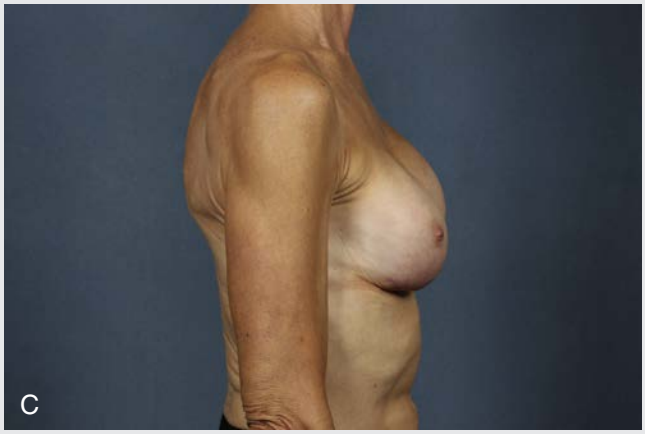
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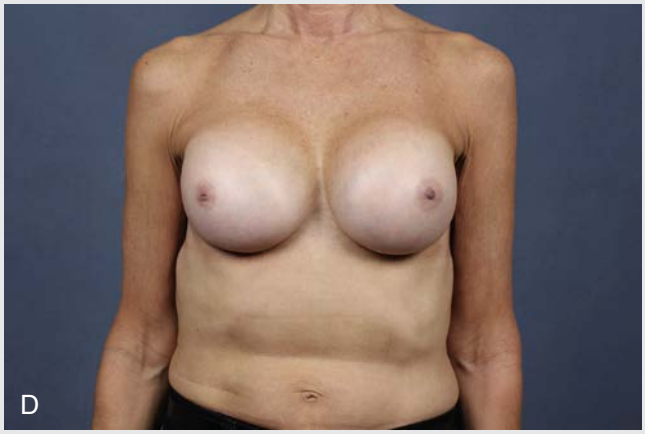
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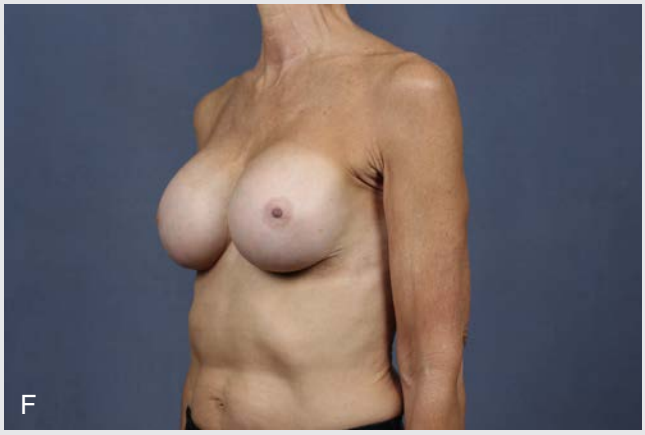
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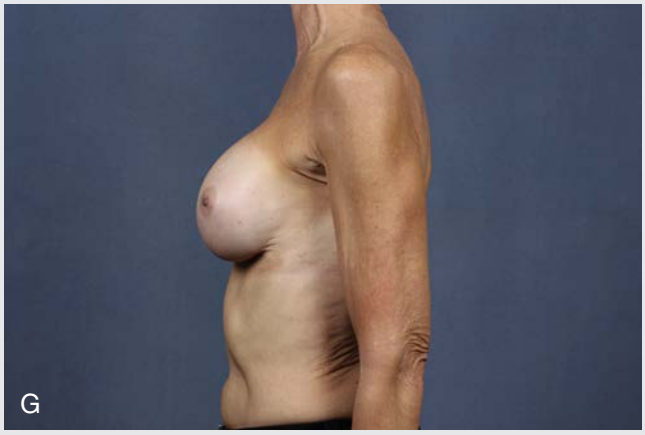
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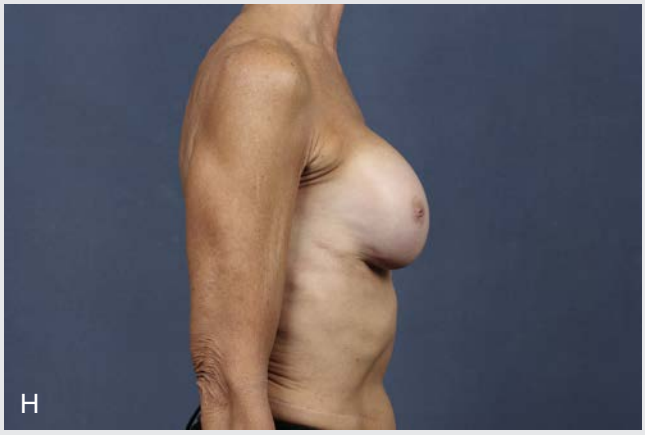
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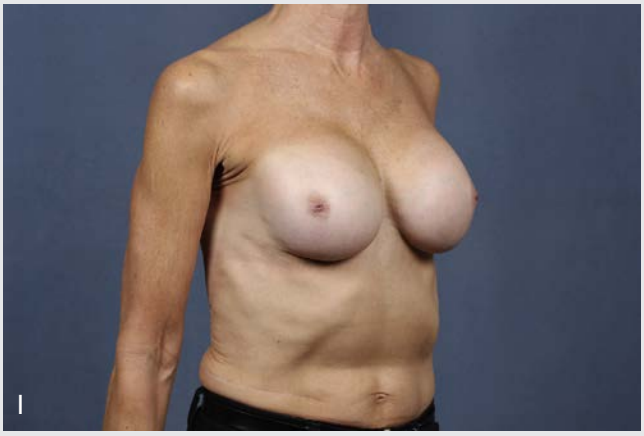
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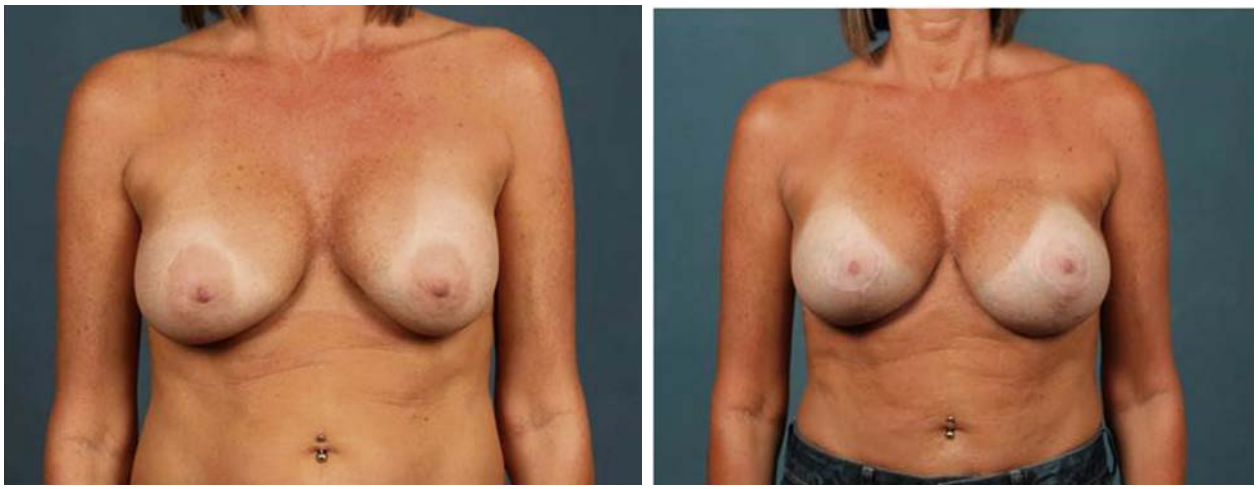

• **Fig 11.16** Frontal view of the breast with a unilateral capsulectomy showing the increased laxity and ptosis that can occur after capsulectomy versus no capsulectomy.

Management of Complications

The appropriate management of these patients in the early postoperative period can help minimize complications. This includes limited activity, use of supportive bras, and appropriate management of the drains, especially if ADM is in place. The most common early complication is bleeding and hematoma development. Surgical intervention with evacuation of hematoma, pocket irrigation, and drainage are mandatory to control bleeding but also reduce risk of recurrent capsular contracture if a stable hematoma is left to resorb over time. Infections are extremely rare but generally would require implant removal and a delay of reimplantation for 3 to 6 months.

A concern with the use of ADM is prolonged drainage, the development of a seroma, and/or failure of adherence of the ADM graft in the breast pocket. Exploration of postoperative seromas will often reveal partial or complete non-adherence of the ADM. This requires excision of all non-adherent ADM, irrigation, possible implant exchange, and drainage.

Secondary Procedures for Late Sequelae

Long-term, recurrence of the capsular contracture is always possible. Ideally, all preoperative decisions and operative maneuvers are used to reduce the risk of recurrence. If recurrence occurs, ADM is used for correction if not employed in the first capsular contracture treatment. Other considerations would be to use a more optimal pocket, such as submuscular if the implant remained subglandular, or consider a different implant such as a textured device in an attempt to achieve a more favorable outcome. If all attempts fail, explantation with or without capsulectomy is always an option. Newer techniques, such as the simultaneous implant exchange with fat (SIEF) procedure, provide another excellent option for patients with recalcitrant capsular contractures.[16] This procedure involves explantation of the device, retention of the capsule, and fat grafting for volume enhancement.

One additional challenge when treating unilateral capsular contractures is the potential for asymmetry postoperatively. When the implant is in the new pocket without capsule present, the lower pole soft tissue will continue to stretch until the new capsule has formed. This can create a softer, more lax breast on the treated side (Fig. 11.16). We have found the use of more cohesive gel implants and/or the use of textured devices with good postoperative garment support can be helpful in mitigating this risk. Nonetheless, patients should be counseled preoperatively about this possibility. It is this potential risk that fuels the arguments for those surgeons who perform only capsulotomies instead of capsulectomies for the treatment of capsular contracture in an attempt to retain pocket support for the implant. It is also why retaining the anterior capsule during the capsulectomy in selected patients with very thin, lax skin envelopes may be appropriate to reduce the risk of stretch deformity and wrinkling postoperatively. When this stretch deformity develops, capsular tightening procedures are usually required. The use of mesh-reinforcement (e.g., GalaFLEX, Galatea Surgical) or ADM can be extremely helpful in reinforcing the capsule and soft tissue envelope. If the amount of stretch is significant, some form of a secondary mastopexy also may be required.

Conclusion

When treating a capsular contracture, every effort should be made to employ every technique available to reduce recurrence. This is always balanced with consideration of anticipated results, complications, technical difficulty, and the costs associated with these procedures. Although there is no consensus as to which approach is best, the authors adhere to the principles of capsular removal from the implant environment, new pocket creation with a priority for the submuscular pocket if possible, implant and exchange, and the

selective use of ADM with complicated or recurrent capsular contractures. Through proper patient education, proper preoperative decision making, and a well-executed operative technique, optimal results can be obtained with limited capsular contracture recurrences.

Pearls for Success

- Preventive measures outlined in the 14-point plan can reduce the incidence of capsular contracture.[17]
- Nonoperative management (e.g., Singulair) can provide improvement in early capsular contractures.
- Submuscular implants and textured implants are associated with lower capsular contracture rates.
- Surgical intervention is indicated for Baker grade III and IV capsular contractures.
- Capsular contractures are ideally treated with a capsulectomy (total or subtotal) or neosubpectoral pocket.
- When a capsular contracture is subglandular, an exchange to submuscular is preferred.
- Implant exchange and pocket exchange when possible reduce recurrence.
- Acellular dermal matrix is used for complicated or recurrent capsular contractures.

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12

Revision Breast Augmentation With Posterior Capsular Flap Techniques

BRADLEY P. BENGTSON

Introduction

Complications continue to be a problem in breast implant surgery with the original prospective meta-analyses (PMAs) studies showing complications and revision rates as high as 30% (Fig. 12.1). When a patient has one major complication or revision, their complication rates continue to increase to over 45% in most studies.[1–3] I have written extensively about trying to establish standard terminology to classify these complications and deformities, focusing on objective terminology versus subjective terms such as "bottoming out."[2–9] In the description of theses deformities, I believe the best terminology is "medial and lateral malposition."[4–9]

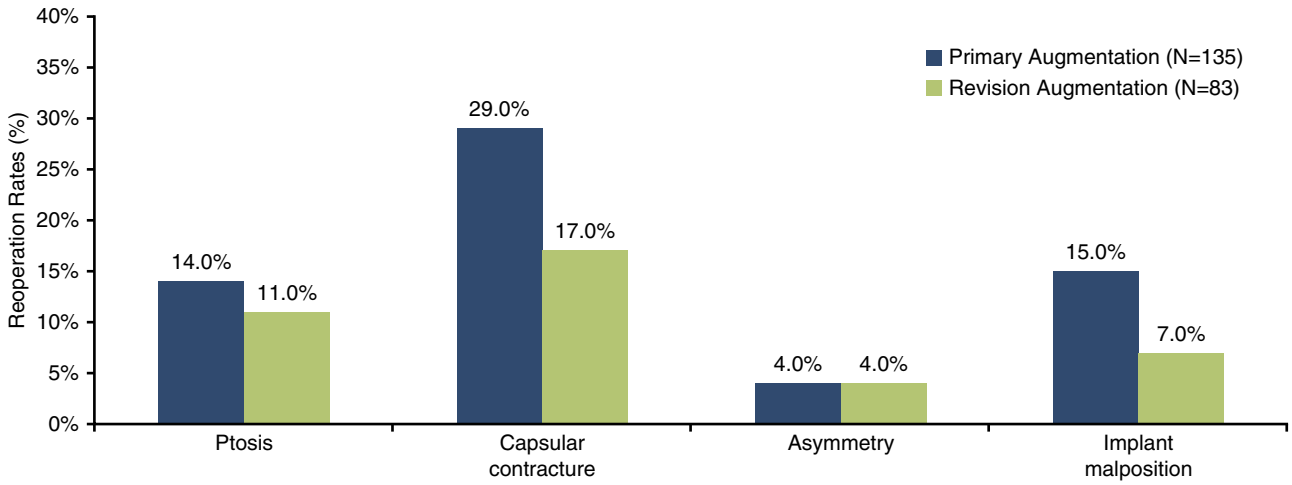
Developing strategies to specifically correct these complications in a consistent, reliable fashion is absolutely vital in stopping this cycle of revision. Many of the original described techniques are unreliable. Every plastic surgeon has seen previously placed permanent capsulorrhaphy sutures embedded in the capsule (Fig. 12.2) with the malposition recurring with the same or worsened deformity. Resecting capsule and suturing or strip capsulectomy also has been advocated, and most recently the use of electrocautery or thermocoagulation capsulorrhaphy is gaining increasing popularity. Although I also use this method, it is not easy to quantify or objectify the outcome and there are no long-term data using this technique.[10,11]

We published the original article detailing the vascularity of the capsule and capsular flap tissue in a pig model in 1992, showing the capsular flap alone could support a skin graft.[12] This confirms the clinical correlation that the capsule can support the revascularization of an acellular dermal matrix (ADM) or scaffold; however, I think placing tissue or a scaffold on the underside of an elevated capsule increases the reliability of "take" and revascularization of the matrix. The capsule has been used in breast revision for decades. The first references I found in the literature were by Silver in 1971 and Snyder in 1975, in which use of the posterior capsule was described. I have modified the surgical approach using the posterior capsule as most recently published by Parsa et al.,[13] who resurrected this concept of using posterior capsule for synmastia repair. Additional references using the capsule have been sparse, although I have continued to present these techniques in instructional courses and presentations at national and international meetings over the past 20 years and encourage my colleagues to try these techniques at Bioskills Laboratories and every opportunity I have at educational events.[14]

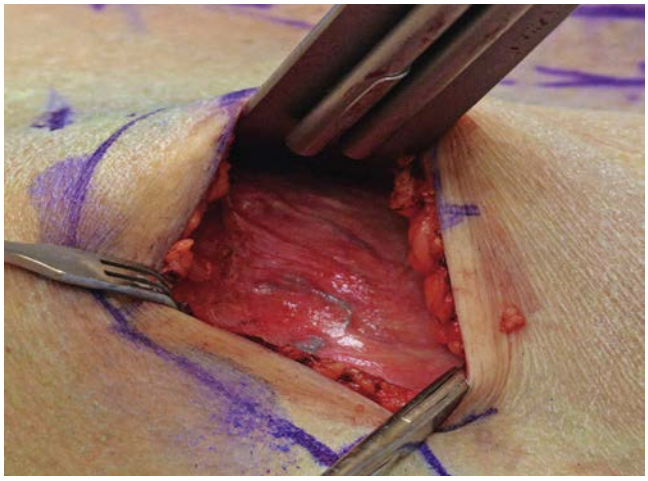
Most surgeons view the posterior capsule flap as an advanced technique, but I have found it fast, reliable, bloodless, reproducible, and easy to teach, with no patients having a complete recurrence in over 500 breasts in the past 20 years. This chapter will detail using the posterior capsule in new ways that most surgeons may have not previously recognized and shows specific techniques and patients that will benefit from these procedures.

Indications and Contraindications

I am continuing to refine a basic algorithm in treating patients with malposition. The general principle is to create a new breast pocket that fits as closely as possible the new breast implant dimensions, centralizing the implant to the new breast pocket. If too much implant is too medial, lateral, high, or low, it will distort and kick the nipple in the opposite direction. Thus, centralization is a critical principle. In addition, when patients come in seeking a revision, they need a solution that will be predictable and will solve their problem. As with patients who present with recurrent capsular contracture, in more than 350 patients I have performed a total capsulectomy and used an acellular dermis as a pectoral extension with a zero percent recurrence rate. Patients desiring revision need solutions. I have been working on an algorithm that is still evolving but currently is as follows:



• **Fig. 12.1** Malposition of the breasts is one of the top two major complications after breast augmentation in nearly every published study in the literature. Revision rates as high as 30% have been reported after primary augmentation, with rates increasing to over 45% in patients undergoing more than one revision. (Reproduced from Bengtson, B., Van Natta, B, Murphy, D, 2007. Style 410 highly cohesive silicone breast implant core study results at 3 years: Silicone Breast Implants Outcomes and Safety. Plast. Reconst. Surg. 120, 40S–48S.[2])



• **Fig. 12.2** Imbedded capsulorrhaphy suture re-encapsulated in a patient with recurrent malposition is depicted. Capsulorrhaphy alone is not a reliable long-term repair in the correction of significant malposition in my experience, particularly in patients with multiply recurrent malposition who are seeking a complete correction.

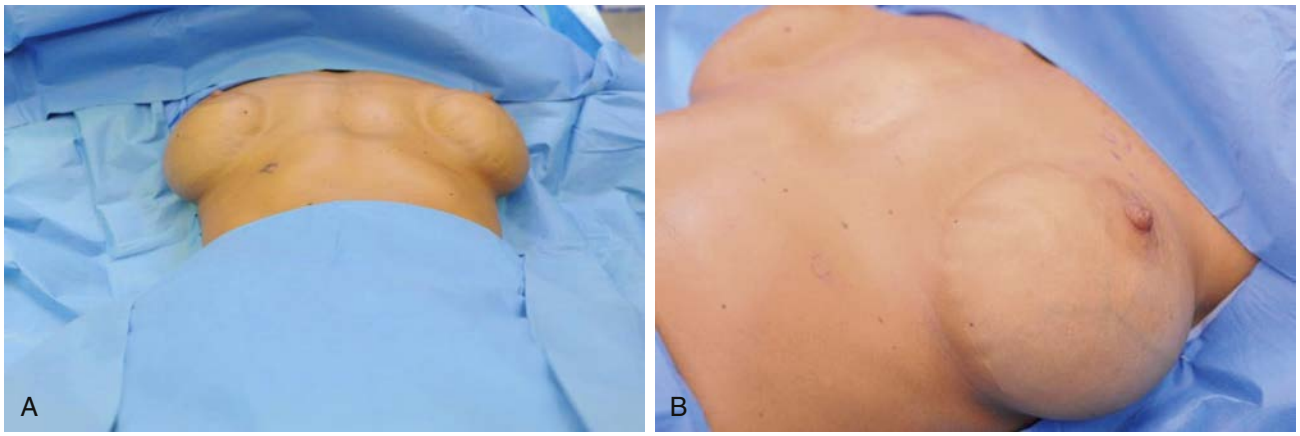
- For patients with less than 1 cm of pocket width, I perform electrocautery thermocoagulation medially, laterally, or both.
- For patients with 1–2 cm of extra pocket width, I perform a posterior capsular flap without reinforcement.
- For patients with larger breasts or combined breast/implant volume, prior history of significant weight loss or more than 2 cm of pocket width, I perform a posterior capsular flap with reinforcement.

The main contraindication for using the posterior capsule would be if there is no or minimal capsule present or in the case of a very old or calcified capsule. However, these patients usually have capsular contracture and not malposition. In addition, even in patients with very thin capsule medially, particularly below the fourth rib, the capsule with or without the intercostal fascia may be raised as a triangle of tissue and scaffold or ADM may still be used. Once over the fourth rib, even medially the posterior capsule is always sufficient to use, in my experience. In the case of ultra-thin capsules I would recommend a scaffold support as well.

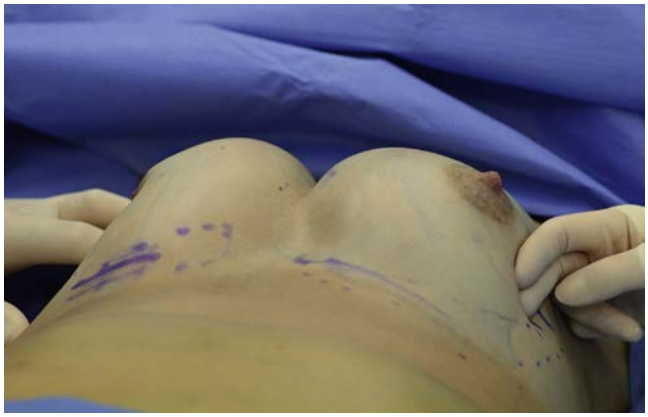
Preoperative Evaluation

Posterior capsular flaps are primarily beneficial in patients with malposition. This includes patients with lateral malposition and medial malposition and is even an option for inferior malposition. Figs. 12.3 and 12.4 present patients with lateral and medial malposition deformities, respectively, who would benefit from this repair technique. Both complications are best visualized and evaluated with the patient in the reclining position.

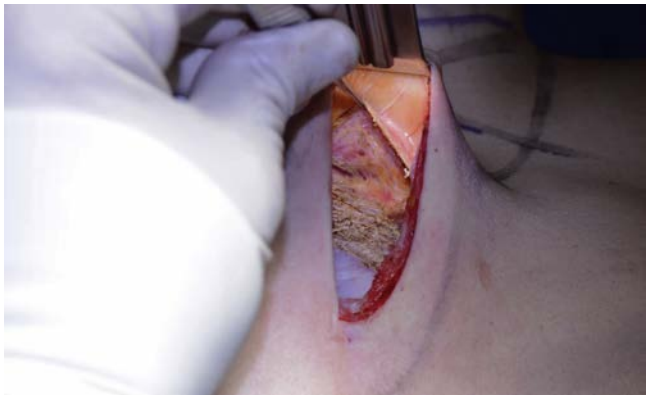
It is difficult to photograph and document this in the office, but examination with the patient in the reclining view is mandatory. I have often been surprised by the level and degree of deformity when a patient lies down, and the first time you see this should not be in the operating room. Examination of the patient in the supine position is part of my routine evaluation. The worst cases of lateral malposition tend to be in patients with saline implants with a primary transaxillary incision that without endoscopic assistance may lead to overdissection of the lateral pocket. This deformity may be further exacerbated by a laterally sloping chest wall. I have the patients animate, which also may elucidate the degree of displacement. As previously discussed, I will use a posterior capsular flap with any pocket width greater than 1 cm. If greater than 2–3 cm, I will also use an ADM or scaffold to reinforce the repair.



• **Fig. 12.3** (A, B) Lateral malposition is particularly common and prominent in prior transaxillary, non-endoscopic approach with saline implants and a lateral chest wall descent.



• **Fig. 12.4** Medial malposition is most commonly iatrogenic and results when a surgeon has overreleased the pectoralis muscle off of its sternal attachments. This is the least common breast augmentation complication, but also the most challenging to fix in one procedure.



• **Fig. 12.5** The posterior capsular flap is elevated and when rotated up onto the anterior surface will thicken the anterior soft tissues versus thinning the anterior surface with a classic neosubpectoral pocket.

Surgical Techniques

Relevant Surgical Anatomy

In patients with capsular contracture the capsule is a "Foe," and it should be removed as part of the surgical revision. In patients with malposition, the capsule is a "Friend" and can be used as a significant part of the surgical revision. Capsular tissue is the natural body's response to a breast implant, and, depending on the implant surface, age or device, implant failure, and individual patient factors, the capsule can be varying degrees of thickness and inherent strength. Just as in a neosubpectoral pocket technique in which the capsular repair can be very strong, it is the same with a posterior capsular flap technique. The majority of the time in patients with significant malposition, the overlying breast and soft tissues are significantly thinned. It is not uncommon for the capsule to be on dermis. It is often difficult or certainly a detriment to perform a neosubpectoral pocket in these patients because it will thin the anterior tissue thickness further. It is exactly these patients in whom it is helpful to elevate and use the posterior capsule. Adding this tissue layer doubles or increases the anterior thickness, rotating the posterior flap and suturing it up and onto the deep surface of the anterior skin flap (Fig. 12.5).

Similar to an anterior neosubpectoral pocket, in which the tissue plane is dissected between the capsule and skin flap/muscle and then collapsed down, the edge of the neopocket is incredibly strong. The main issue when elevating the posterior capsule for a medial malposition repair or synmastia, the capsule can be quite thin and adherent to the fifth and sixth ribs medially. Still, I have been able to

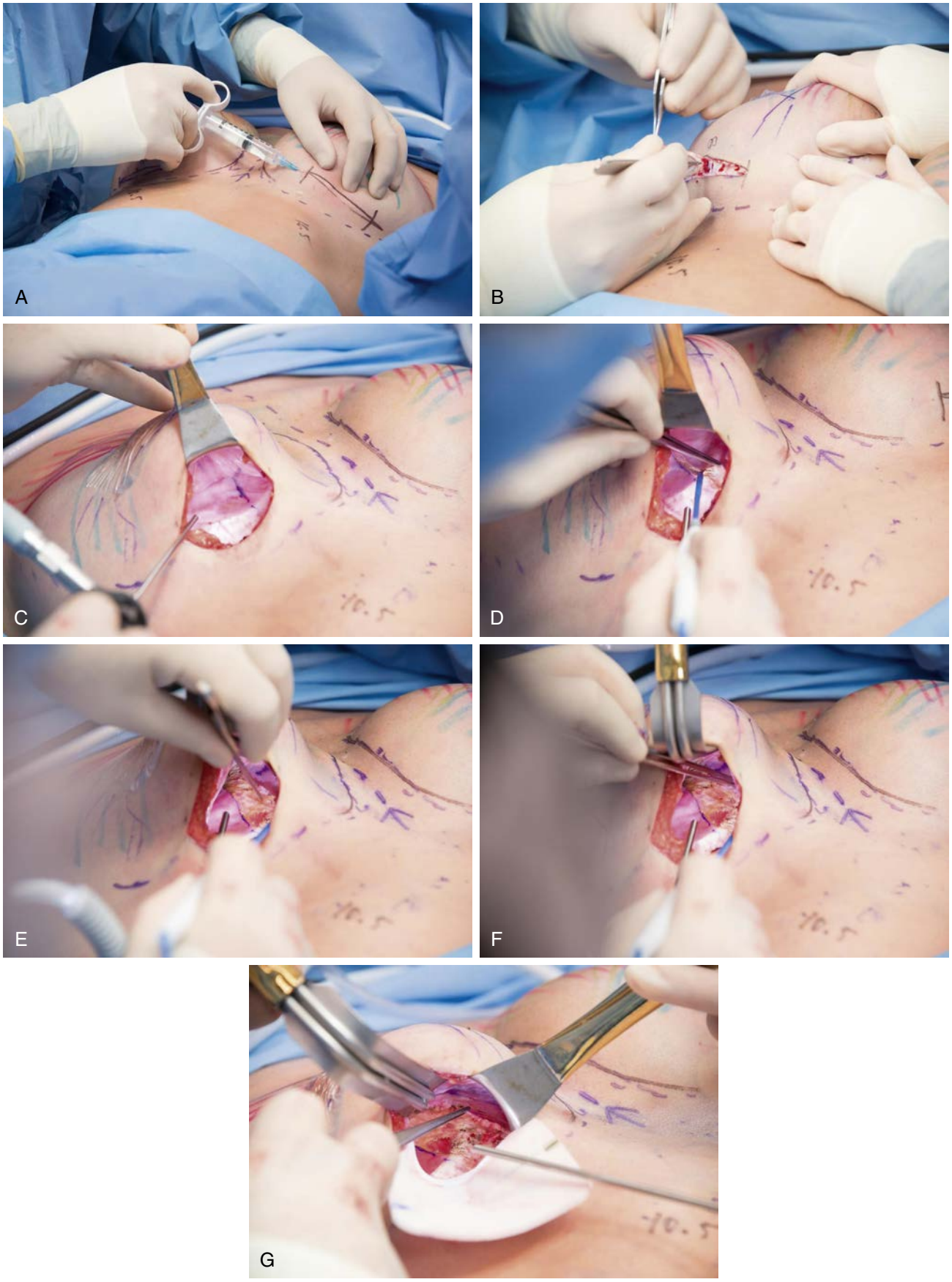
elevate the posterior capsule 80% of the time. Even if the capsule is adherent to the ribs medially, the capsule and intercostal fascia may be elevated in the rib interspaces as a triangle and the reinforced with scaffolding. Once you have elevated up over the fourth rib or more laterally, the posterior capsule is easily elevated (see following discussion of flap elevation sequence). In cases of lateral malposition the posterior capsule is very easily elevated and is quick and bloodless. You may also choose to elevate some of the pectoralis minor or serratus fascia up with the capsule. It is critical to mark the new dimensions of your new breast pocket medially and laterally and do not overdissect past this line to avoid recreating the prior deformity. Flap elevation and planning will be specifically covered in following sections.

Preoperative Markings, Surgical Exposure With Capsular Flap Elevation, and In-setting

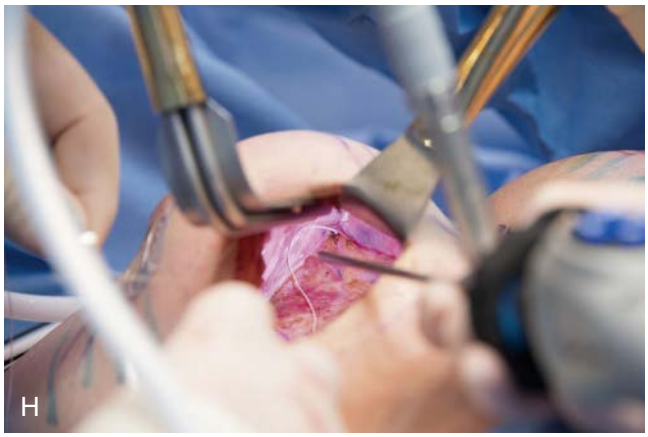
The procedures of preoperative marking, surgical exposure with capsular flap elevation, and in-setting are performed mainly through a 7- to 8-cm inframammary fold (IMF) incision. The implant is removed and the pocket inspected. The new implant width/diameter to be used in the revision as noted, and the soft tissues are manually pressed externally to visualize the approximate location of the new breast pocket. It is important to centralize the new implant to the new pocket. Marks are placed medially and laterally on the posterior pocket, outlining the new pocket dimensions. Marks are made 5–6 cm medial to the new lateral pocket line and 5–6 cm lateral to the medial pocket line toward the center of the breast. These lines are then "hockey-sticked," or angled, out to the axilla (lateral) and toward the sternal notch (medial). Bovie cautery on cut mode through the capsule and then coagulation mode for the dissection are used to elevate the posterior capsular flap. The dissection is fast, nearly without bleeding, with the flap elevated to the new outer flap dimension line. Be very careful not to overdissect past this new pocket line, because it is very easy to overdissect and recreate the deformity. Often in patients with lateral malposition there is a tight capsule medially and vice versa. If this is present, capsulotomy is performed again to the border desired for the new implant, again keeping the implant centrally located in the new breast pocket. The posterior capsule is then sutured and secured to the anterior capsule with either a 2-0 polydioxane suture (PDS) or a 3-0 PDS, depending on the thickness of the anterior tissue. Vicryl suture may be used if preferred. In the case of a significant deformity of greater than 2 cm, scaffold or ADM support is laid into the pocket and sutured from the border of the cut posterior capsule on the deep/underneath side of the reflected capsule and sutured to the capsule again with PDS. This adds significant thickness to the anterior soft tissue surface and also creates a potential pocket for fat transfer if chosen in the future. The new devices are placed after further hemostasis and antibiotic/antiseptic irrigation. Deep breast fascia is then closed with 2-0 PDS and running 2-0 Vicryl and your standard skin closure. Series of flap design and elevation are shown in Fig. 12.6A–J for medial malposition repair and Fig. 12.7A–E for lateral malposition repair.

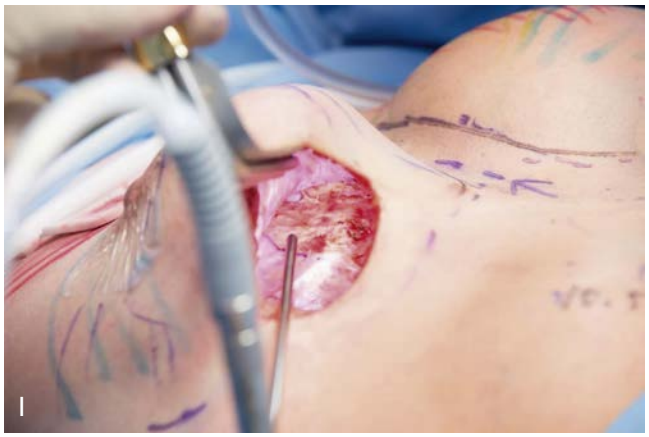
The sequence of medial malposition repair with a posterior capsular flap is shown beginning with an 8-cm inframammary approach with prior scar excision (see Fig. 12.6A–J). The medial border of the new pocket is marked and a vertical line drawn 4–5 cm lateral to the future medial border. A Bovie extender is used and the posterior capsule elevated and then hockey-sticked into the apex of the medial pocket. The flap is elevated just to the new desired medial pocket border, being careful not to go past the new desired border and overdissect the pocket. The posterior flap is then sutured to the anterior flap surface with a 2-0 or 3-0 Vicryl or PDS. If a scaffold or ADM is used for further support, the residual lateral capsule still on the chest wall is slightly elevated to allow a strong border to affix the scaffold. The scaffold is then rotated on the deep/underneath side of the posterior capsular flap and sutured to the anterior capsule.

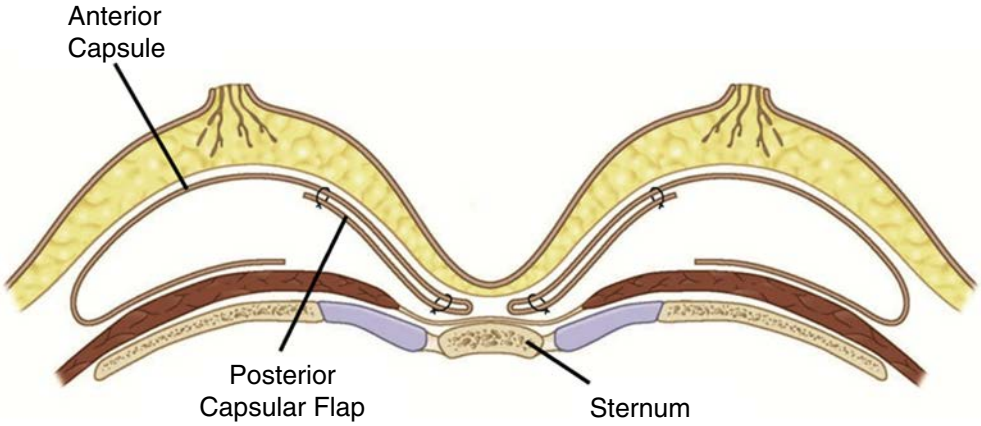
Posterior capsular flaps for lateral malposition are simpler and faster to elevate, and it is easy to incorporate pectoralis minor fascia or even serratus fascia for increased thickness and strength depending on patient anatomy. The procedure is marked and designed in a fashion similar to that for medial malposition. The lateral pocket is confirmed by external manual compression and then marked internally on the posterior capsule. This will mark the new lateral pocket dimension. Confirmation of the new implant width is then marked on the posterior capsule and medial pocket dimensions to either expand the pocket if medial constriction is present, or a medial posterior capsular flap may be required. A mark on the posterior capsule 4–5 cm medial to the new pocket dimension is then created, and using a Bovie extender the posterior capsule is elevated inferiorly toward the apex. The flap is tapered out toward the axilla in a hockey-stick fashion. Similar to the medial flap the posterior capsule is then sutured to the anterior capsule with 2-0 or 3-0 PDS or Vicryl. Again care is taken to not overdissect past the new lateral pocket desired border. Running barbed sutures also may be used for this application. Scaffolds or ADMs may be fashioned and in-set for additional reinforcement into the gutters to add to the strength, thickness, and reliability of these flaps, particularly when the capsule is thin and attenuated.

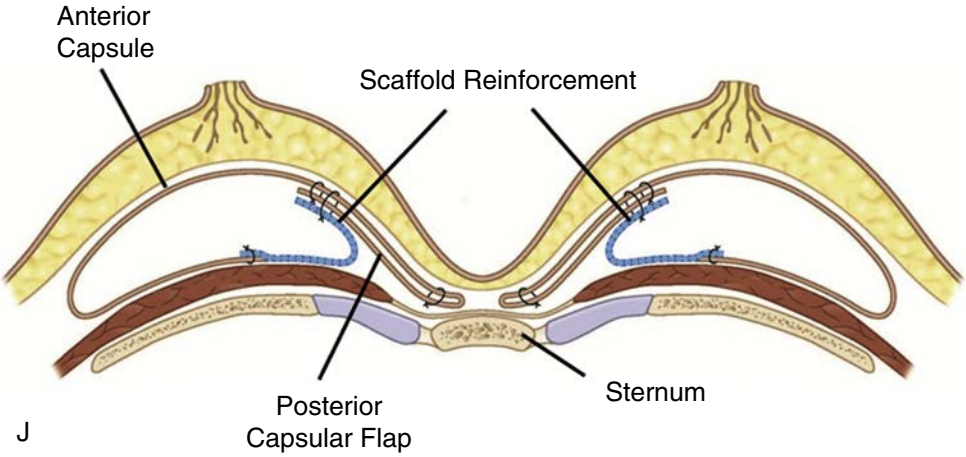


• **Fig. 12.6** (A–J) Sequence of medial malposition repair with a posterior capsular flap is shown beginning with an 8-cm inframammary approach with prior scar excision. The medial border of the new pocket is marked and a vertical line drawn 4–5 cm lateral to the future medial border. A Bovie extender is used and the posterior capsule elevated and the angled, or "hockey-sticked," into the apex of the medial pocket. The flap is elevated just to the new desired medial pocket border, being careful not to go past the new desired border and overdissect the pocket. The posterior flap is then sutured to the anterior flap surface with a 2-0 or 3-0 Vicryl or PDS. If a scaffold or ADM is used for further support, the residual lateral capsule still on the chest wall is slightly elevated to allow a strong border to affix the scaffold. The scaffold is then rotated on the deep/underneath side of the posterior capsular flap and sutured to the anterior capsule.

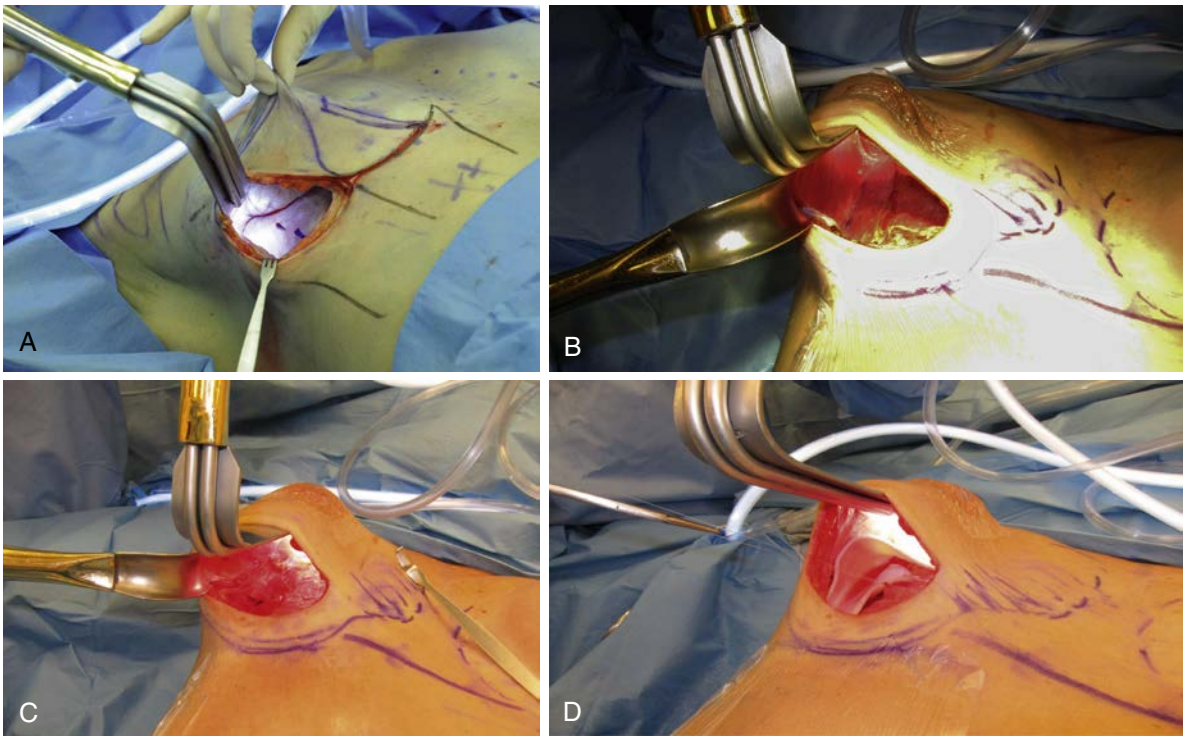


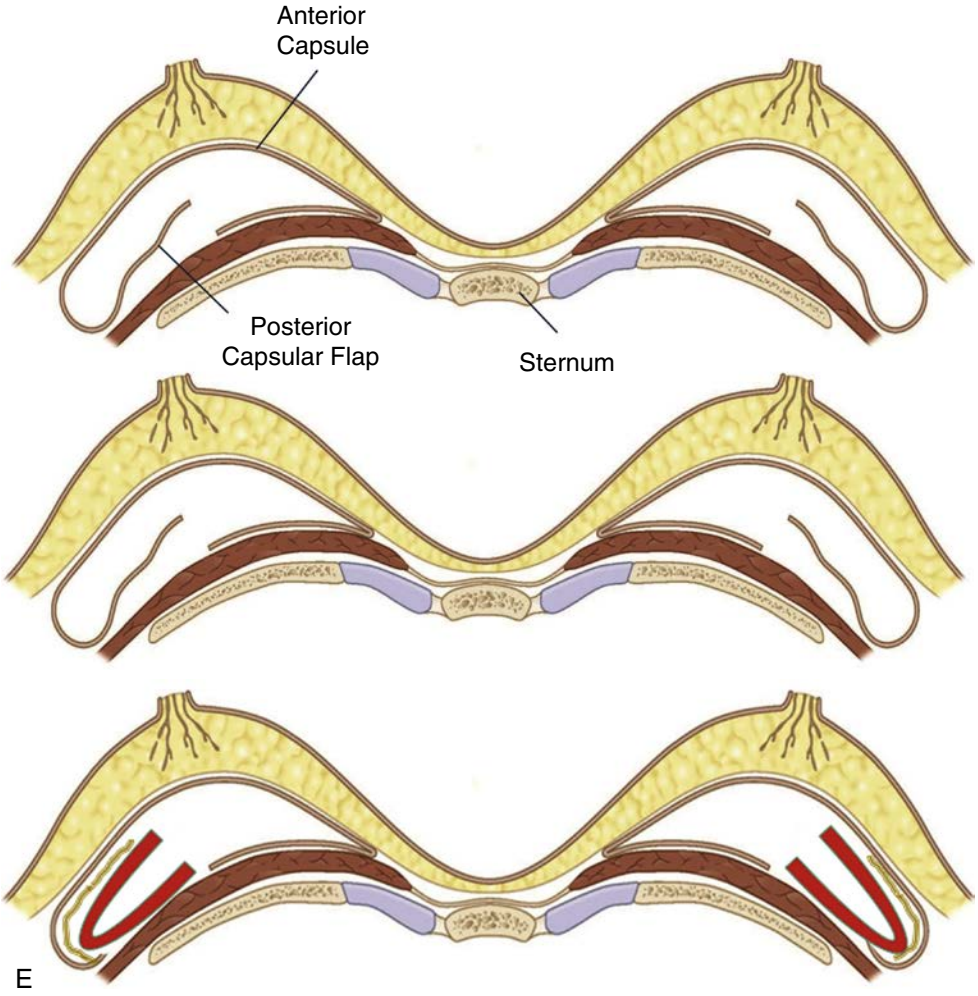






• **Fig. 12.6 cont'd**



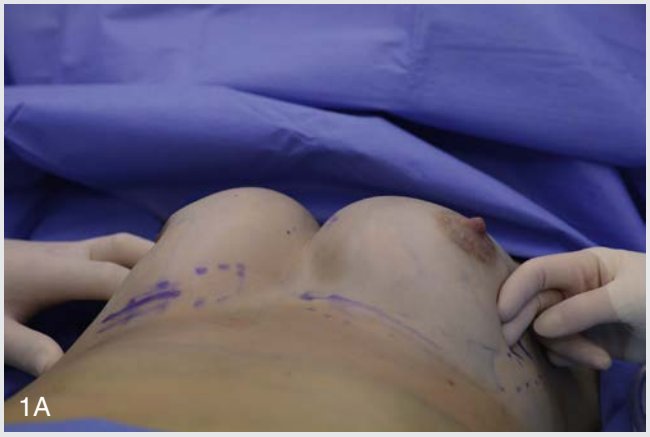


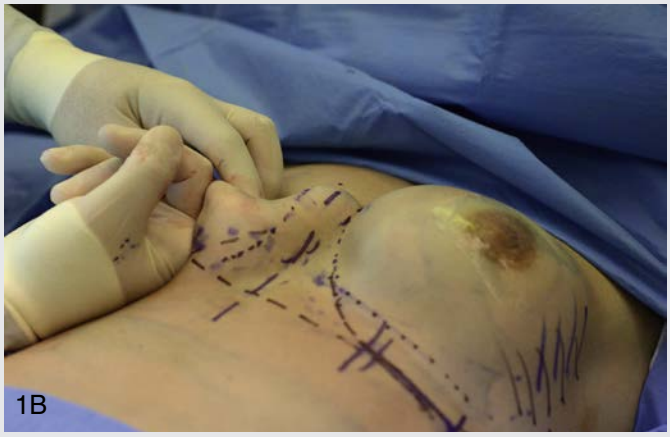
• **Fig. 12.7** (A–E) Posterior capsular flaps for lateral malposition are simpler and faster to elevate, and it is easy to incorporate pectoralis minor fascia or even serratus fascia for increased thickness and strength, depending on patient anatomy. The procedure is marked and designed in a fashion similar to that for medial malposition. The lateral pocket is confirmed by external manual compression and then marked internally on the posterior capsule. This will mark the new lateral pocket dimension. Confirmation of the new implant width is then marked on the posterior capsule, and medial pocket dimensions to either expand the pocket if medial constriction is present or a medial posterior capsular flap may be required. A mark on the posterior capsule 4–5 cm medial to the new pocket dimension is then created, and using a Bovie extender the posterior capsule is elevated inferiorly toward the apex. The flap is tapered out toward the axilla in a hockey-stick fashion. Similar to the medial flap, the posterior capsule is then sutured to the anterior capsule with 2-0 or 3-0 PDS or Vicryl. Again care is taken to not overdissect past the new lateral pocket desired border. Running barbed sutures also may be used for this application. Scaffolds or ADMs also may be fashioned and in-set for additional reinforcement into the gutters to add to the strength, thickness, and reliability of these flaps, particularly when the capsule is thin and attenuated.

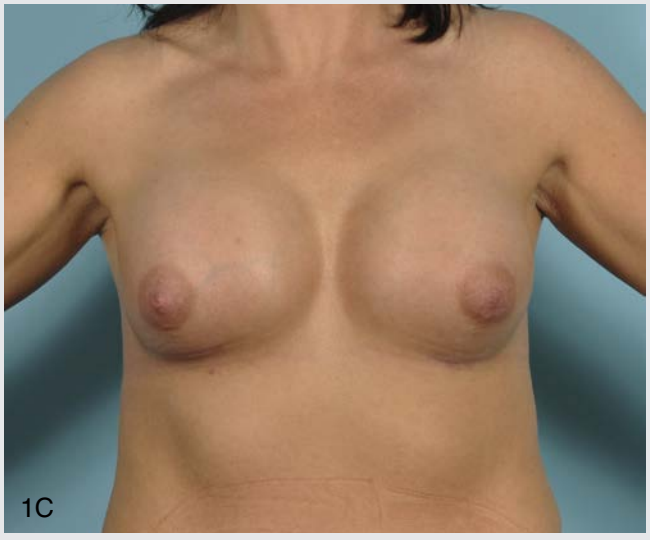
Case Examples

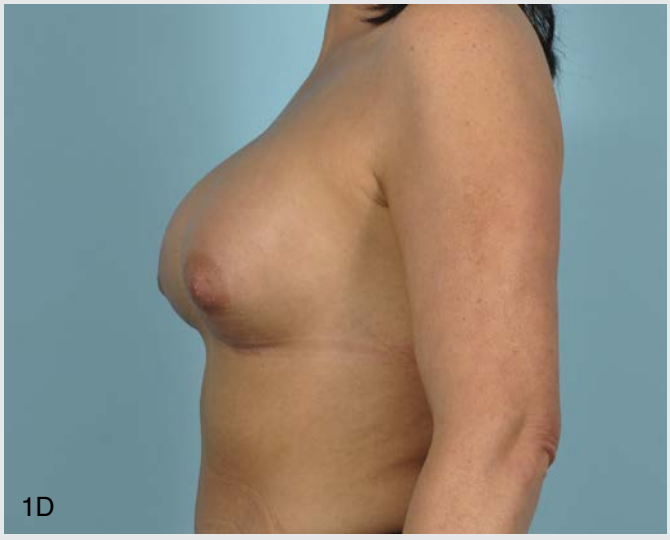
CASE 12.1

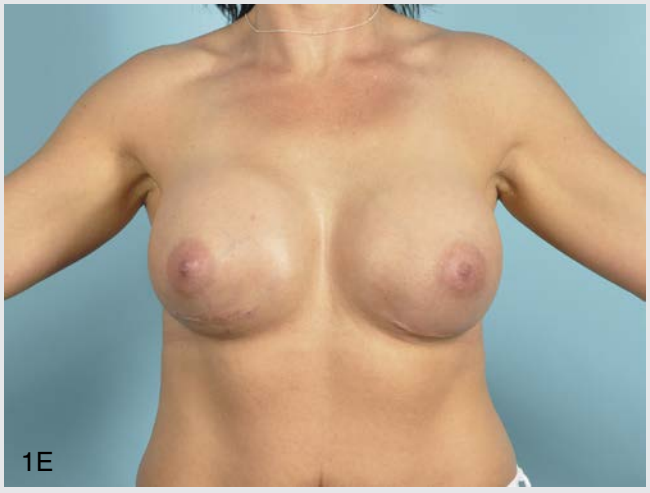
A 29-year-old woman presented with synmastia. She had one prior attempt at revision and developed along with her synmastia a superior fold malposition that is worse on the right (Case 12.1A). She had no significant capsular contracture. A posterior capsular flap was performed medially (Case 12.1.2B) , creating a new pocket and barrier medially, with the new medial pocket beginning 1.5 cm in from the midline. This creates an approximately 3-cm intermammary distance or cleavage, but there is usually some superficial skin or soft tissue stretch and it is very important not to undercorrect. Her scars were too high on her breasts from her original procedure, but it was decided to use these again rather than create a new incision in the fold. Her posterior capsular flap and synmastia repair was further supported by GalaFLEX, although ADM or other scaffolds also may be used. This helps further reinforce the solid repair. My thoughts and approach are that patients come to me for a "fix," so I will use whatever means and all means possible to secure the outcome. I also take this approach using Strattice (Allergan, Madison, NJ, United States) or ADMs along with capsulectomy to treat recurrent capsular contracture. In addition, after her fold was lowered to her new desired IMF level and an overlay of GalaFLEX was placed in each gutter of the breast pocket to reinforce the fold as well. It is very easy to create a new complication while fixing another, so it is important to spend the time to reinforce and secure the final outcome. Before (12.1C-D) and after (Case 12.1E-F) patient images at 1 year are shown.


1A


1B


1C


1D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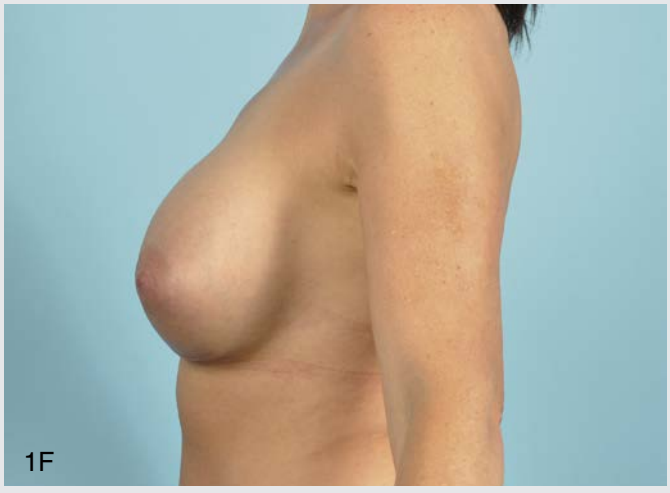
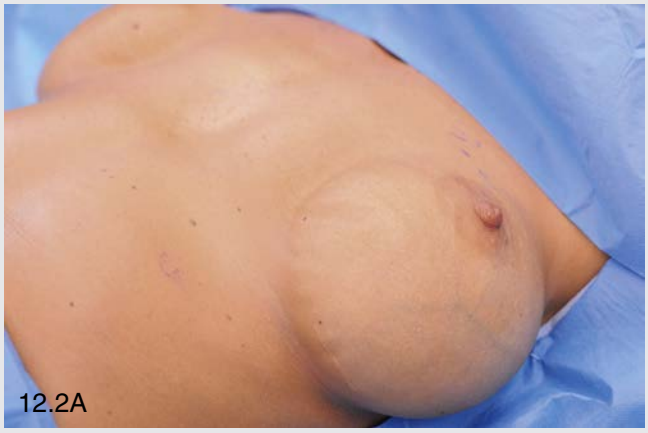

1F

CASE 12.2

When trying a new technique it is often best to begin with the most straight forward case, and this is certainly a lateral malposition repair with the capsular flap technique. The tissue are very well defined, the dissection quick and bloodless and the pectoralis minor fascia and/or serratus fascia may be raised with the posterior capsule. This patient has significant lateral malposition (Case 12.2 A-B) that is most apparent with the patient fully supine. It is not uncommen to have the medial implant border at the medial areola when supine. Preoperative photos standing are shown in 12.2 C-D and her postoperative images are shown in 12.2 E-F at 18 months. Video images showing the patients have no further lateral displacement are also helpful to document. I have transition into using scaffolds such as Galaflex for malposition support and ADM for capsular contracture patients.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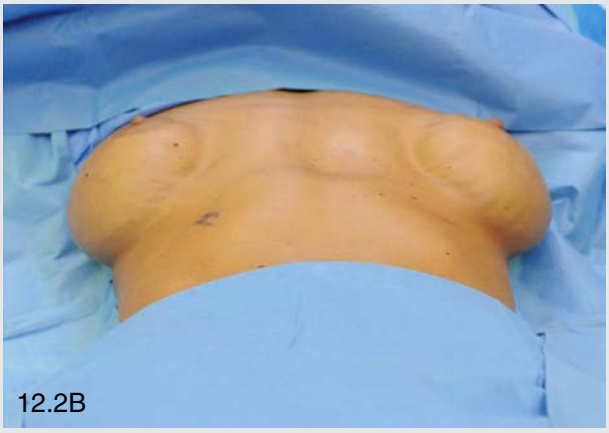
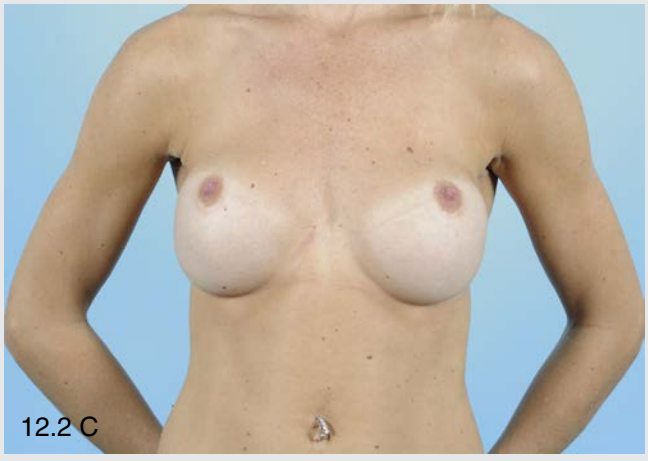

12.2B


12.2 C


12.2D


12.2E


12.2F

Postoperative Care

A good-quality compressive postsurgical bra is placed, and patients are given instructions on activity and wound care. No high-impact aerobic activity or chest-focused exercises are allowed for 4–6 weeks. Drains may be used but are not typically placed except in patients with more than normal bleeding or oozing. The capsular flaps are generally bloodless. Drains may be considered if ADMs are used.

Management of Complications and Secondary Procedures

Complications are unusual when performing these procedures, other than the usual postoperative complications in over 500 capsular flap procedures. I have had two patients who had concurrent IMF repairs with a lateral or medial malposition in which an ADM was used and did not revascularize, a seroma occurred, and the ADM extruded and had to be removed. I have had no pure cases of posterior capsular flaps with deep scaffold support in the medial or lateral position that have had an infection, lack of integration, seroma, or extrusion. It is extremely difficult to quantify objectively the degree of any relapse of the malposition; however, I have not repeated a posterior capsular flap or a posterior capsular flap with scaffold when this repair was used, and I offer revision to patients with visible recurrence or deformity.

Technique Highlight

Medial Posterior Capsular Flap Repair (Synmastia Repair)

Synmastia, or medial malposition, in my experience is a triad of findings, including medial malposition, marked thinning of the medial tissue secondary to atrophy, and often a medial fold malposition. It is the least common malposition deformity in my practice but the most difficult to fix in one procedure, at least until using the posterior capsular flap techniques.

Anterior capsular flaps or neosubpectoral pockets are useful as well; however, in both medial and lateral malposition with marked thinning, often with capsule on dermis, to attempt to perform a neo-pocket would thin the tissues even more. These are the ideal procedures for posterior capsular flap techniques. Laterally, this is a very straightforward, bloodless, and quick technique. Medially, it is a bit more challenging elevating the capsule off the ribs; however, I have found this possible in over 80% of cases. In the other 20%, capsule and fascia may be elevated between the ribs; then, up over the fourth rib the capsule comes up easily and the underneath side of the capsule may be reinforced with a scaffold or ADM. The benefit of this flap is that instead of thinning the tissues it actually thickens and often doubles the soft tissue thickness, and by adding ADM or scaffold the tissues are thickened further. In addition, the "pita pocket" of capsule can be fat grafted in the future.

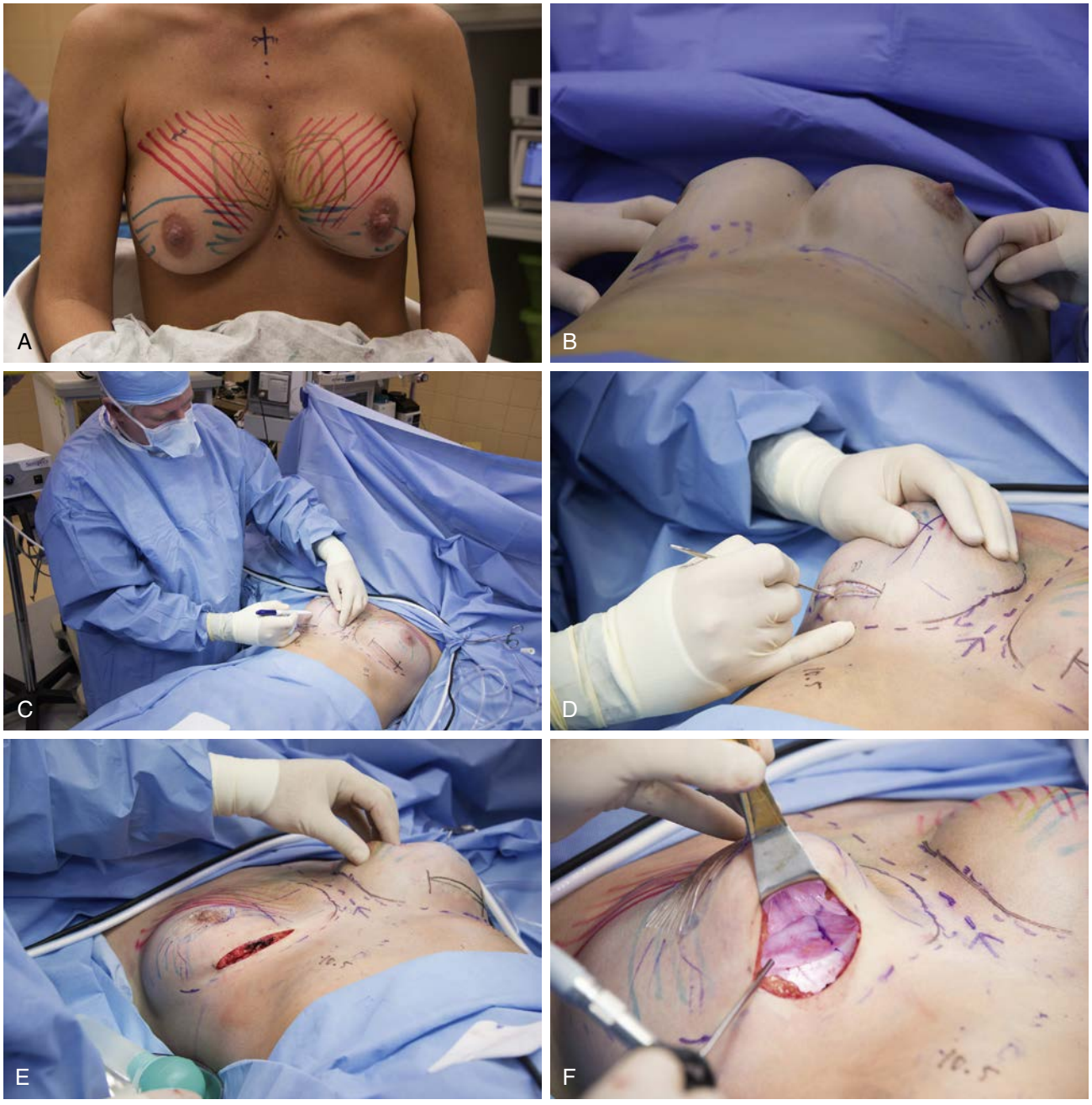
The Fig. 12.8A–N series of images shows the sequence of elevation. Typical patients have medial displacement of their implants, which in turn kicks the nipples out laterally as shown in Fig. 12.8A, B. The best way to approach the patients surgically to minimize further complications is through a minimum 8-cm incision in the IMF (see Fig 12.8C–M). After implant removal the defect is fully visualized, usually with marked thinning. The extent of the medial defect is then visualized. In general, I prefer to establish the new medial border of the new pocket 1.5 cm lateral to the middle, which creates a 3-cm intramammary distance, although with the soft tissues stretched it appears closer. This new medial border is marked internally. It is vital not to dissect past this line and recreate the deformity. A vertical incision is then marked 4–5 cm lateral to this new ideal pocket location. A Bovie extender is then used to make a vertical cut in the capsule and extends to about the third rib and then hockey-sticked in medially to allow for flap rotation. Elevation of the flap is then performed (see Fig. 12.8F–H), just until the medial pocket border is reached and no further. It is sometimes difficult elevating the capsule off of the lower ribs. If necessary, you may just elevate the capsule and fascia between the lower ribs and then these individual flaps may be supported by ADM or scaffold. Up over the fourth rib the capsule always comes up easily. This capsule is not as adherent to the ribs medially as it is centrally in the pocket.

Once the capsule is elevated the cut edge of the posterior capsule is sutured to the underneath side of the anterior capsule, thickening it. This also creates a well-vascularized undersurface that more readily accepts an ADM or scaffold. We have shown that the capsule does have enough blood supply to support a skin graft, but it is much better and preferred to have a fresh vascularized surface to place scaffold on top. The additional ADM or scaffold further increases the soft tissue thickness, which is advantageous to minimize further implant visibility (see Fig. 12.8I, J).

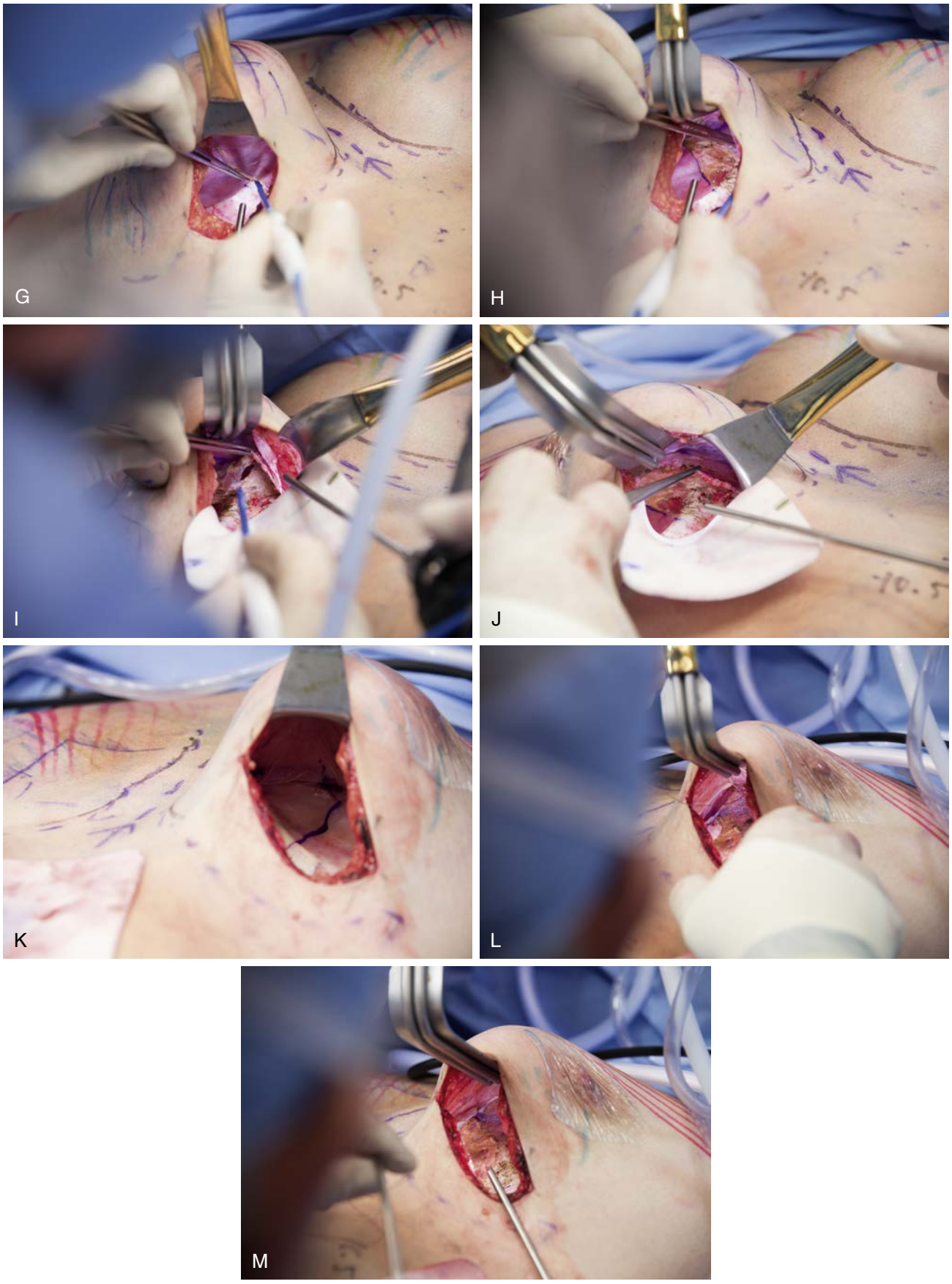
My practice is 25% revision from other plastic surgeons, and they come to me for a permanent correction often after three or more prior procedures. For this I tend to use scaffold or ADM in nearly every patient undergoing revision to increase the chance of success. Saying this, similar to a neo-pocket the repair is quite strong; however, I do not wish to rely only on the patient's tissues and thus add additional reinforcement.

Fig. 12.8L–N shows elevation and suturing of the contralateral side. The drawings show the animation drawing of the posterior capsular flaps and support (Fig. 12.9).

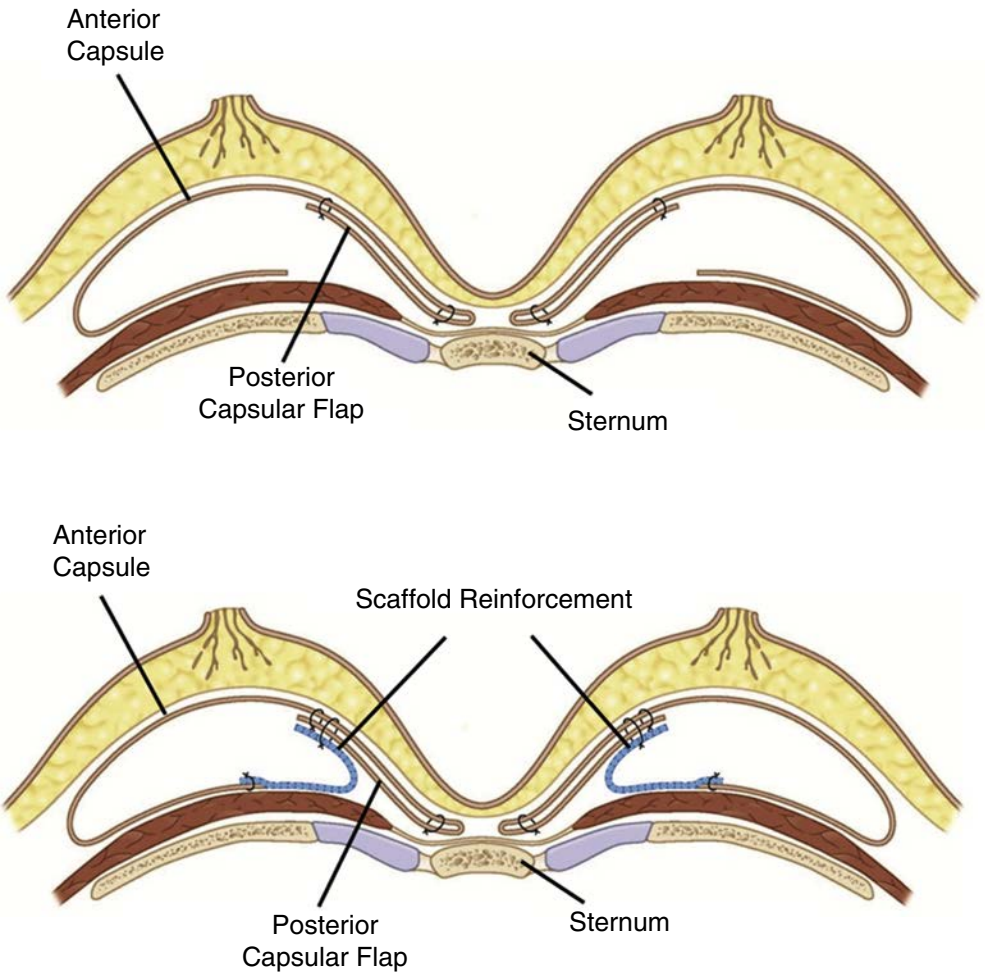
I have performed these posterior capsular flaps in more than 300 patients over the past 20 years and over 75 patients with medial malposition without significant clinical recurrence. For malposition I tend to prefer scaffolds such as GalaFLEX, which creates a stronger repair versus ADM, which tends to stretch many years after integration. In patients with capsular contracture repair I prefer porcine ADM.



• **Fig. 12.8** (A–M) This series of images shows the sequence of elevation. Typical patients have medial displacement of their implants, which in turn kicks the nipples out laterally. (C) A minimum 8-cm incision is made in the IMF. (D) After implant removal the defect is fully visualized, usually with marked thinning. The extent of the medial defect is then visualized. (E–M) Once the capsule is elevated the cut edge of the posterior capsule is sutured to the underneath side of the anterior capsule, thickening it. This also creates a well-vascularized undersurface that more readily accepts an ADM or scaffold. We have shown that the capsule does have enough blood supply to support a skin graft, but it is much better and preferred to have a fresh vascularized surface on which to place the scaffold. The additional ADM or scaffold further increases the soft tissue thickness, which is advantageous to minimize further implant visibility. The contralateral side is elevated and sutured. The drawings in Fig. 12.9 show the animation drawing of the posterior capsular flaps and support.



• **Fig. 12.8 cont'd**



• **Fig. 12.9** Illustration of capsular flap.

Conclusion

Breast complications are common after primary augmentation, augmentation mastopexy, and breast reconstruction with implants and expanders. It is even more common to have a complication and require a revision when a patient has had a prior revision. Patients with complications, particularly after failed prior attempts, need a true correction and fix and not just a possible or partial solution. Adding a material for support does increase the cost of the surgery, but it is more expensive to do another revision without a scaffold or ADM and then have another complication with an unresolved malposition. Although many surgeons would consider a posterior capsular flap an advanced technique, the procedure is quite straightforward, consistent, reliable, and durable, particularly with additional internal support creating an excellent solid long-term repair and patient outcome. In addition, it augments and thickens the anterior soft tissue thickness versus thinning it further and allows for an excellent receptive pocket for future fat grafting. I would recommend you give it a try in your next patient with complex medial or lateral malposition.

PEARLS FOR SUCCESS

- Implant malposition is one of the most common complications after aesthetic and reconstructive procedures of the breast when devices are used.
- Standard capsulorrhaphy and capsulectomy alone are frequently unreliable in creating a stable outcome in patients undergoing breast revision.
- Neosubpectoral pockets are a strong and durable option in breast revision surgery; however, the anterior soft tissues are often thin, commonly capsule on dermis, and attenuated, and these techniques will further thin the anterior thickness.
- Posterior capsular flaps are equally strong, reliable, and easy to raise and have the added benefit of actually thickening the anterior soft tissue thickness, which is very beneficial in these patients.
- Fat transfer procedures also may be performed into these “pita-pocket” enfoldings of the capsule.
- The deep/underneath side of the posterior capsule is fresh, rough, and vascularized and will readily accept an ADM or surgical scaffold.
- These posterior flaps have been used hundreds of times without significant clinical recurrence, and they are fast and straightforward to perform, adding few if any additional complications to the overall revision.

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SECTION 3

Mastopexy

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13

Mastopexy—Periareolar Approach

JOÃO CARLOS SAMPAIO GÓES, ALEJANDRO POVEDANO, AND GABRIEL SALUM D'ALESSANDRO

Introduction

Mastopexy is the surgical technique mostly employed for modification of volume, compaction, and repositioning of the breast mound. The harmonious combination of proportion, position, and projection requires a dermoglandular resection or, sometimes, exclusively skin resections, resulting in extensive scarring. The balance between breast shape and scarring has long posed a challenge to the plastic surgeon in search for lesser incisions that do not change the breast morphology. Periareolar mastopexy allows resection, compaction, and repositioning of the breast mound, providing wide surgical access, reduced scarring, and long-term stable results in specific cases.[1–8]

The senior author's experience in the field of breast-conserving surgery for breast cancer led him to explore the concept of using the periareolar approach in aesthetic breast surgery. In 1976, Dr. J.C. Góes described the resection of a breast quadrant by the periareolar approach and reconstruction of the resulting defect by approximating the glandular flaps.[9] This technique was the basis for the description of periareolar mammaplasty, first published in 1989.[10,11] The surgical technique was initially designed to reduce and reshape the breast for a more harmonious appearance. At that time, synthetic mesh interposition was not used for the stability of the aesthetic outcome. Instead, de-epithelialized periareolar skin excess was used as an internal "brassiere" to support the reshaped breast. However, this type of support was insufficient to provide a stable breast contour in the long term.

A mesh support was then innovated and was interposed between the reshaped breast mound and the skin flap to prevent tissue distention in the distal direction. Tissue stretch leads to widening of the breast base and areola, resulting in loss of aesthetic results in the short and medium term. The use of a mesh support provides long-lasting aesthetic results by helping maintain the proportion and position of the reshaped breast, allowing adequate tissue fixation, and counterbalancing healing forces and gravity.

Meshes of different materials have been used as a support system. First, a polyglactin 910 mesh was employed, because this is a fully absorbable mesh, but changes of aesthetic outcome were observed 2–3 years after surgery.[12,13] As a result, partially absorbable meshes started to be used as a support system, resulting in longer lasting aesthetic results.[14,15]

This chapter describes the refinements incorporated in the technique over the years, making periareolar mastopexy a treatment of choice for achieving satisfactory and long-lasting results in patients with mild to moderate breast ptosis and hypertrophy.

Indications and Contraindications

The parameters for indication of periareolar mastopexy include the degree of breast hypertrophy, degree of ptosis, quality of breast tissue (glandular and adipose tissue), and thickness and laxity of the skin. Thus the technique is particularly indicated in cases of mild to moderate breast ptosis, breast hypertrophy requiring up to 500 g resection per breast.

The surgical access via periareolar incision broadens the indications for breast-conserving surgery in the treatment of breast cancer, allowing breast reconstruction with preservation of the mammary gland structure, even after extensive resection. The technique is also a good alternative for correction of breast asymmetry resulting from oncologic surgery.

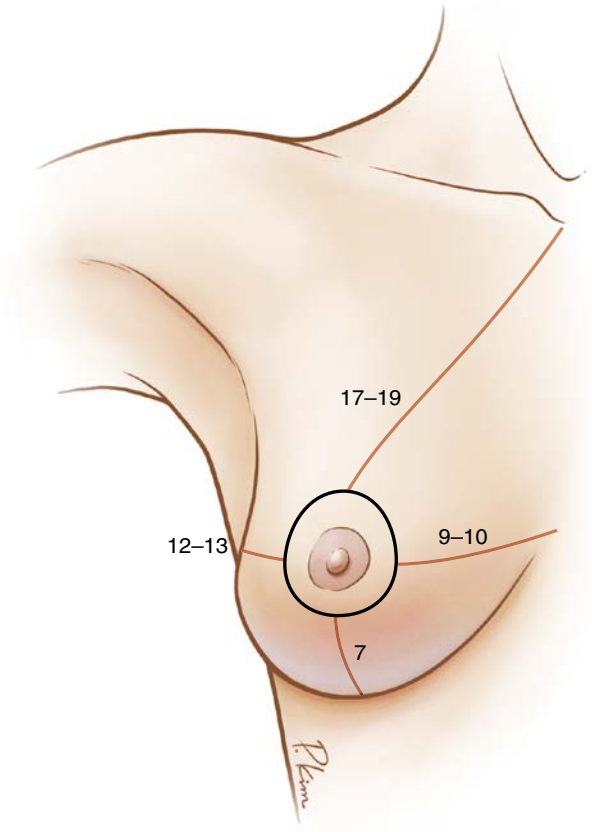
Patients with a history of any previous breast procedure, those showing signs of transient poor perfusion of the nipple–areola complex (NAC), and smokers should not undergo periareolar mastopexy, as described in this chapter.

Preoperative Evaluations and Special Considerations

A careful patient selection is fundamental for obtaining predictable and satisfactory results. The quality of breast tissue is an important selection criterion to be considered. Patients with a thicker dermal layer and greater skin elasticity experience a more efficient retraction and better tissue adaptation during wound healing, resulting in an aesthetically acceptable scar. In addition, long-lasting results are associated

• BOX 13.1 Indications and Patient Selection

- Mild to moderate ptosis
- Resection of breast tissue less than 500 g
- Breast-conserving surgery for breast cancer
- Correction of breast asymmetry
- Breasts with a large proportion of glandular tissue
- Adequate thickness and elasticity of the skin



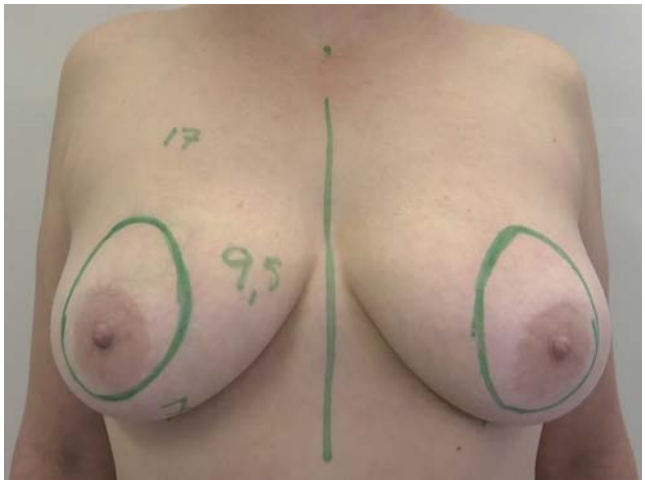
• Fig. 13.1 Illustration showing the preoperative marking of the area to be de-epithelialized according to limits defined based on four anatomic landmarks.

with breasts containing a large proportion of glandular tissue, which results in increased stability to the breast mound (Box 13.1).

Surgical Techniques

Preoperative Marking

The preoperative marking of the periareolar area to be de-epithelialized must be rigorously planned to ensure balance among breast proportion, position, and projection after surgery. Resections leading to excessive tension on the suture line result in loss of breast projection and widening of the areola and scar.



• Fig. 13.2 Patient after preoperative marking of the area to be de-epithelialized based on four anatomic landmarks.

The marking is based on four anatomic landmarks, as follows:

1. Sternal notch
2. Inframammary fold (IMF)
3. Midsternal line
4. Outer edge of the breast

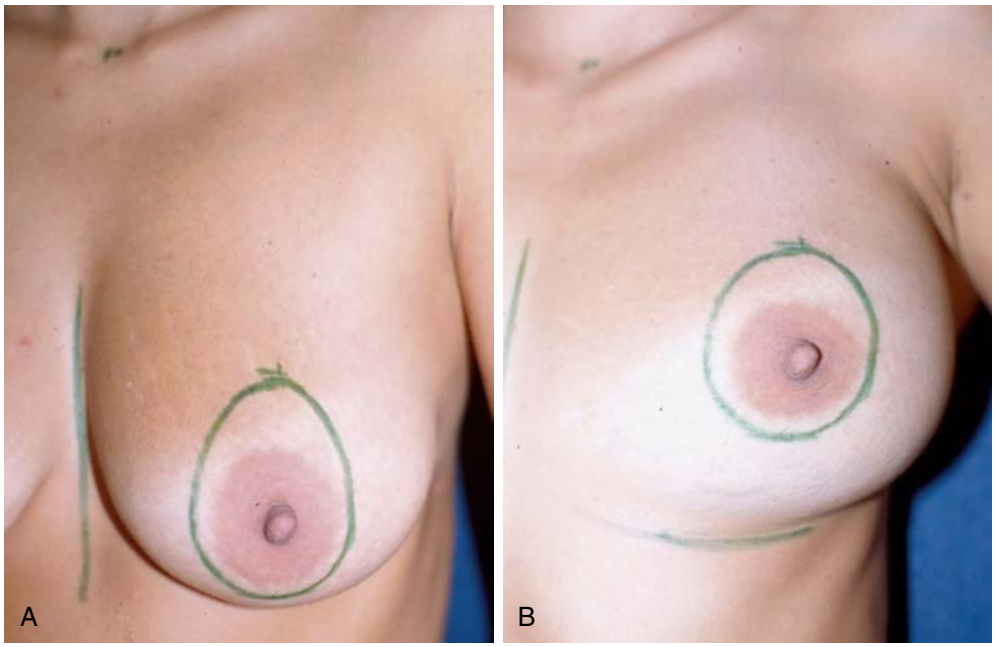
Point A represents the final position of the upper edge of the NAC and is marked approximately 17–19 cm from the sternal notch. Point B corresponds to the final position of the lower edge of the NAC and is placed 7 cm from the IMF. Points A and B define the vertical axis of the breast, responsible for the elevation of the NAC and definition of the breast mound. Point C marks the final position of the inner edge of the NAC and is located about 9–10 cm from the midsternal line. Point D refers to the final position of the outer edge of the NAC and is marked 12–13 cm from the outer edge of the breast or anterior axillary line. Points C and D define the transverse axis of the breast (Figs. 13.1 and 13.2).

Special attention should be given to the final checking of the surgical marking by manually testing tissue approximation, especially in the transverse axis, to prevent excessive resection of skin, which may affect breast shape and scar quality.

The marking of the periareolar incision should have a teardrop shape with the patient in the standing position, with the longest axis in the vertical direction (A–B) because of gravity (Fig. 13.3A) and a more circular shape with the patient in the supine position (see Fig. 13.3B).

Surgical Procedure

The technique used in periareolar mammoplasty or mastopexy is characterized by the independent treatment of the mammary gland and skin envelope. The technique can be described in 7 steps.



• **Fig. 13.3** Marking of the periareolar incision defining (A) a teardrop-shaped area with the patient in the standing position or (B) a more circular-shaped area with the patient in the supine position.

Step 1: De-epithelialization of the Teardrop-Shaped Area

The surgical procedure begins with the de-epithelialization of the previously marked teardrop-shaped area, creating a ring of dermal tissue around the NAC.

Step 2: Flap Undermining

Flap incision and sharp undermining start at the teardrop-shaped area outline. The undermining procedure is performed using different techniques (Fig. 13.4).

Initially, a bevel incision is made on the upper edge of the flap with a progressive increase in flap thickness as it approaches the pectoral fascia. The purpose of this procedure is to increase the fullness of the upper pole of the breast after elevation of the previously reshaped breast mound.

The inner edge of the flap is undermined with a uniform thickness of about 0.5 cm. The undermining is extended to approximately 2 cm from the pectoral fascia. This preserves the intercostal perforators responsible for perfusion of the skin flap and mammary parenchyma.

The undermining of the lower edge also has a uniform thickness of 0.5 cm, extending to the IMF, which must be entirely preserved.

The outer edge of the flap is undermined following the same criteria of uniformity of the inner and lower edges. The sharp undermining is limited by the transition from the breast border to the pectoral fascia, completing the circumferential dissection of the breast (Fig. 13.5).

Step 3: Undermining of the Periareolar Ring

The periareolar ring of dermal tissue, previously de-epithelialized, is radially undermined from the mammary gland. The undermining extends to 1.5 cm from the areolar border to ensure flap perfusion (Fig. 13.6).

Step 4: Glandular Treatment

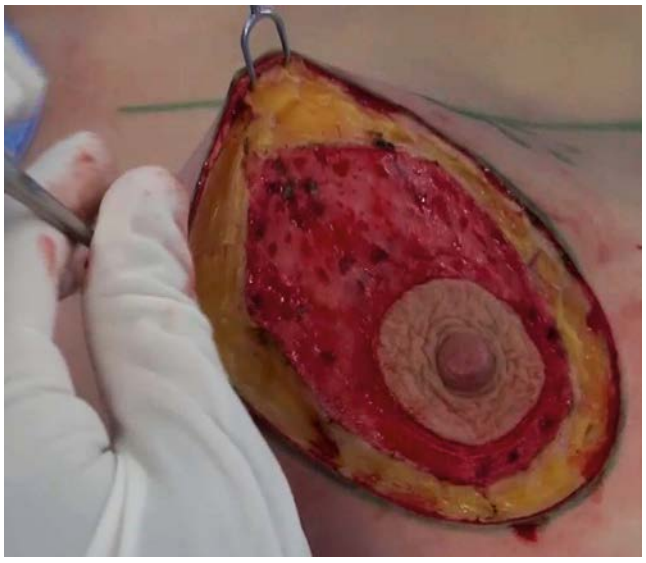
The sharp undermining of the skin flap, according to the procedures described previously (see Fig. 13.5), completely separates the skin envelope from the mammary gland, which can then be easily evaluated for resection, compaction, and elevation. The blood supply to the mammary gland is guaranteed by maintaining the intercostal perforating branches of the internal thoracic artery in the inner portion and by the posterior intercostal artery and its branches.

A large U-shaped wedge resection of glandular tissue is made in the upper pole of the breast. The U-shaped wedge is previously marked on the central portion of the upper pole and extends medially and laterally for vertical reduction of the breast, facilitating elevation of the breast mound.

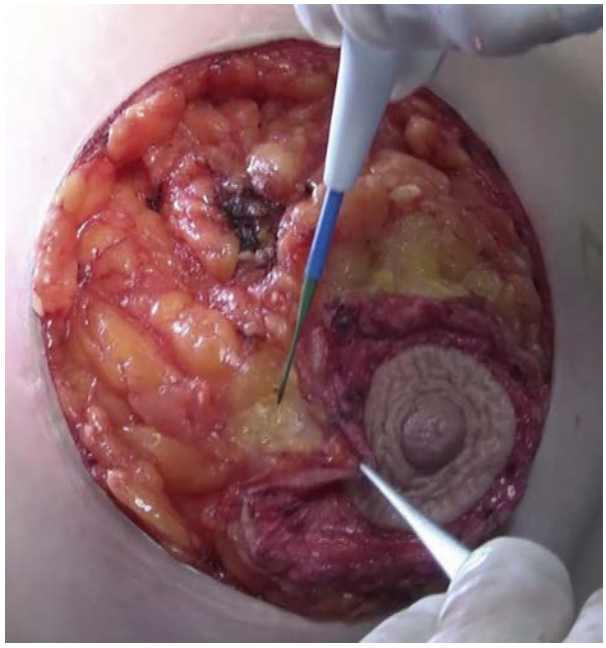
Glandular tissue from the lower pole of the breast can be either resected or tucked under the NAC to increase anterior projection, with special care to avoid retroglandular detachments that may affect blood flow through the perforator vessel.

The approximation of the upper glandular flaps and their fixation to the anterior pectoral fascia lead to reduction of the transverse axis of the upper pole and elevation of the breast mound to the desired position. The approximation and fixation of the flaps in the lower pole result in the medialization and reduction of the breast base.

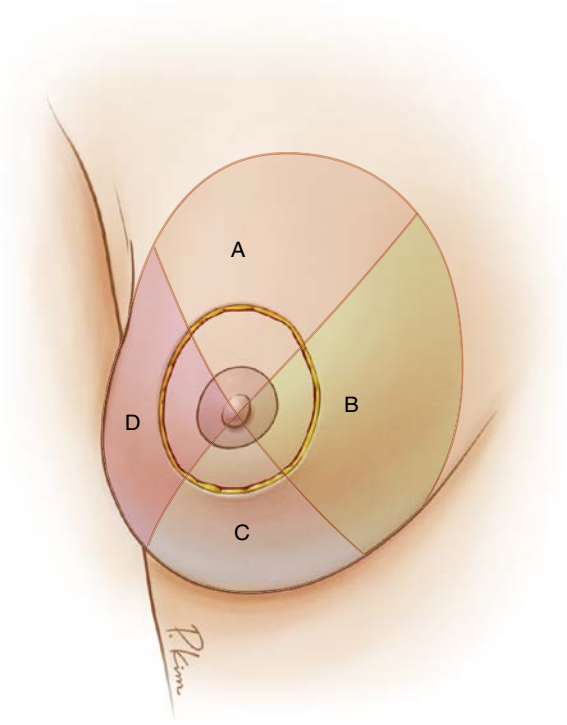
If necessary, the glandular surface and skin flaps can be trimmed to decrease irregularities (Fig. 13.7).



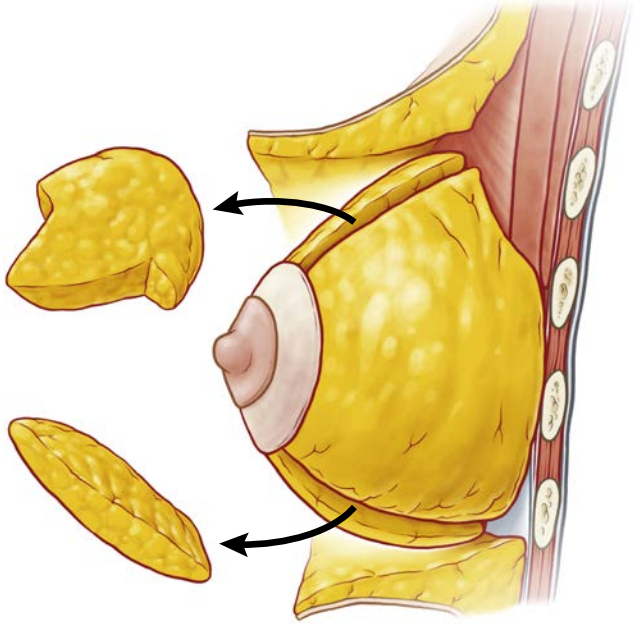
• **Fig. 13.4** Illustration showing the periareolar ring of de-epithelialized dermal tissue and start of sharp undermining by a dermal incision at the flap outline.



• **Fig. 13.6** Creation of the de-epithelialized, periareolar dermal flap.



• **Fig. 13.5** Quadrants of skin flap undermining. *(A)* Upper pole: sharp undermining by a bevel incision extended to the pectoral fascia. *(B)* Inner pole: undermining with a uniform thickness of 0.5 cm extended to 2 cm from the pectoral fascia for the preservation of intercostal perforators. *(C)* Lower pole: undermining with a uniform thickness of 0.5 cm extended to the IMF. *(D)* Outer pole: undermining with a uniform thickness of 0.5 cm extended to the outer border of the mammary gland and pectoral fascia.



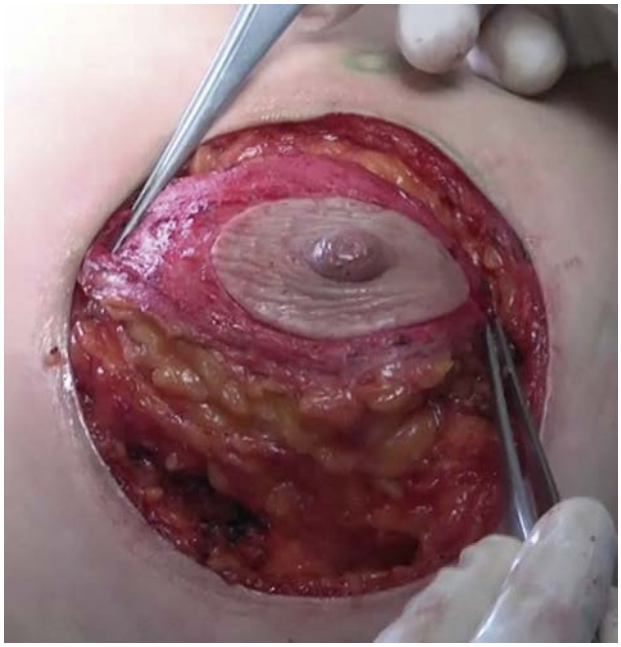
• **Fig. 13.7** Illustration of the resection of glandular tissue.

Step 5: Suturing of the Dermal Flap

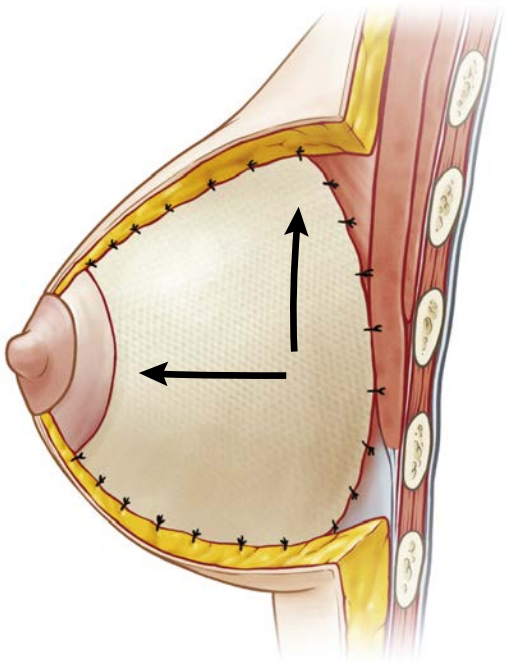
The de-epithelialized, radially undermined, periareolar dermal flap is sutured to the glandular surface, creating an additional tissue coverage (Fig. 13.8).

Step 6: Mesh Interposing

A synthetic mesh is placed as an internal brassiere, completely covering the reshaped breast mound to provide support, thus reducing the effect of gravitational pull. The mesh is initially secured with single 4-0 nylon sutures to the IMF, subsequently adjusted, and gradually secured bilaterally in the cranial direction up to the upper pole, providing adequate support and elevation of the breast (Figs. 13.9 and 13.10). Drainage is performed using a 15-French silicon suction drain.



• **Fig. 13.8** Advancement and fixation of the de-epithelialized, periareolar dermal flap.

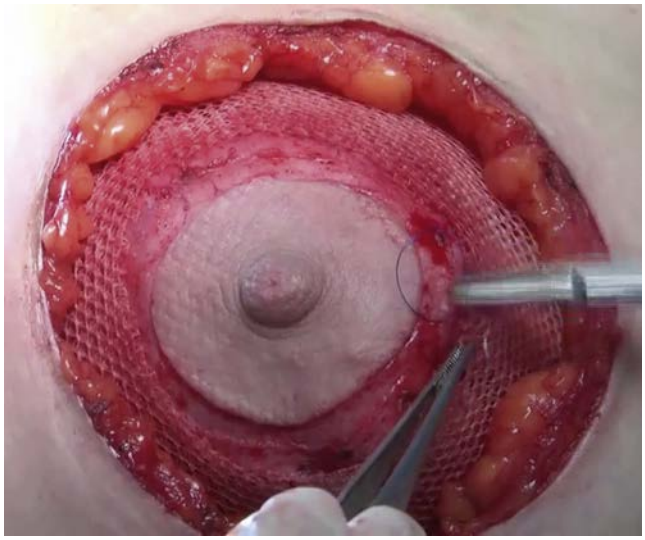


• **Fig. 13.9** Illustration showing the fixation of the mesh interposed between the skin flap and the reshaped breast mound with the purpose of providing long-lasting postoperative elevation and projection of the breast.

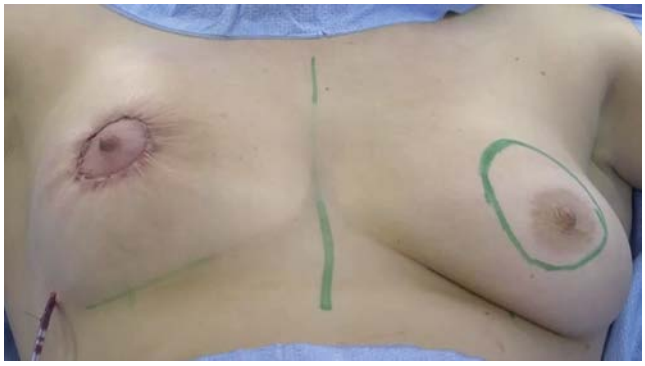
Step 7: Skin Closure

Skin closure is performed in three layers, as follows:

- Purse-string suture of non-absorbable material (e.g., 2-0 nylon suture)
- Simple subcutaneous approximation suture using 4-0 polyglactin 910



• **Fig. 13.10** Intraoperative photograph showing the fixation of the mesh interposed between the skin flap and the reshaped breast mound.



• **Fig. 13.11** Intraoperative photograph showing the results of the completed procedure in one of the breasts.

- Intradermal suture using 4-0 polyglactin 910 (Fig. 13.11)
- Surgical wound sealing with surgical glue

Step 8: External Breast Shaping

External shaping of the breast is made with a self-adhesive, permeable, transparent synthetic film, such as IV3000 (Smith and Nephew Med Ltd; London, United Kingdom), and a non-compressive, surgical chest dressing.

Postoperative Care and Expected Outcomes

Patients should wear non-compressive chest bandages for 7–10 days. The bandages are then replaced with a light-compression shaping brassiere, which is worn for 2 months. The external shaping performed with self-adhesive, permeable, transparent synthetic film is removed 5–7 days after surgery.

Non-steroidal anti-inflammatory and analgesics are prescribed for 7 days postoperatively. A second-generation cephalosporin and a gastric mucosal protective drug are prescribed for 14 days postoperatively.

Patients who smoke or those showing signs of poor perfusion of the NAC are treated topically with a cream containing coumarin and sodium heparin (Venalot H; Takeda Pharma, Jaguariúna, São Paulo, Brazil) for 7 days. Suction drains are left in place until drainage volume is less than 20 mL/24 h.

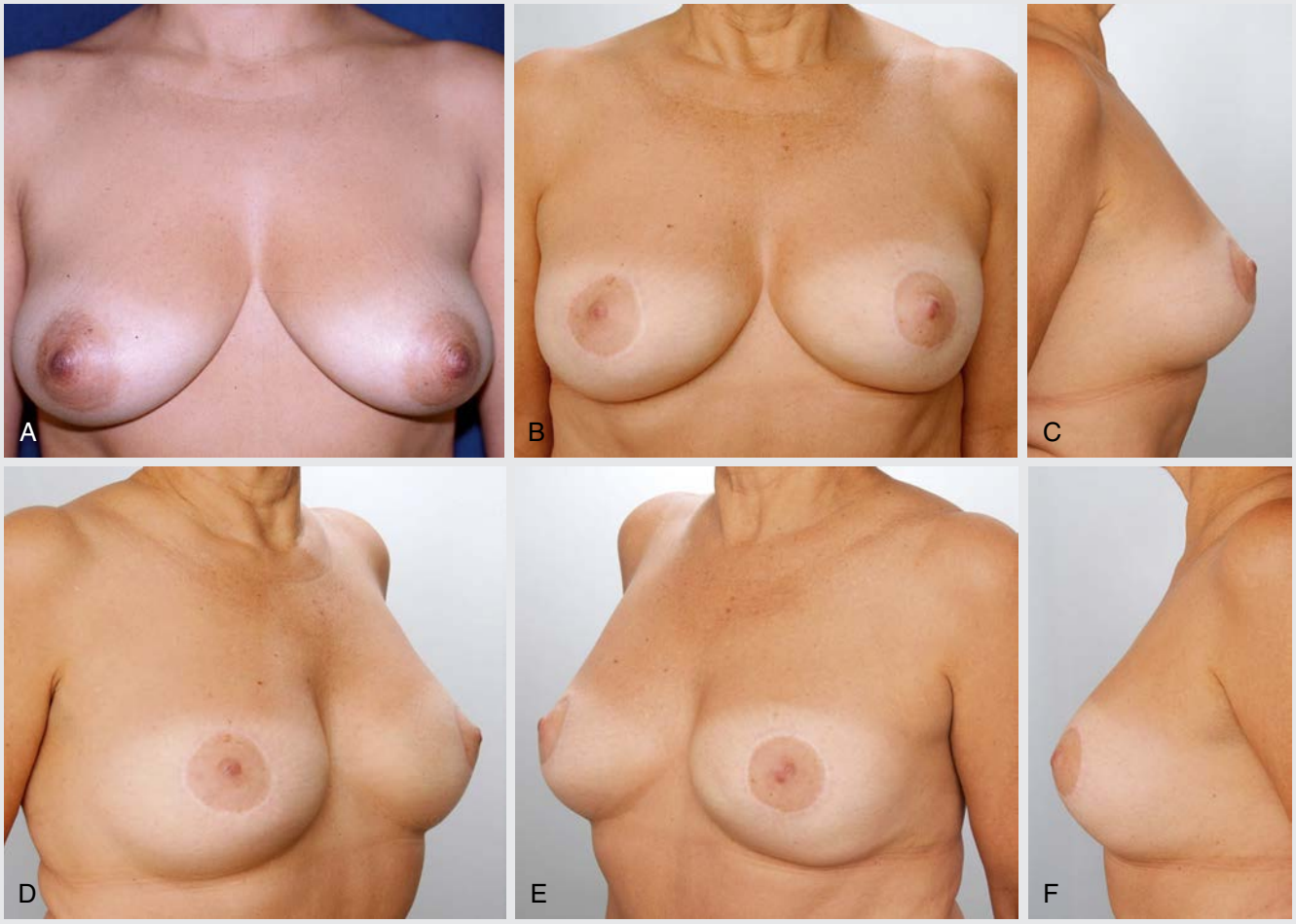
Any application of pressure on the breasts should be avoided for 60 days to ensure effective tissue healing in proper position. Unnecessary movements of the arms, including abduction and backward movements, should be avoided during the first week after surgery. The patient can gradually return to her usual activities 30 days after operation. After this period, tissues are considered to have achieved sufficient healing to support mild to moderate daily living activities.

The described technique is associated with low early complication rates, which are related to a careful selection of patients and rigorous postoperative care. Patients should avoid caffeine and smoking before and after surgery to optimize blood flow to the healing tissues. Fat necrosis is one of the most common complications, especially among smokers, occurring in about 2% of cases. It is usually subclinical and diagnosed through postoperative imaging, and rarely requires surgical intervention. The long-lasting aesthetic results with our technique can be achieved in most our patients.

Case Examples

CASE 13.1

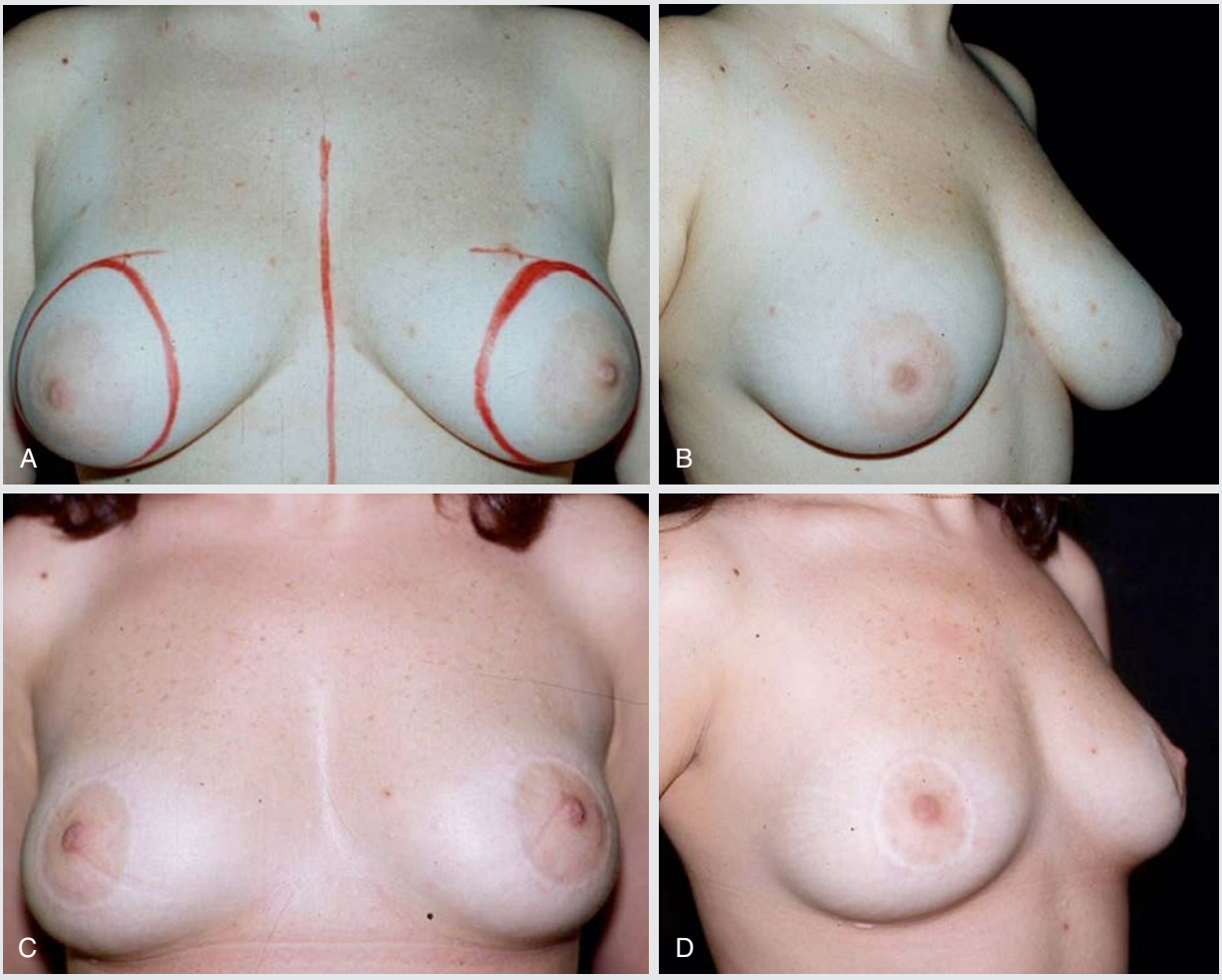
Two case examples of the long-lasting aesthetic results obtained with periareolar mammaplasty with interposition of a partial absorbable mesh are presented. The first case refers to a 35-year-old patient with mild breast hypertrophy and ptosis who underwent the described technique. The preoperative photograph and aesthetic results after 16 years of surgery are seen in Case 13.1A–F.



• **Case 13.1** Preoperative photograph on anterior view (A) and 16-year postoperative photographs on anterior (B), oblique (D, E), and lateral (C, F) views of a 35-year-old patient with mild hypertrophy and ptosis who underwent periareolar mammaplasty with interposition of a partial absorbable mesh.

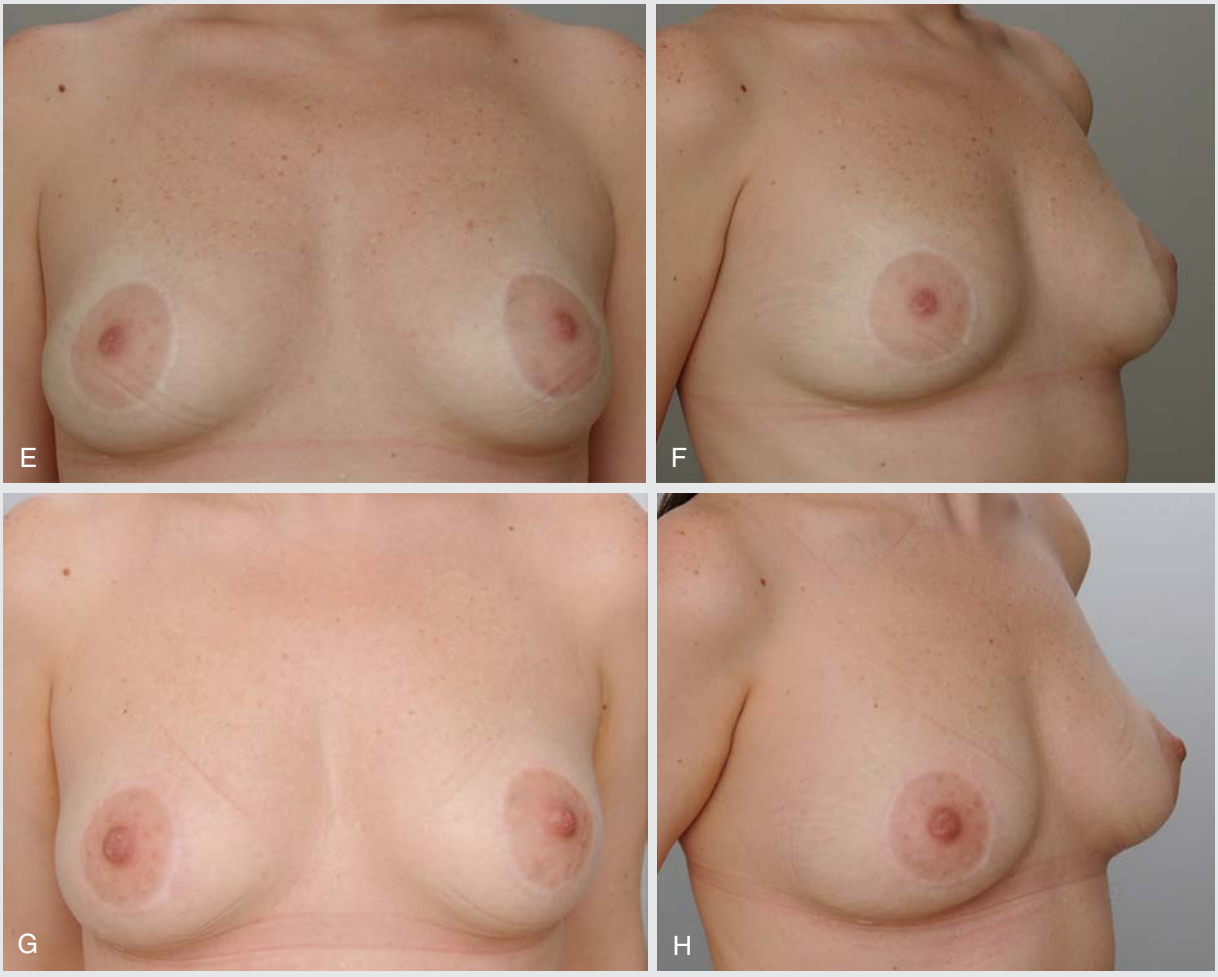
CASE 13.2

A 19-year-old patient with moderate breast hypertrophy and ptosis (Case 13.2A, B) also underwent periareolar mammaplasty, as described in this chapter. The photographs show the aesthetic results at 3 years (Case 13.2C, D), 8 years (Case 13.2E, F), and 19 years (Case 13.3G, H) after surgery.



• **Case 13.2** Preoperative photographs on anterior (A) and right oblique (B) views and 3-year postoperative photographs on anterior (C) and right oblique (D) views of a 19-year-old patient with moderate hypertrophy and ptosis who underwent periareolar mammaplasty with interposition of a partial absorbable mesh. The patient after 8 years (E, F) and 19 years follow-up (G, H).

CASE 13.2



Management of Complications

Seromas and hematomas occur in less than 2% of cases, are usually treated in outpatient facilities without the need for further surgery, and do not affect the final aesthetic result. These complications tend to occur in young patients because of excessive arm movements in the immediate postoperative period, causing tears of the pectoralis major muscle at points of mesh fixation. Complications occurring in less than 1% of cases include infections, persistent edema, and scar retraction.

Infections are easily treated with broad-spectrum antibiotics. Persistent edema occurs in older patients, probably because of the absorbable component of the mesh. In these cases, the breast is treated by compressive dressing with micropore tape for 20–30 days, especially in the lower pole. Scar retractions are treated with massage performed by a physiotherapist.

No cases of total NAC necrosis, skin necrosis, or mesh extrusion have been reported. Transient signs of poor perfusion of the NAC may result in epitheliolysis and are observed in patients with a history of previous breast procedures, which may have affected circulation (central pedicle). Thus, these patients should not undergo the described technique of periareolar mammaplasty.

Nipple–areola sensation is fully recovered in 97% of cases approximately 30 days after surgery. The high rate of sensory recovery is attributed to the careful preservation of the fourth intercostal nerve, which innervates the NAC (Table 13.1).

Secondary Procedures

Revision and secondary surgical interventions are uncommon and are performed for specific reasons. A careful patient selection tends to reduce the need for these procedures.

TABLE 13.1 Postoperative Complications (*n* = 385)

Complication	Percent (%)
Paresthesia of the nipple–areola complex	3
Fat necrosis	2
Hematoma	<2
Seroma	<2
Infection	<1
Persistent edema	<1
Scar retraction	<1
Total necrosis of the nipple–areola complex	Absent
Skin necrosis	Absent
Mesh extrusion	Absent

Approximately 10% of patients would benefit from revision of the periareolar scar and NAC diameter, but most of them decline revision. The periareolar purse-string suture is usually made with non-absorbable thread to avoid areolar widening. However, major changes in breast volume or excess skin laxity lead to areolar widening. The periareolar suture may become palpable, or an excessive, unnatural nipple projection may be observed. In these cases the removal of the periareolar suture is necessary.

Some patients may show loss of anterior projection of the breast mound as a result of laxity of the glandular tissue, excess adipose tissue adjacent to the mammary parenchyma, or excess skin laxity. In these cases, a secondary surgery is performed with separation of the periareolar scar by a vertical incision, compacting the lower pole of the breast and projecting the central portion. Loss of anterior projection is usually observed 2–3 years after surgery and is associated with the use of meshes of fully absorbable material. The mesh support is essential to maintain the anterior projection of the breast mound and provide long-lasting aesthetic results.

Other less common reasons for secondary surgery include the placement of silicone implants because of patient dissatisfaction with the resulting breast volume, replacement of absorbable meshes with partially absorbable meshes, and resection of benign breast tumors. These procedures are performed through the previous periareolar scar.

Conclusion

The described technique of periareolar mastopexy in combination with partially absorbable mesh interposition possess the necessary attributes to provide consistent results in aesthetic breast surgery. It has low complication rates and provides stable results in the medium and long term when indicated. In addition, the technique has great applicability to the treatment of breast neoplasms and breast asymmetry after cancer treatment.

PEARLS FOR SUCCESS

- Careful evaluation of preoperative marking to avoid excessive skin resection
- Treatment of the mammary gland separated from the skin envelope by sharp undermining through the periareolar incision
- Resection, compaction and elevation of the breast mound, which is then secured to the anterior pectoral fascia
- Interposition of a partially absorbable, synthetic mesh for support and stability of the aesthetic result
- Concentric adjustment of the skin using a previously de-epithelialized dermal flap to create a double skin layer
- Use of a periareolar purse-string suture to reduce the risk of areolar widening

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14

Mastopexy—Vertical Approach

ERIC SWANSON

Introduction

Commonly, *mastopexy* is understood to be synonymous with "breast lift." Among plastic surgeons, a mastopexy has been traditionally understood to mean a skin tightening procedure, certainly for a skin-only mastopexy. However, the goal of a mastopexy is improvement in the shape of the breast, not simply tightening of its elastic envelope. In ptotic breasts, the lower pole is usually reduced (i.e., parenchymal resection) to achieve an aesthetic lower pole [1–3] and avoid a "mastopexy wrecking bulge."[4]

Many plastic surgeons use the term *vertical scar* mastopexy. However, the scar is not always vertical. The scar is frequently modified to a short inverted T. The scar may resemble a Wise pattern scar, but the parenchymal treatment is much different. Accordingly, vertical mastopexy is best labeled "vertical," referring to the vertical midline parenchymal resection of the lower pole, not the scar.[2]

Indications and Contraindications

For the woman who lifts her breasts by the cups of her hands and says, "This is what I want," a vertical augmentation/mastopexy is likely to be most satisfactory,[5] in accordance with the minus-plus principle.[6] A patient who says, "I like my size, but just want it up here," should be advised that such a result is impossible with a mastopexy alone. Breast remodeling is needed—more on top, less on the bottom—and this effect can be accomplished only by simultaneously inserting implants.[1]

Measurements confirm that the inframammary fold (IMF) level moves up after a vertical mammaplasty.[7] Both vertical and inverted-T techniques can elevate the lower pole.[8] However, only the vertical method elevates the IMF. When a Wise pattern and inferior pedicle are used, the IMF remains fixed at the base of the pedicle.

An underappreciated benefit of elevation of the IMF and lower breast pole is the appearance of a longer torso.[2] With the emphasis on fitness in our culture, and the frequent display of the abdomen, this anatomic area takes on greater importance. However, upward mobilization of the *superior* border of the breast is more challenging. Breast implants are needed to substantially boost breast projection and upper pole projection,[1,5,6] providing the illusion of breast mound elevation. The author inserts breast implants in more than 70% of patients undergoing a mastopexy.[2] A vertical mammaplasty, with a medial, superior, or superomedial pedicle is now used exclusively by a growing number of plastic surgeons.[2]

Although smoking is never advisable, a smoking history is not an absolute contraindication to surgery.[2] The vertical approach is more robust than the inverted-T, inferior pedicle technique because the keel-shaped lower pole parenchymal resection is not accompanied by skin undermining.[9] Nipple–areola perfusion is optimized by preserving medial and deep vascular pedicles. Nevertheless, patients are instructed not to smoke during the perioperative period to reduce the risk of delayed healing, suboptimal scars, and nipple–areola tissue loss.

Preoperative Evaluation and Special Considerations

The mastopexy candidate presents with breast ptosis. The nipple position is evaluated. Patients are informed that implants provide minimal, if any, nipple elevation. Breast implants are not a substitute for a mastopexy. Implants do not adequately "take up the slack."

The areola size is a consideration. Women with large areolae may wish to have them reduced, making the periareolar scar a favorable trade off. Existing breast asymmetry is the rule, not the exception. Patients are informed of their existing asymmetry and the fact that perfect symmetry is not realistic.

Patients may have had a previous augmentation. This is the time to discuss whether to replace the implants. Considerations include the desired size and the number of years the implants have been in place.

Patients who have had a previous breast lift may be candidates for secondary mastopexy. The original method used does not matter. Obtaining the original operative report is generally unnecessary. The author makes no attempt to replicate the original resection pattern. However, the

surgeon must be especially careful regarding blood supply, often including the (de-epithelialized) superior areola hemi-circumference.

Many women who have had a previous Wise pattern mastopexy or reduction already have over-elevated nipples that do not require any additional elevation. Existing nipple overelevation may be improved or corrected by the elevating effect of the vertical lift on the breast mound. The challenge is to site the nipple as low as possible without leaving a scar superior to the nipple–areola.

Vertical Method

The vertical technique lengthens the lower pole distance (the length along the lateral curve from the plane of maximum postoperative breast projection to the posterior breast margin[10]), a measure of breast constriction,[11] by converting an elliptical defect to a vertical straight-line closure.[1,2,8] The lower pole is elevated, and the length dividend increases projection.[1,2,11]

Simultaneous Breast Implants

Some surgeons think that a mastopexy and breast implant work at cross purposes because a mastopexy tightens the skin envelope whereas a breast implant stretches it. The procedures are in fact synergistic when a vertical method is used.[2] Implants make mastopexy easier to perform. There is less gathering of tissue in the lower pole. An inverted-T modification is less often required because the implant fills out the lower pole.[2]

The mean increase in breast projection after vertical mastopexy is about 1.2 cm (Fig. 14.1).[1] Upper pole projection increases 0.5 cm, on average. These modest increases confirm the clinical impression that mastopexy and reduction cannot duplicate the effect of an implant in creating upper pole fullness.

Areola Diameter

The areolar diameter decreases approximately 1 cm after mastopexy.[1] Patients do not favor large areolae.[1] Despite using a 39-mm areola marking ring and an intraoperative positioning technique that theoretically reduces skin tension around the areola,[8] areola diameters for the combined group of vertical mastopexy and reduction averaged approximately 5 cm after surgery, at the outside margin of the range deemed "okay" by patients.[1] For this reason, an areola marking device with a diameter of 39 mm or less is recommended, allowing for a 1-cm stretch after surgery.[1]

Lower Pole Level and Breast Mound Elevation

Vertical mastopexy elevates the lower pole level about 3 cm on average.[1] Vertical mammaplasty effectively elevates the breast mound (level of maximum breast projection) about 4.7 cm.[1] The nipple moves up 5.8 cm, on average. These measurements suggest that 80% of the upward nipple movement derives from breast mound elevation; 20% comes from nipple repositioning on the breast mound.[1] This figure is calculated by dividing breast mound elevation by nipple elevation.

Surgical Technique

Relevant Surgical Anatomy

The intercostal perforating arteries from the internal mammary artery provide the dominant superficial circulation to the nipple and areola in 70% of women (Fig. 14.2).[11]

Superior and superomedial pedicles are popular. The advantage of a superomedial pedicle is inclusion of the second intercostal perforator. The advantage of the medial pedicle is ease of rotation and in-setting, which can occasionally be difficult when using a superior pedicle.[9] Moreover, a medial pedicle preserves the medial anterior cutaneous innervation. By preserving a deep parenchymal attachment there is greater likelihood of maintaining innervation from the deep branch of the lateral branch of the fourth intercostal nerve (Fig. 14.3). Superior pedicles are more likely to compromise sensation by sacrificing the deep innervation and by partially excluding superficial medial innervation.[12] In choosing a medial pedicle, the author prioritizes nipple sensation, recognizing that perfusion is seldom a problem. Nipple sensation is important to women.[13] A vertical mastopexy with a medial pedicle preserves nipple sensation in 90% of patients.[13]

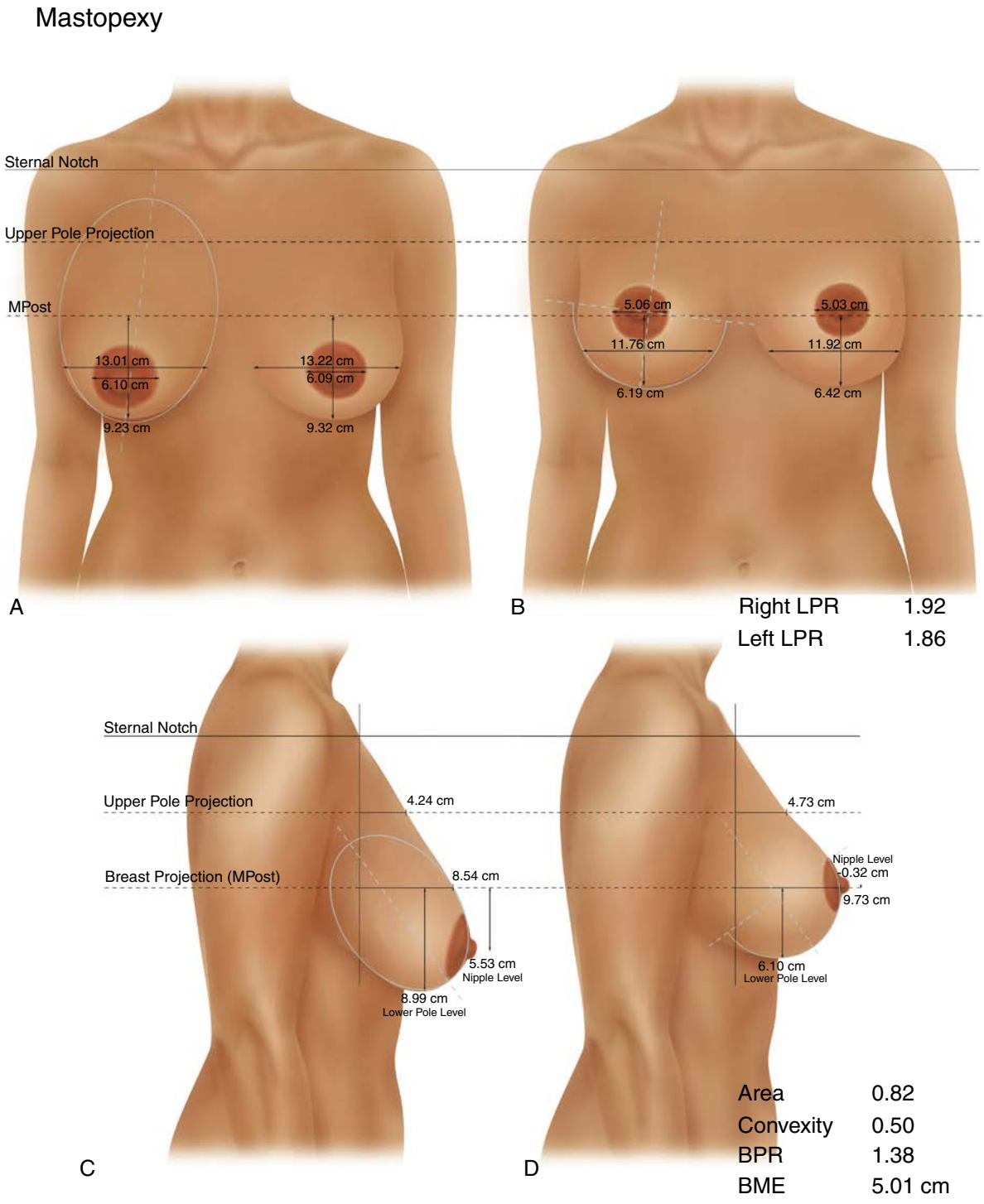
Preoperative Marking

Preoperative marking is performed with the patient standing. A measurement is made from the sternal notch, usually 21 cm. Next, the midline is marked at the xiphoid and an equidistant marking is made within each IMF (typically 10–12 cm). A vertical ellipse is marked. A mosque-dome or keyhole pattern is not used because the nipple position will be determined in surgery. The width of the ellipse is judged by folding in the lower pole tissue. A 10-cm width is common, but there is considerable variation depending on breast size, ptosis, and whether implants will be inserted simultaneously. The final determination is made in surgery. When they are used, breast implants are inserted first, before the mastopexy, so as to avoid overresection.

Anesthesia

Total intravenous anesthesia is administered. SAFE principles (Spontaneous breathing, Avoid gas, Face up, Extremities mobile) are observed. A laryngeal mask airway is used. No muscle relaxation is used to preserve the calf-muscle pump, an important consideration for preventing deep venous thromboses. A propofol infusion optimally maintains the mean arterial blood pressure.

Local anesthesia is injected in the form of 0.25% lidocaine, 0.125% bupivacaine, and 1:300,000 epinephrine. A volume



• **Fig. 14.1** Breast shape before (A,C) and after (B,D) vertical mastopexy with a medial pedicle. Breast projection and upper pole projection are modestly increased. The elliptical shape of the lower pole is tightened to a semicircle on both frontal and lateral views. The lower pole is elevated. The lower pole ratio *(LPR)* measures less than 2.0 on both sides. The upper pole contour remains linear after surgery. The areola diameter is reduced approximately 1 cm. These mammographs were created based on mean breast measurements among study patients. *BME,* Breast mound elevation; *BPR,* breast parenchymal ratio; *MPost,* maximum postoperative breast projection. (Reprinted from Swanson, E. Prospective photographic measurement study of 196 cases of breast augmentation, mastopexy, augmentation/mastopexy, and breast reduction. *Plast. Reconstr. Surg*. 131, 802e–819e. With permission from Wolters Kluwer Health.)

of 60–100 cc per breast is injected. Both breasts are injected before the first incision is made to maximize the local anesthesia and epinephrine effect.

Surgical Technique

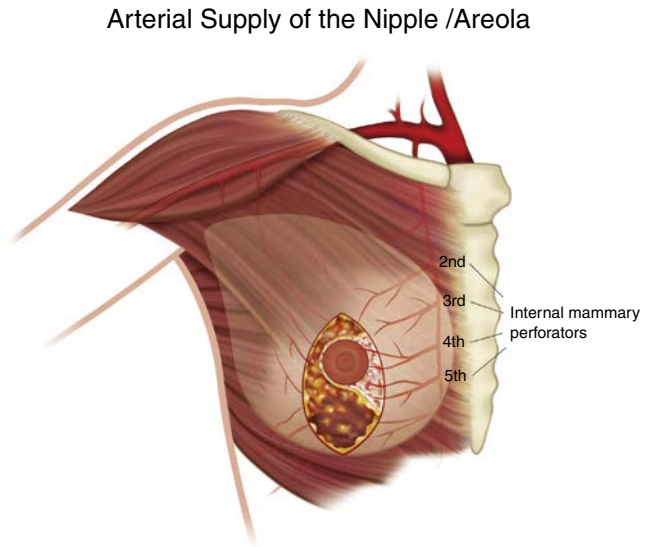
A video demonstrating a vertical mastopexy is provided (see Video 14.1). The video includes preoperative marking, details of the surgery and anesthesia, and follow-up 24 hours after surgery. The author's mean operating time for a vertical mastopexy is 106 minutes.[2] Intraoperative photographs of the same patient featured in the video are provided in Fig. 14.4.

Video 14.1 This video demonstrates preoperative marking, anesthesia, surgery, and 24-hour follow-up photographs of a 36-year-old woman undergoing a vertical mastopexy with a medial pedicle and inverted-T modification.

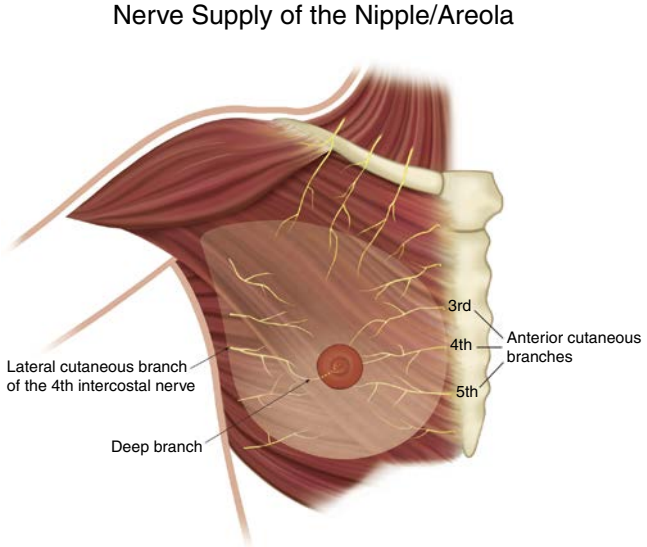
The vertical mastopexy is performed using a medially based pedicle[9] and intraoperative nipple siting.[1,2,11] Only scalpel dissection is used, not electrodissection, to minimize tissue burn and avoid seromas. The areola margin is marked using a 39-mm diameter ring. The vertical ellipse is incised. A medially based pedicle is de-epithelialized, from the 1 o'clock to 4 o'clock position (8 o'clock to 11 o'clock on the left breast). A keel-shaped midline lower pole resection is performed. Cautery forceps are used to cauterize individual bleeders. A parenchymal base is preserved deep to the nipple–areola complex. A more superficial resection is performed around the lateral and superior margin of the nipple/areola. Additional parenchyma and fat are resected from the inferior end of the lower pole to maximize cinching of the lower pole (see Fig. 14.4).

The medial and lateral pillars are approximated using 2-0 Vicryl sutures (Ethicon Inc., Somerville, NJ, United States). The dermis is repaired with 3-0 Vicryl inverted sutures. Midline approximation of the pillars elevates the IMF to a level that is often above the lower end of the wound. A short inverted-T modification is used to avoid a scar below the new (elevated) IMF level, with maximum horizontal skin gathering to limit the length of the horizontal component (illustrated in the Video 14.1).

The nipple and areola are temporarily oversewn (see Fig. 14.4). The new site for the nipple is determined after creation of the new breast mound. The author does not find it necessary to sit the patient up during surgery. The nipple is positioned just inferior to the apex of the breast, with a slight lateral inclination. The same 39-mm areola marking ring is used. The areola margin is closed using 3-0 Vicryl sutures (typically 8 are used) followed by a 5-0 Vicryl subcuticular suture. The resected tissue weights are recorded. These are useful references when there is an existing size discrepancy, which is common. Steri-Strips (3M Comp., Maplewood, MN, United States) are applied followed by gauze dressings and a sports bra.



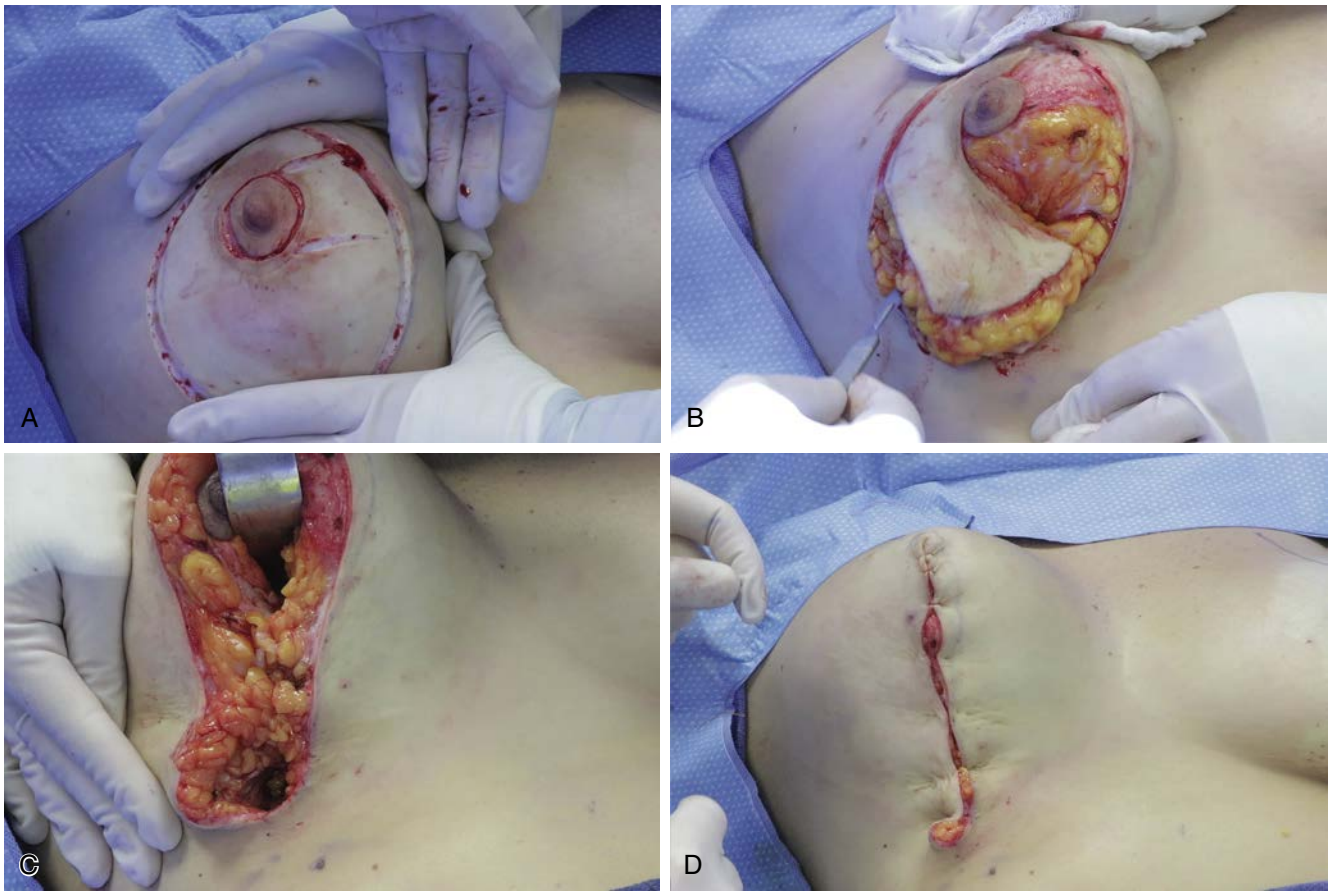
• **Fig. 14.2** Arterial blood supply of the nipple and areola. The intercostal perforating arteries from the internal mammary artery supply the dominant superficial circulation to the nipple and areola in 70% of women. A medially based pedicle is designed to include these vessels. (Reprinted from Swanson E. Evidence-based cosmetic breast surgery. Cham, Switz: Springer; 2017. With permission from Springer Nature.)



• **Fig. 14.3** The predominant superficial nipple innervation is provided by the medially based 3rd, 4th, and 5th anterior cutaneous branches. A deep branch of the lateral cutaneous branch of the 4th intercostal nerve consistently provides deep innervation to the nipple. (Reprinted from Swanson E. Evidence-based cosmetic breast surgery. Cham, Switz: Springer; 2017. With permission from Springer Nature.)

Areola Circularity

The recipient site must be circular with no distorting tension. The goal of a mosque-dome or keyhole pattern is to close the pattern to a circle. Although a circular shape may be achieved in diagrams, it is less likely to happen in surgery. An inverted teardrop deformity is the norm rather than the exception, present in 84% of published studies using a preoperative keyhole (Wise pattern) or mosque-dome shaped (Lejour) marking pattern.[8] It is so common that it



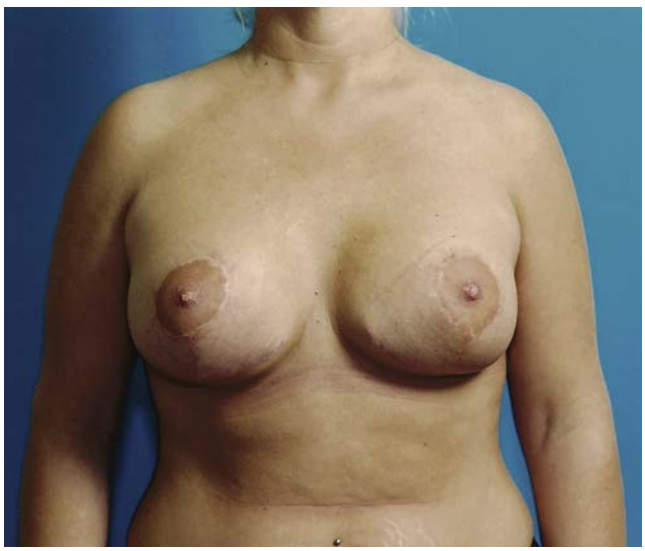
• **Fig. 14.4** Intraoperative photographs of a 36-year-old woman undergoing a vertical mastopexy. (A) The vertical elliptical pattern and medial pedicle have been incised. (B) Resection of lower pole skin and parenchyma, continuing laterally and superiorly at a more superficial level, preserving the parenchymal base to the medial pedicle. (C) The medial and lateral pillars are approximated in the midline of the lower pole. (D) The nipple and areola are oversewn. This patient is featured in the video (Video 14.1) along with preoperative marking, anesthesia, surgery, and 24-hour postoperative photographs.

is generally overlooked as a complication. An inverted teardrop areola shape (Fig. 14.5) may compromise an otherwise excellent result.

Fortunately, an inverted teardrop areola deformity is usually avoidable. As the vertical ellipse is closed, a dog ear is produced superiorly. The topography of this local skin excess is variable, depending on the width of the vertical ellipse, skin laxity, and the possible simultaneous use of an implant. The shape of redundant skin to be excised is unlikely to exactly match a preoperative marking. However, when this local skin redundancy is oversewn in the closed technique and then resected as a circle, there is better assurance of equal and balanced tension and circularity of the recipient site.[1,8]

Nipple Level

Nipple overelevation is an unavoidable consequence of the geometry of the inverted-T design, even when limiting the vertical limb to 5 cm.[8,11] Nipple overelevation may be avoided by using the vertical technique and intraoperative positioning of the nipple slightly below the level of maximum breast projection.[1]



• **Fig. 14.5** This 36-year-old woman demonstrates an inverted teardrop deformity of her left areola after a previous inverted-T mastopexy with implants. The areolae measured 6 cm in diameter, slightly greater than the desired 4–5 cm. She has a mild dog ear of the medial end of the left inframammary scar.

Nipple position is measured relative to the level of the breast apex, which is the only important anatomic landmark for nipple position. There is no consideration of its relationship to the sternal notch or IMF, a level that is hidden in photographs and known to be dynamic, making it an unreliable landmark.[7]

Nipple Repositioning, Not Transposition

Because of the upward movement of the nipple caused by creation of the new breast mound,[1] in most patients minimal nipple movement is needed (see Video 14.1). Nipple transposition was originally added to the inverted-T design in an attempt to preserve the nipple level because the skin flaps were paradoxically displaced downward, leading to predictable nipple overelevation with respect to the breast mound. The new paradigm is to correct the parenchymal disproportion and reposition the nipple when this is done. The nipple is temporarily oversewn and then pulled through and replaced atop the breast mound—nipple reposition, not transposition.

Using the vertical technique, which pushes the nipple and its pedicle up, the challenge for the surgeon is usually in keeping the nipple from being located too high on the breast mound, while still removing the excess skin (dog ear) that accumulates at the superior end of the elliptical resection.[1] Even in patients undergoing mastopexy/reduction who present with nipples located well below the level of maximum preoperative breast projection, the needed nipple elevation with respect to the breast mound is usually minimal. The greatest discrepancy between nipple level and maximum breast projection in the author's series was one patient who sought reduction whose down-pointing nipples were located 6.5 cm below the plane of maximum preoperative breast projection.[1] Therefore, the maximum distance needed to move the nipple relative to the surrounding breast tissue was 6.5 cm. Short pedicles greatly improve the reliability of nipple/areola perfusion, avoid the need for nipple grafting, and reduce the incidence of nipple loss to almost none.[11]

Postoperative Care and Expected Outcomes

Patients are seen in the office on the day after surgery. The dressings are removed, and bathing is allowed on the first postoperative day. Steri-Strips are typically left on for up to 1 week. Patients insert a gauze dressing within the sports bra, which is worn day and night for 2 weeks. Patients sleep in a supine position for at least 2 weeks. Exercising is resumed 1 month after surgery.

The mean pain rating is 4.2 on a scale of 1–10. The mean time off work is 6 days. Patients report being "back to normal" in 1 month, on average. Most patients report being more comfortable wearing a bra. Scar dissatisfaction is about 14%. Although the surgery is performed to improve appearance, a surprising number of women report improvement in back, shoulder, or neck pain, similar to patients who have undergone reduction surgery.[13]

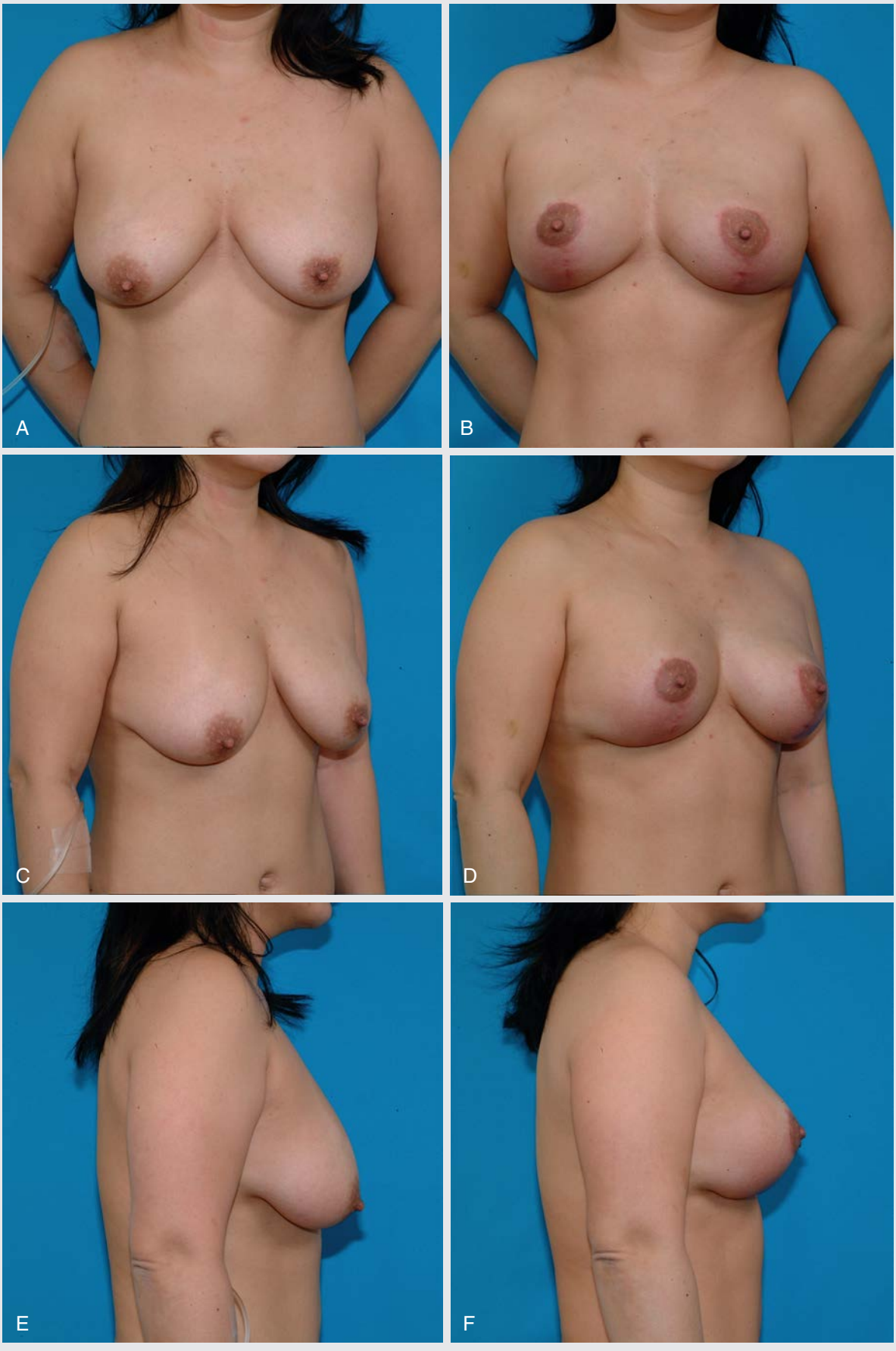
Patient satisfaction in the authors' patient-reported outcome study was 97%, with all women reporting that they would do it again. The mean result rating was 8.9 on a 1–10 scale (range, 5–10). The percentage of women reporting that they were self-conscious about their breasts before surgery was 92%, versus 11% after surgery. An improvement in self-esteem was reported by 89% of women, and 70% of patients reported an improved quality of life.[13]

Case Examples

Examples of women treated with vertical mastopexy are provided in Cases 14.1, 14.2, and 14.3

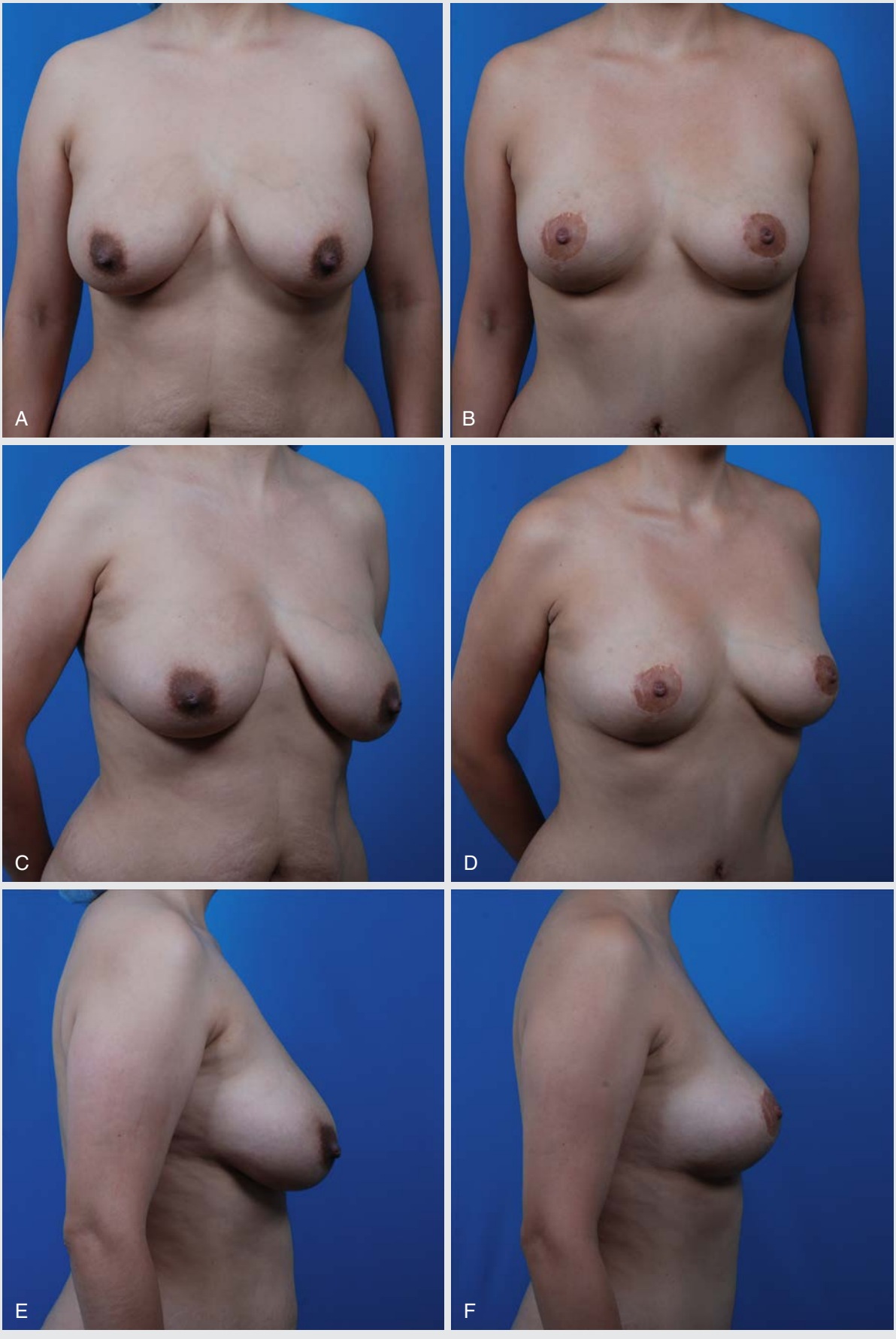
CASE 14.1

A 36-year-old woman before (Case 14.1A, C, E) and 4 months after (Case 14.1B, D, F) a vertical mastopexy. Resection weights: right, 78 g; left, 18g.



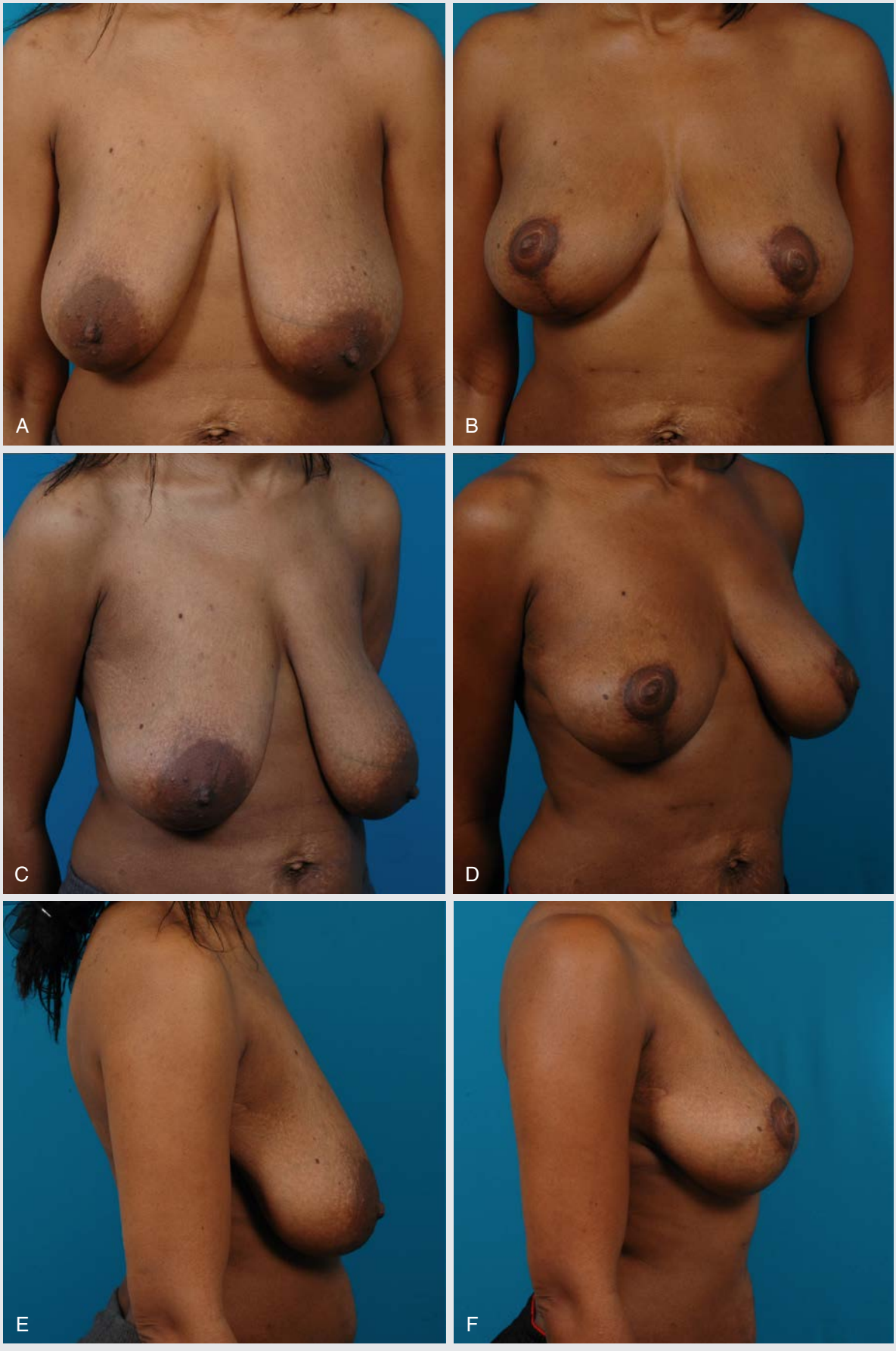
CASE 14.2

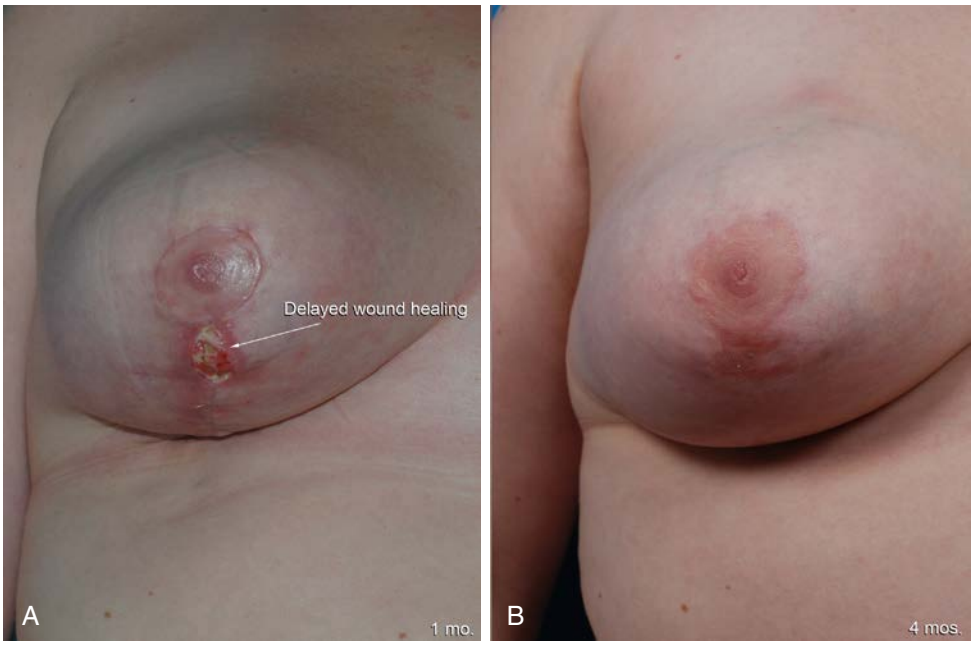
A 30-year-old woman before (Case 14.2A, C, E) and 1 year after (Case 14.2B, D, F) vertical mastopexy, abdominoplasty, and liposuction of lower body, arms, and axillae. Resection weights: right, 175 g; left, 196 g.



CASE 14.3

A 36-year-old woman before (Case 14.3A, C, E) and 6 months after (Case 14.3B, D, F) a vertical mastopexy. Resection weights: right, 122 g; left, 212 g.





• **Fig. 14.6** (A) Delayed wound healing 1 month after vertical mammaplasty in a 26-year-old woman. This wound was allowed to heal spontaneously. No revision was needed. (B) The healed wound is seen 4 months after surgery.

Management of Complications

In the author's clinical study, there were no major systemic complications, no deep venous thromboses, and no pulmonary emboli.[2] No patient required a blood transfusion or hospital admission. The complication rate after mastopexy was 33%. The most common complication was persistent ptosis (12%), followed by a scar deformity (10.5%) and size asymmetry (5.3%). There were no cases of nipple or areola loss.

In evaluating mastopexy and breast reduction, there were no significant correlations between the incidence of complications and body mass index, resection weights, or combination procedures.

Published complication rates for vertical mastopexy and breast reduction vary widely, depending largely on the surgeon's definition of a complication.[2] If persistent ptosis, suboptimal scars, non-circular areola, and minor delays in wound healing (Fig. 14.6) are counted, the complication rate approaches 100%.[2] Fortunately, patients usually do not report persistent ptosis, scar deformities, and areolar irregularities as complications.[13] With appropriate preoperative counseling, patients accept that fine-tuning is to be expected and report complication rates much lower than their surgeon (5.6% after mastopexy).[13]

Notably, there were fewer seromas (0.8%) encountered among patients undergoing vertical mammaplasty (including breast reductions) in the author's study than in some other series.[2] This favorable experience may be related to the use of a wedge-shaped parenchymal excision without skin undermining, no liposuction, and the use of scalpel dissection rather than electrodissection.[2]

Secondary Procedures

The high rate of revisions after vertical mastopexy and reduction (7%–24%) is a well-known and frequently cited disadvantage of the vertical technique.[2] However, this frequency of revisions is partly related to the fact that such revisions are possible. Problems associated with an inverted-T technique do not lend themselves easily to surgical revision. If shape considerations are given the importance they deserve, the inverted-T technique has a consistently high level of complications such as flattening of the upper poles, loss of breast projection, squaring of the lower poles, and nipple overelevation.[8]

Revision rates may reflect the surgeon's level of perfectionism as much as the patient's and a favorable pricing policy. Patient satisfaction remains high despite the frequency of revisions.[13,14]

The author's published clinical series includes his first 100 patients treated with vertical mastopexy.[2] Lessons learned include greater resection of lower pole parenchyma and more tightening of the lower pole. With these adjustments, the need for revisions for persistent ptosis has dropped in half, from about 10% to 5% for the most recent 100 cases.[5]

Notably, there was no increased risk for secondary mastopexy or reduction. In the author's study, all previous mastopexy procedures had been performed using the inverted-T technique and all were revised using the vertical method.[2] Although it might seem logical to reuse the same resection pattern in secondary cases, out of concern for blood supply across periareolar scars, in practice this precaution seems unnecessary.

Combined Procedures

A practical benefit of the vertical mastopexy is a greater capability for combination ("mommy makeover") procedures. Operating times for vertical mastopexy are about 1 hour shorter than for inverted-T procedures.[2,9] By shortening operating times and reducing blood loss,[2,9] combinations with other cosmetic procedures, such as liposuction and abdominoplasty, may be undertaken safely, with appropriate attention to anesthetic considerations and blood loss.[15]

Conclusion

A vertical mastopexy provides an ideal conical breast shape with less scarring than the traditional inverted-T method. Vascular safety of the nipple is improved, and nipple sensation may be better preserved. Operating time and blood loss are reduced. All breast sizes may be treated, and implants may be safely inserted simultaneously.

PEARLS FOR SUCCESS

- A vertical mastopexy outperforms other methods in providing greater breast and upper pole projection, IMF elevation, and more conical lower poles.
- Autoaugmentation methods, fascial sutures, and implantable mesh are ineffective.
- A single-stage augmentation/mastopexy is indicated when the patient wishes to substantially increase upper pole fullness.
- Use a medial pedicle and preserve deep parenchyma to maximize nipple sensation.
- Site the nipple position intraoperatively using a marking ring (≤40 mm) just below the breast apex to avoid nipple overelevation and an inverted-teardrop areola deformity.
- A vertical lift provides 80% of the breast mound elevation. Minimal nipple movement is needed.
- Short pedicles greatly improve the reliability of nipple/areola perfusion and reduce the incidence of nipple loss to almost none.
- T off the lower end of the mammaplasty when needed to avoid a scar below the IMF.
- Adequately resect lower pole parenchyma to avoid a postoperative "mastopexy-wrecking bulge."

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15

Mastopexy—Inverted T Approach

M. BRADLEY CALOBRACE AND CHET MAYS

Introduction

Breast ptosis is one of the most common issues seen for evaluation in a plastic surgeon's office. It can be developmental or more commonly acquired, secondary to weight loss, hormonal changes, pregnancy, and aging. A mastopexy is reserved for a patient for whom the major concern is breast ptosis and not an issue of volume, because the procedure repositions the breast with only limited removal of breast tissue.

There are many types of mastopexy techniques described to address the ptotic breast. The techniques are often described in reference to the final scar placement, such as the circumareolar technique,[1] circumvertical technique,[2,3] and inverted-T scar technique.[4,5] However, there is much more variation in the techniques, including the vascular pedicle orientation, management of the parenchyma, and additional ancillary procedures to enhance the results.

The inverted-T scar technique has been the most widely used technique for both mastopexy and breast reductions because of its versatility, ease in execution, and predictable results.[4] Excessive unwanted skin often plaguing a ptotic breast is addressed and excised as part of the procedure. The disadvantage is of course the presence of an additional scar along the inframammary fold (IMF) and failure to maintain lower pole stability over time.

In this chapter, we will describe our preferred technique for an inferior pedicle inverted-T mastopexy with or without mesh-reinforcement and the superior pedicle circumvertical mastopexy with inverted-T scar with or without auto-augmentation. Special emphasis will be placed on preoperative decision making and technical details of the operative approach.

Indications and Contraindications

The ideal candidate for a mastopexy alone is a patient who is relatively satisfied with her volume and is mainly looking for correction in her breast ptosis and improvement in breast shape. The ideal candidate has adequate breast volume and enough ptosis to warrant a mastopexy and the scars associated with these procedures. In the authors' opinion, the inverted-T mastopexy is an excellent alternative for anyone who meets the criteria for a mastopexy based on its versatility, allowing for different pedicle designs, parenchymal manipulations, and use of ancillary techniques, such as mesh placement (Fig. 15.1)

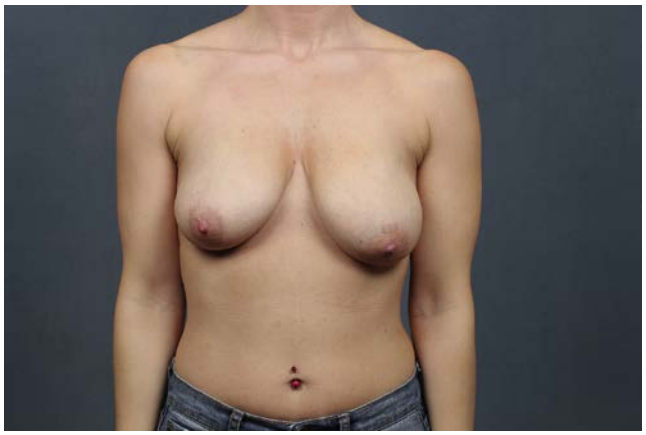
There are a few patients in whom a mastopexy alone is not an ideal procedure. A patient desiring considerably more volume or significant upper pole volume and cleavage would be better served with an augmentation mastopexy technique (Fig. 15.2). The exception would be the patient desiring those attributes, but the simultaneous procedure is deemed inappropriate or unsafe. In these cases, a mastopexy can be performed at the initial procedure, followed at least 6 months later with a breast augmentation (two stages). Additionally, a patient with mammary hyperplasia desiring significant volume reduction would be better served with a reduction mammoplasty.

Preoperative Evaluation and Special Considerations

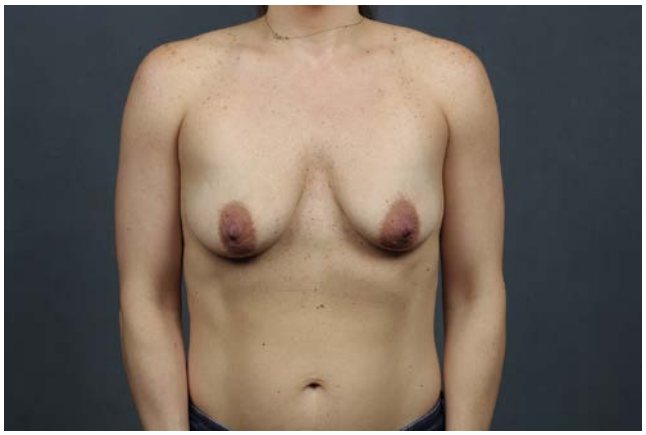
The preoperative evaluation is used to determine the mastopexy technique that will achieve an optimal outcome that meets the patient's desired results (Box 15.1).

Ptosis was described by Regnault based on the relationship of the nipple–areola complex (NAC) to the IMF[6] (Table 15.1).

The inverted-T technique is reserved for patients with significant ptosis and vertical excess that will benefit from skin excision along the fold. For patients with less ptosis and minimal vertical excess, a circumareolar or circumvertical mastopexy can be performed without the need for skin removal along the fold. In our experience, if the distance from the new nipple position to the fold is less than 10 cm, most likely only a vertical or a vertical with small horizontal wedge or J-extension will be adequate for correction, most commonly using a superior pedicle. To avoid the inframammary scar with a circumvertical mastopexy, the tissue at the base of the breast is resected internally causing elevation of the fold with the excess vertical length tucked under the new breast fold, eliminating the need for the horizontal scar. This



• **Fig. 15.1** Ideal candidate for mastopexy only based on the breast volume and current size of the breast. This patient would benefit from lifting the breast to restore a symmetric elevated location of the NAC.



• **Fig. 15.2** Ideal candidate for augmentation mastopexy. The ptotic breast has lost upper pole volume and become flattened with a loss of projection. Lifting the NAC and adding volume to the breast with an implant would restore a more youthful breast.

• BOX 15.1 Analysis of the Ptotic Breast

1. Relationship of the NAC to the IMF (Regnault's degree of ptosis)
2. Amount of breast tissue overhanging the fold
3. Location of the NAC on the breast mound
4. Amount of vertical excess and horizontal excess

has been less satisfying in our hands, and we always prefer to excise vertical excess skin through an inverted-T excision to achieve long-term success. Not removing the skin at the fold increases the risk of fold malposition, scar irregularities or dog ears, or elongation of the lower pole with bottoming-out over time.

When an inverted-T scar technique is selected, the decision on whether to use a superior pedicle or inferior pedicle must be determined. That decision is based mostly on the amount of ptosis, the quality of the breast tissue, and the position of the NAC. For patients with good-quality breast tissue and if the amount of NAC elevation is less than 5–6 centimeters, a superior pedicle is used with a circumvertical mastopexy inverted-T scar (Fig. 15.3). An auto-augmentation may be performed with this approach if appropriate.

In breasts with poor-quality tissue with associated laxity and ptosis, if the NAC elevation is greater than 6 cm, an inferior pedicle inverted-T mastopexy is our preferred technique (Fig. 15.4). Often, a mesh reinforcement is secured across the inferior pedicle to limit the lower pole stretch from the extra volume of the pedicle being retained in the lower pole. Whereas the superior pedicle technique may not be suitable for all patients undergoing mastopexy based on the limitations in pedicle length, the inferior pedicle has much greater versatility and can be used for most ptotic breasts based on a variety of factors, including surgeon preference.

Surgical Technique

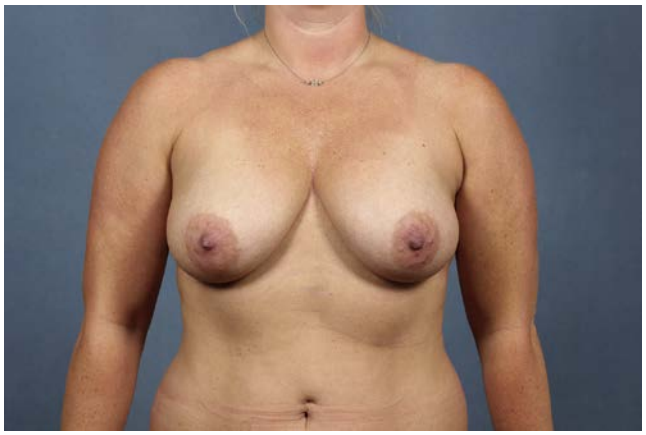
Relevant Surgical Anatomy

The breast is a structure composed of breast lobules enveloped in a superficial fascial system. Many aspects of the breast composition contribute to the shape and stability of the breast. Assessment should include evaluation of the skin thickness and elasticity, the quantity and distribution of subcutaneous fat, the composition and firmness of the breast parenchyma, the integrity of the Cooper's ligaments, the nature and position of the underlying musculature, and the shape and slope of the underlying chest wall. All of these aspects influence the shape of the breast and ultimately the outcome after the mastopexy. Thin skin with a lax skin envelope, fatty composition and elongated Cooper's ligaments would predictably be qualities associated with poor outcomes in maintaining upper pole volume and shape postoperatively (Fig. 15.5).

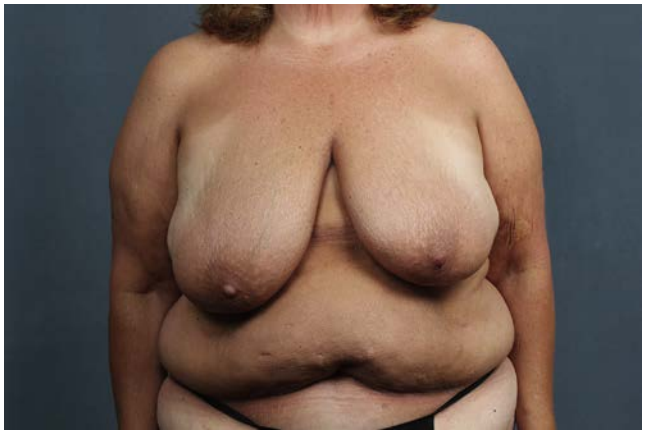
Although this provides some information about the degree of breast ptosis, it is insufficient to describe the true extent of breast ptosis. A more complete assessment of ptosis is summarized in (Table 15.1). When performing a mastopexy, an understanding and assessment of the vascular anatomy is critical to performing the procedure safely. The breast has a rich blood supply from multiple sources, including the internal mammary artery (IMA) perforators, the lateral thoracic arteries, the thoracoacromial, anterolateral, and anteromedial intercostal perforators. The superior pedicle is supplied by the second branch of the IMA that emerges deep from the second interspace and courses superficially across the medial upper breast to enter the NAC slightly medial to the midline and approximately 1 cm deep. The medial pedicle is supplied by the third branch of the IMA that emerges from the third interspace and similarly courses superficially across the breast parenchyma to the medial aspect of the NAC. The inferior pedicle and central pedicle are supplied by the fourth branch of the IMA that courses deeply across the medial breast to enter through the Wuringer's septum approximately 1–2 cm above the IMF and just medial to the breast meridian. The inferior pedicle also has additional blood supply through contribution from intercostal perforators along the IMF[7] (Fig. 15.6).

TABLE 15.1 Regnault's Classification of Breast Ptosis

Breast Ptosis		
True ptosis	Grade I	Areola at the level of the mammary crease and above the contour of the gland
	Grade II	Areola below the level of the mammary crease and above the contour of the gland
	Grade III	Areola below the level of the mammary crease and below the contour of the gland
Glandular ptosis		Areola above the crease and gland ptosis
Pseudoptosis		Areola above the mammary crease. Loose skin because of hypoplasia



• **Fig. 15.3** Preoperative photograph of the patient in Case 15.3 representing good-quality breast tissue and a NAC position that will not need to be lifted more than 5–6 cm, which is ideal for a superior pedicle with an inverted T-mastopexy.



• **Fig. 15.4** Preoperative photo of the patient in Case 15.1 represents a breast with poor-quality tissue, associated ptosis, and laxity requiring NAC elevation greater than 6 cm requiring an inferior based pedicle inverted-T mastopexy.

Preoperative Markings

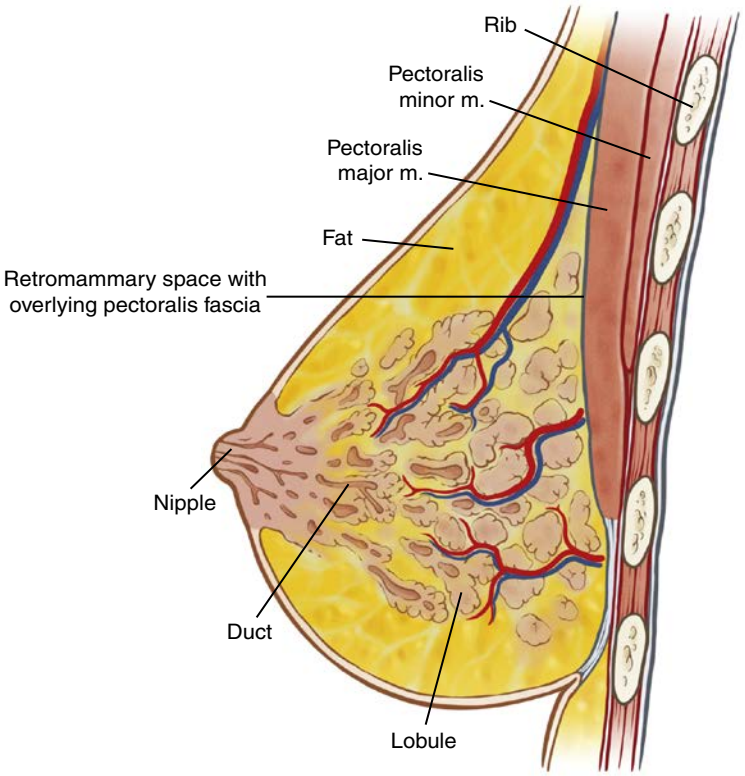
The markings guide the surgeon in providing symmetric NAC placement and mastopexy design. The patient is sitting upright during the markings. A line is initially drawn along the midline of the breasts and bilaterally down the meridians. The meridian lines bisect the breast equally and may not intersect though the nipple if there is NAC malposition. The IMFs are then drawn, noting any asymmetries to be addressed at surgery.

The position of the IMF is then drawn on the anterior breast through the meridian incision. The breasts are rotated medially and laterally to mark the location of the vertical incisions. Placement of the areola is then marked, starting approximately 2 cm above the nipple position and extending the curved drawing down to meet the medial and lateral vertical markings (Fig. 15.7). This areolar opening marking should produce an areolar opening of approximately 42 mm. Approximately 7 cm below the bottom of the keyhole opening, a line is drawn marking the inferior extent of the vertical incision. Curved transverse lines are then drawn from these medial and lateral points extending down to the IMF.

When performing a superior pedicle technique, approximately 2–3 cm above the fold a U-shaped line connects the medial and lateral vertical markings to define the extent of skin resection (Fig. 15.8). With inferior pedicles, the entire lower segment between the two medial and lateral vertical lines is de-epithelialized, making this line unnecessary (Fig. 15.9).

Intraoperative Markings

Once the patient has been prepped for the operative procedure, all markings are confirmed and retraced as necessary. The symmetry of the drawings is also confirmed. If any questions exist as to the accuracy of the markings, "tailor-tacking" can be performed in many cases to reconfirm the markings. "Tailor-tacking" is performed with a stapler, and the patient is placed in the upright position to confirm design, symmetry, and NAC positioning. In the supine position, the staples are removed and the selected pedicle is designed and then marked out. For the superior pedicle technique, the pedicle



• **Fig. 15.5** Illustration of the breast, highlighting the pertinent anatomy of the breast. *m,* Muscle. (Reproduced with permission from Standring S, editor. *Gray's anatomy.* 41st ed. London: Churchill Livingstone; 2015.)

TABLE 15.2 Breast Local Anesthetic

0.5% lidocaine plain	25 mL
0.5% lidocaine/1:200,000 epinephrine	25 mL
0.5% bupivacaine/1:200,000 epinephrine	25 mL
Injectable saline	25 mL
0.25% lidocaine, 0.125% bupivacaine, 1:400,000 epinephrine	100 mL

is positioned in the superior keyhole from the 8 o'clock to 4 o'clock position. If using an inferior pedicle, the markings include at least a 1-cm cuff around the areola and is designed between the vertical and lateral pillars extending down to the IMF. The pedicle is designed with a width of approximately 6–8 cm based on the length of the pedicle, ensuring the length-to-width ratio does not exceed 2:1.

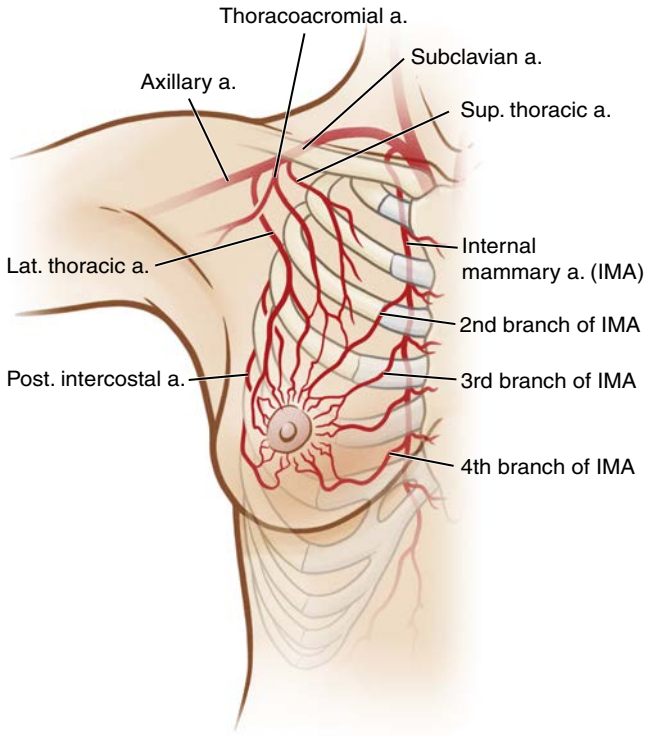
Details of the Procedure

Inferior Pedicle Inverted-T Mastopexy With Mesh Reinforcement

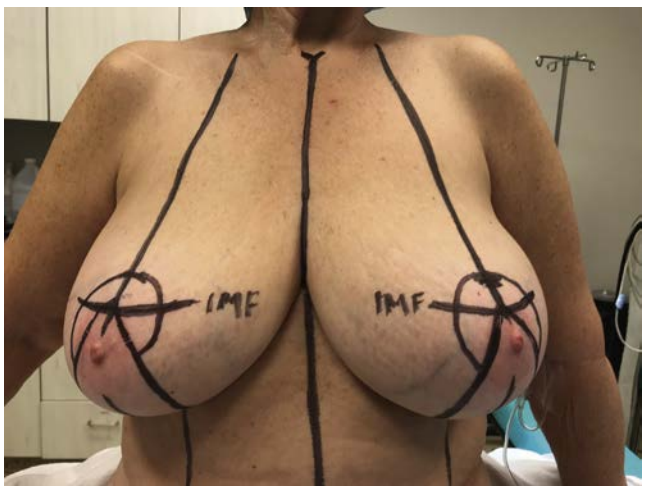
Each breast is placed under maximal stretch, and the areolae are marked with a 42-mm cookie cutter (range 38–45 mm, depending on desired aesthetics) and superficially incised with a no. 15 blade scalpel (Fig. 15.10). Incisions are then made along the planned skin resection for the inverted-T mastopexy. The inferior pedicle is then de-epithelialized from the IMF to the NAC, ensuring to include at least a 1-cm cuff of dermis around the NAC (Fig. 15.11). Care is taken to preserve the subdermal plexus during the de-epithelialization. Dissection is then carried out around the entire de-epithelialized inferior pedicle, ensuring not to narrow the base of the pedicle at its attachments to the chest wall perforators by beveling outward to maintain its integrity and bulk (Fig. 15.12). The medial and lateral dermoglandular segments are then resected. The upper breast skin flaps are then undermined to the pectoral fascia, excising fat and glandular tissue as necessary for shaping.

The inferior pedicle is positioned centrally in the pocket, and 2-0 Vicryl sutures are placed from the pedicle to pectoralis fascia to stabilize its position (Fig. 15.13). It is helpful if possible to secure the pedicle from the dermis to the fascia for the best suture purchase, but this is not always feasible. The inferior pedicle has to be stabilized in a position that allows the NAC to be brought through the keyhole once the position of the NAC is confirmed and the opening created.[8]

To ensure stability, we place a piece of poly-4-hydroxybutyrate mesh (GalaFLEX) reinforcement across the inferior pedicle stabilized with 2-0 Vicryl sutures on the medial and lateral pectoralis fascia[9] (Fig. 15.14). The size of the mesh is variable, but in general a piece that is 5 × 15 cm per side has been adequate to create stability of the pedicle. This



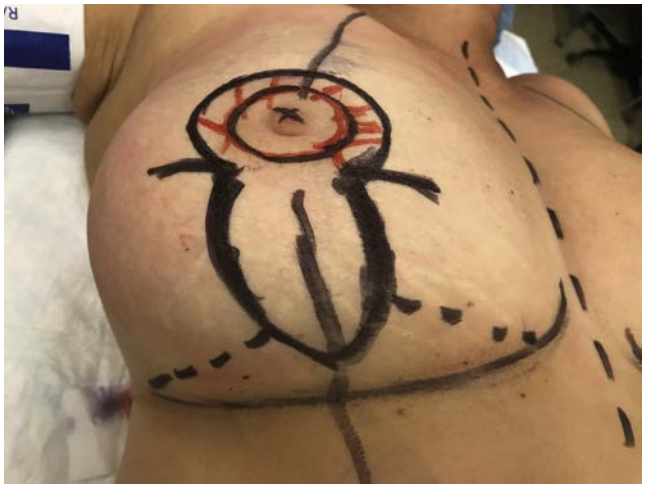
• **Fig. 15.6** Illustration highlighting the vascular anatomy of the breast. As can be seen, the breast has a variety of vessels responsible for the overall blood supply. The vessels shown are the reasons that different pedicles can be used when performing a mastopexy. *a,* Artery; *lat.,* lateral; *post.,* posterior; *sup.,* superior.



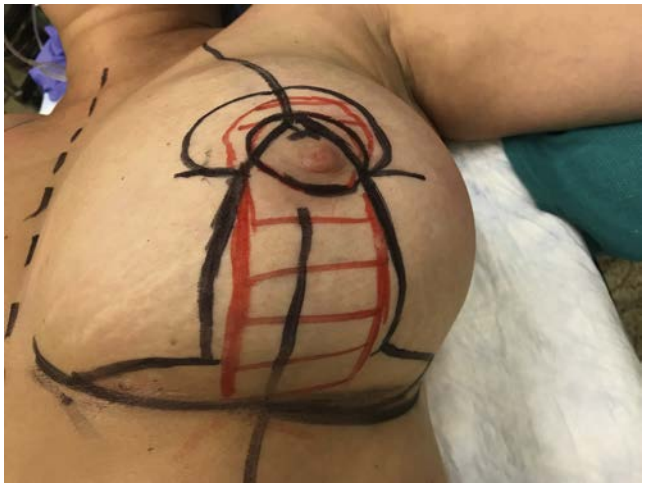
• **Fig. 15.7** Preoperative marking showing the inverted-T mastopexy design with the nipple position transposed from the IMF (the Pitanguy point) and the planned NAC markings 2 cm superior to the IMF.

mesh resorbs in 12–18 months but with retention of wound strength often four to five times the strength of the native tissue. The mesh should be placed snug enough to stabilize the pedicle but without compressing or compromising the circulation through the inferior pedicle.

The wounds are irrigated, and hemostasis is established with electrocautery. The NAC circulation is assessed for arterial and venous bleeding from the cut edges. The skin



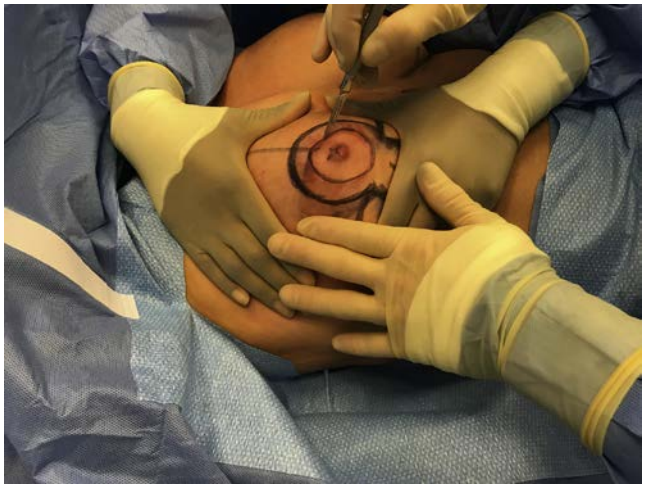
• **Fig. 15.8** Preoperative markings of the superior pedicle, which is noted by the *red marker.* The medial and lateral pillars are noted with the thickened vertical lines. The *transverse dotted lines* represent the planed medial and lateral resection breast tissue resection. Note the *U-shaped line* connecting the inferior extent of the medial and lateral markings, which defines the extent of the skin resection.



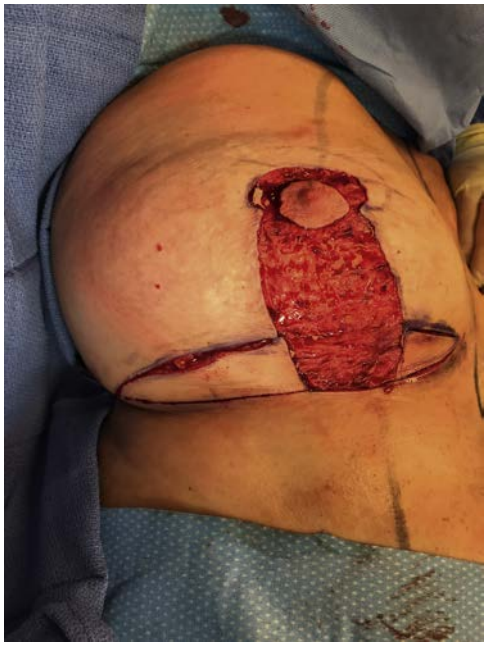
• **Fig. 15.9** Inferior pedicle markings shown in *red marker.* The inferior pedicle extends down to the IMF. The inverted-T mastopexy markings and planned NAC position are shown in *black marker.*

is temporarily brought together with staples to confirm the final shape. The patient is then placed in the upright position to assess the volume, contour, and symmetry of the breast (Fig. 15.15). Tailor-tacking to make some final adjustments in the shape of the breast is almost always performed to create the optimal postoperative outcome.

While the patient is upright the position of the NAC can be selected (Fig. 15.16). A cookie cutter is placed at the apex of the vertical incision and positioned in an aesthetically pleasing location. The inferior areola-to-IMF position is generally 5–7 cm based on the final breast size. Symmetry is confirmed by measuring the distance from the midline to medial areola and also by placing a suture at the sternal notch and checking that equal distance is achieved to the top of each areola. With the patient supine, the staples are

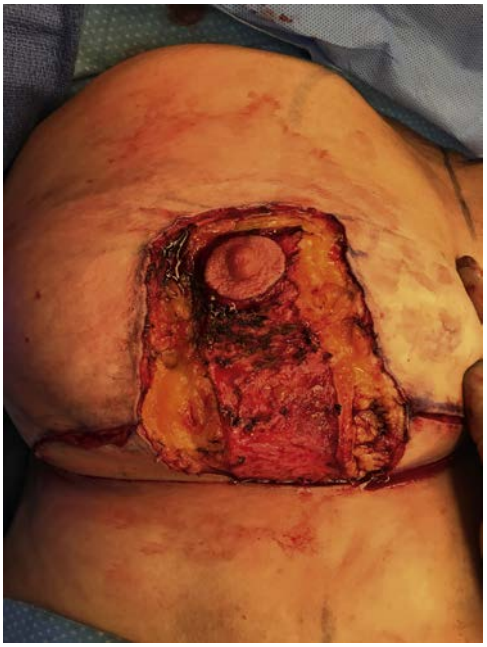


• **Fig. 15.10** The breast is placed under the stretch by the assistant and the 42-mm NAC is cut superficially with a no. 15 blade scalpel.

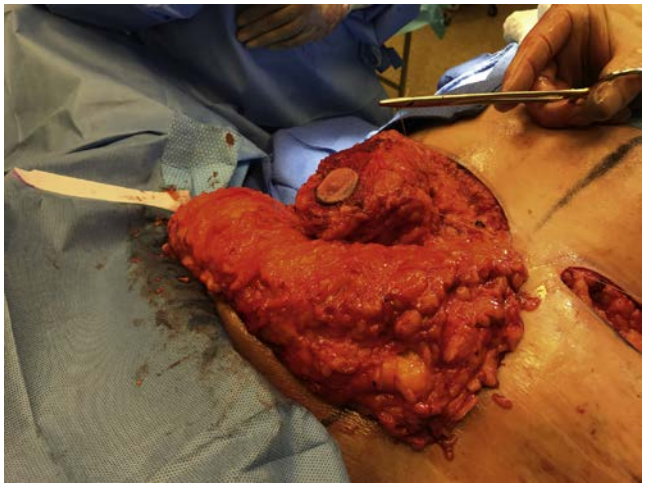


• **Fig. 15.11** The inferior pedicle has been de-epithelialized with at least a 1-cm cuff of dermis around the new NAC.

removed and the keyhole and any additional tissue marked during tailor-tacking are excised. The pockets are irrigated with bacitracin saline solution and hemostasis is ensured. Deep parenchymal sutures of 2-0 Vicryl are then placed along the vertical incision bringing the medial and lateral pillars together at the midline. The incisions are then closed with interrupted 3-0 PDS dermal sutures. The vertical and horizontal scars are closed with a 4-0 Monocryl running subcuticular suture. The areolae are then closed with a simple running 5-0 nylon suture. Steri-Strips are placed over the incision. Contour tape is then placed along the lateral breast border and IMF. The breasts are wrapped with a gauze and elastic wrap to provide gentle compression and support.



• **Fig. 15.12** The inferior pedicle has been de-epithelialized and dissected with electrocautery, being careful to bevel outward to avoid narrowing the pedicle to maintain the blood supply and the bulk of the tissue.

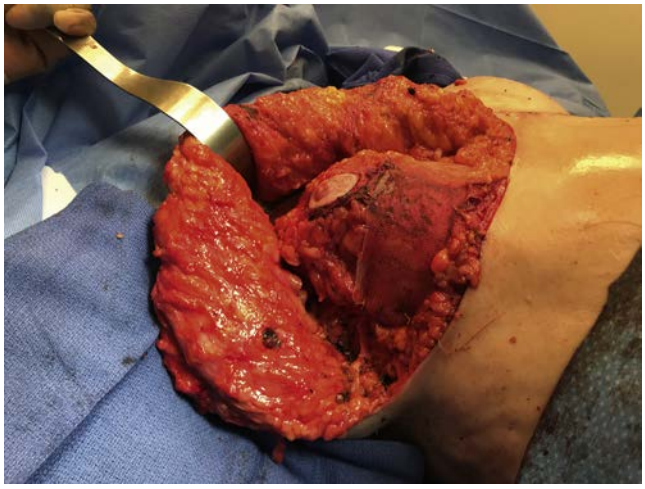


• **Fig. 15.13** The inferior pedicle has been positioned centrally in the pocket, and then 2-0 Vicryl sutures were placed from the pedicle to the pectoralis fascia to stabilize its position.

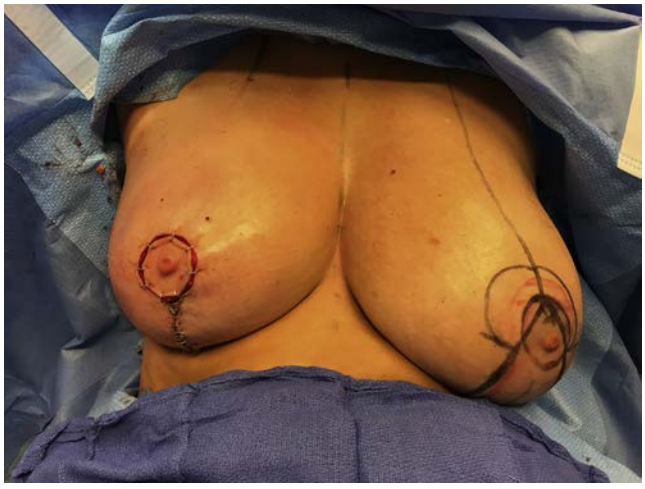
Details of the Procedure

Superior Pedicle Circumvertical Mastopexy With Inverted-T Scar

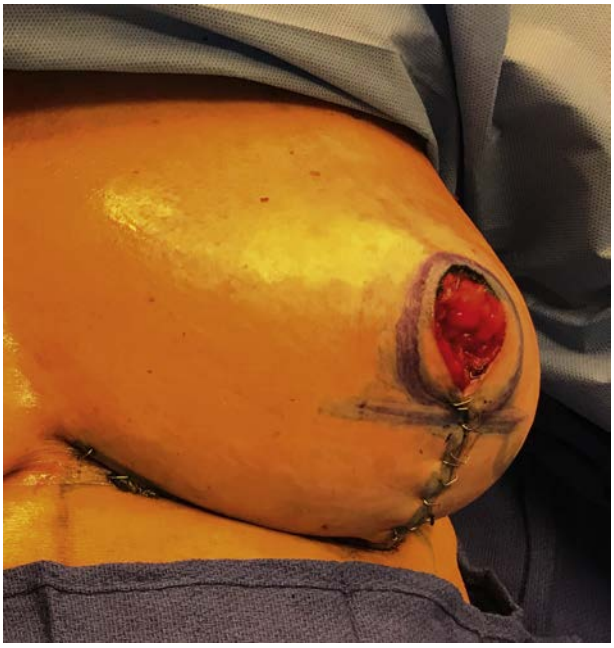
Each breast is placed under maximal stretch, and the areolae are marked with a 42-mm cookie cutter (range 38–45 mm depending on desired aesthetics) and incised with a no. 15 blade scalpel. Using a no. 10 blade, the entire area within the marks is then de-epithelialized and cauterized for hemostasis. The lateral and medial flaps are dissected straight down toward the chest wall. The lateral and medial pillars



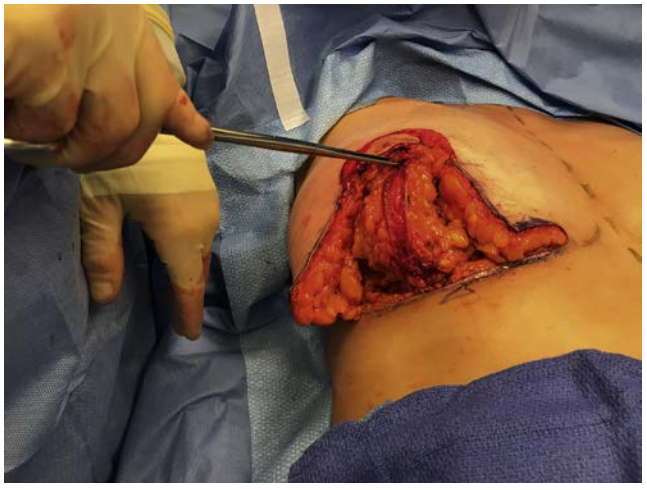
• **Fig. 15.14** The inferior pedicle has been stabilized with a piece of mesh (GalaFLEX) across the lower pole that is sutured with a 2-0 Vicryl to the medial and lateral pectoralis fascia.



• **Fig. 15.15** The right breast with an inferior pedicle has been tailor-tacked with staples to show the difference between the two sides. The contralateral breast will be dissected and tailor-tacked in a similar fashion.



• **Fig. 15.16** The left breast has been tailor-tacked with staples to evaluate the shape and volume of the breast. The keyhole has been cut for the NAC on the inferior pedicle.



• **Fig. 15.17** Inferior island flap has been elevated on the central pedicle from the deep branch of the fourth internal mammary artery.

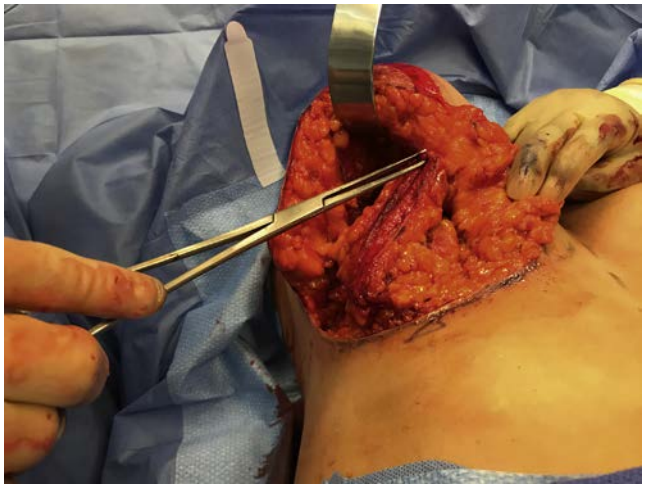
are then developed, keeping them at least 2 cm thick. If there is additional breast tissue deep to the developed pillars, this is either resected if it is not needed or mobilized from lateral to medial and sutured to the main pedicle with 2-0 Vicryl suture to maintain volume.

Option 1: Standard Approach

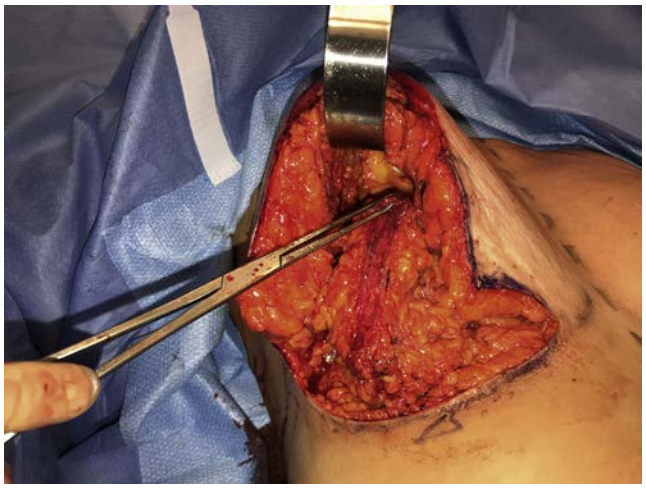
This central main pedicle located in the lower pole is then dissected off the pectoralis fascia starting inferiorly and progressing superiorly under the central pedicle to the upper portion of the breast. This allows the entire breast to be effectively mobilized superiorly. With retractors under the breast, approximately four 2-0 Vicryl Marchac sutures are placed between the deep breast parenchyma and the pectoralis fascia.[5] This central pedicle in the lower pole is then sutured in an elevated position approximately 1–2 cm above the IMF. This stabilizes the tissue in a higher position during the healing process and elevates the IMF. Care must be taken not to elevate too much or aggressively evacuate the lower pole, because this can lead to a flattening in the lower pole or retraction of the IMF superiorly, creating a contour defect along the fold.

Option 2: Lower Island Flap Auto-Augmentation

An alternative to the previously described approach is to use the central pedicle in the lower pole as a flap to transposition into the upper pole, as originally described by Ribeiro et al.[10] and more recently by Hammond and O'Connor.[11] Instead of elevating this central lower island flap off of the fascia, a flap is created that is based off the central pedicle



• **Fig. 15.18** An Allis clamp is shown mobilizing the inferior island flap while the superior pedicle and NAC are retracted superiorly with the Deaver retractor.



• **Fig. 15.19** The lower island flap is transposed into the upper pole and sutured with a 2-0 Vicryl suture to give auto-augmentation volume.

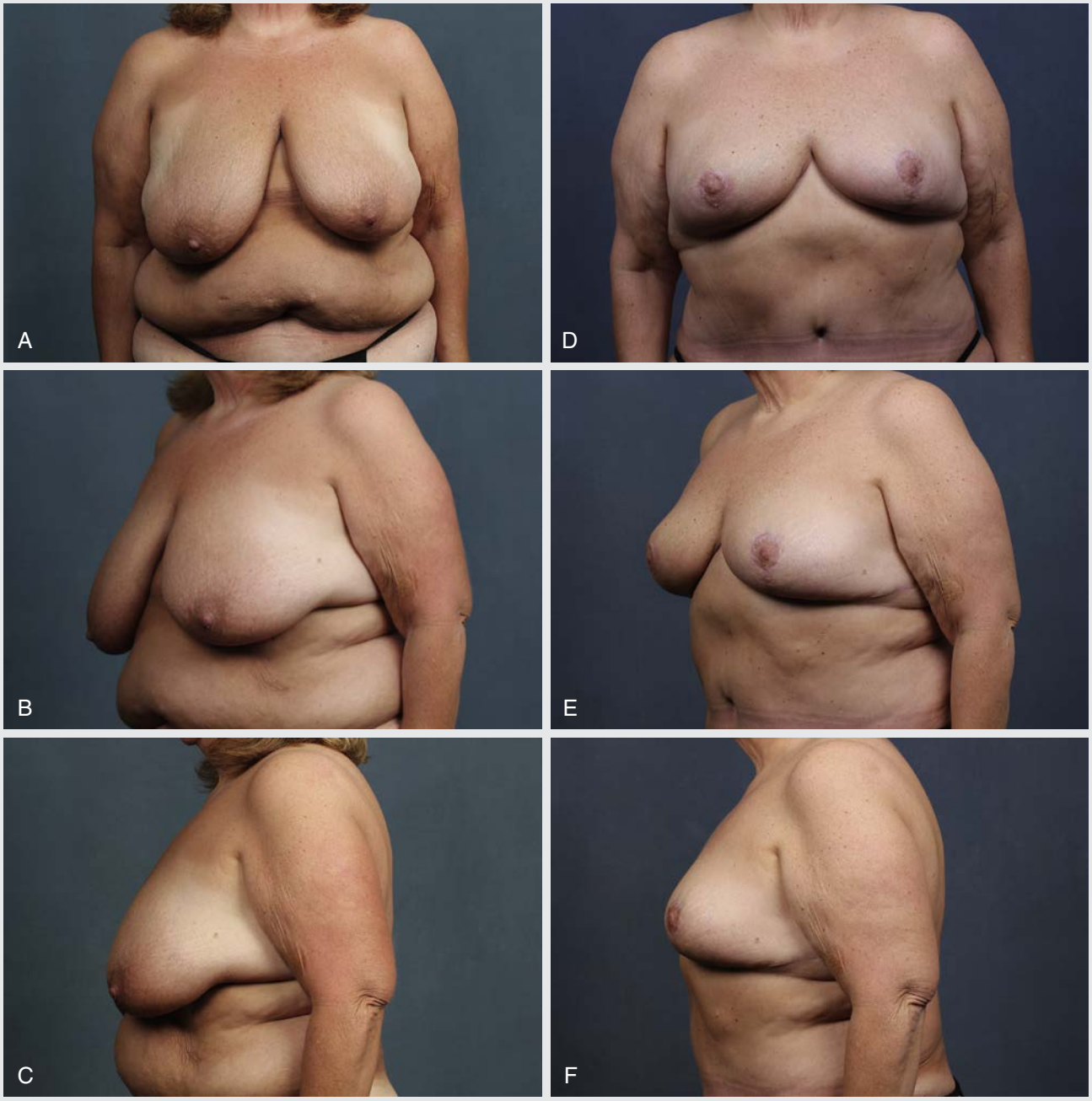
just above the IMF. This flap is dissected circumferentially and then incrementally dissected to free its attachment to create a mobile flap still attached to the deep fourth branch of the IMA that courses through the Wuringer's septum. Once the flap has been dissected and released for mobilization, the remainder of the breast above the flap is elevated off of the pectoralis fascia. The lower island flap is then transposed into the upper pole and sutured into place with approximately four 2-0 Vicryl sutures (Figs. 15.17–15.19).

Once the parenchyma is positioned and stabilized, tailor-tacking is performed to confirm the shape of the breast. Tailor-tacking begins at the inferior areola (6-o'clock position) and proceeds inferiorly toward the IMF. The ideal inferior areola-to-IMF distance varies based on the size of the breast but is usually 6–7 cm. Adjustments are made with tailor-tacking to create the desired breast shape. Markings for the horizontal wedge excisions are then extended medially and laterally to create the inverted-T scar. Once confirmed, all staples are removed and the horizontal wedge is excised. The pockets are irrigated with bacitracin saline solution, and hemostasis is ensured. Deep parenchymal sutures of 2-0 Vicryl are then placed along the vertical incision, bringing the medial and lateral pillars together at the midline. The incisions are then closed with interrupted 3-0 PDS dermal sutures. The vertical and horizontal scar is closed with a 4-0 Monocryl running subcuticular suture. The areolae are then closed with a simple running 5-0 nylon suture. Steri-Strips are placed over the incision. Contour tape is then placed along the lateral breast border and IMF. A bio-patch is placed at the base of the drain as it exits the skin, and the drain is secured with a 2-0 nylon. The breasts are wrapped with gauze and elastic wrap.

Case Examples

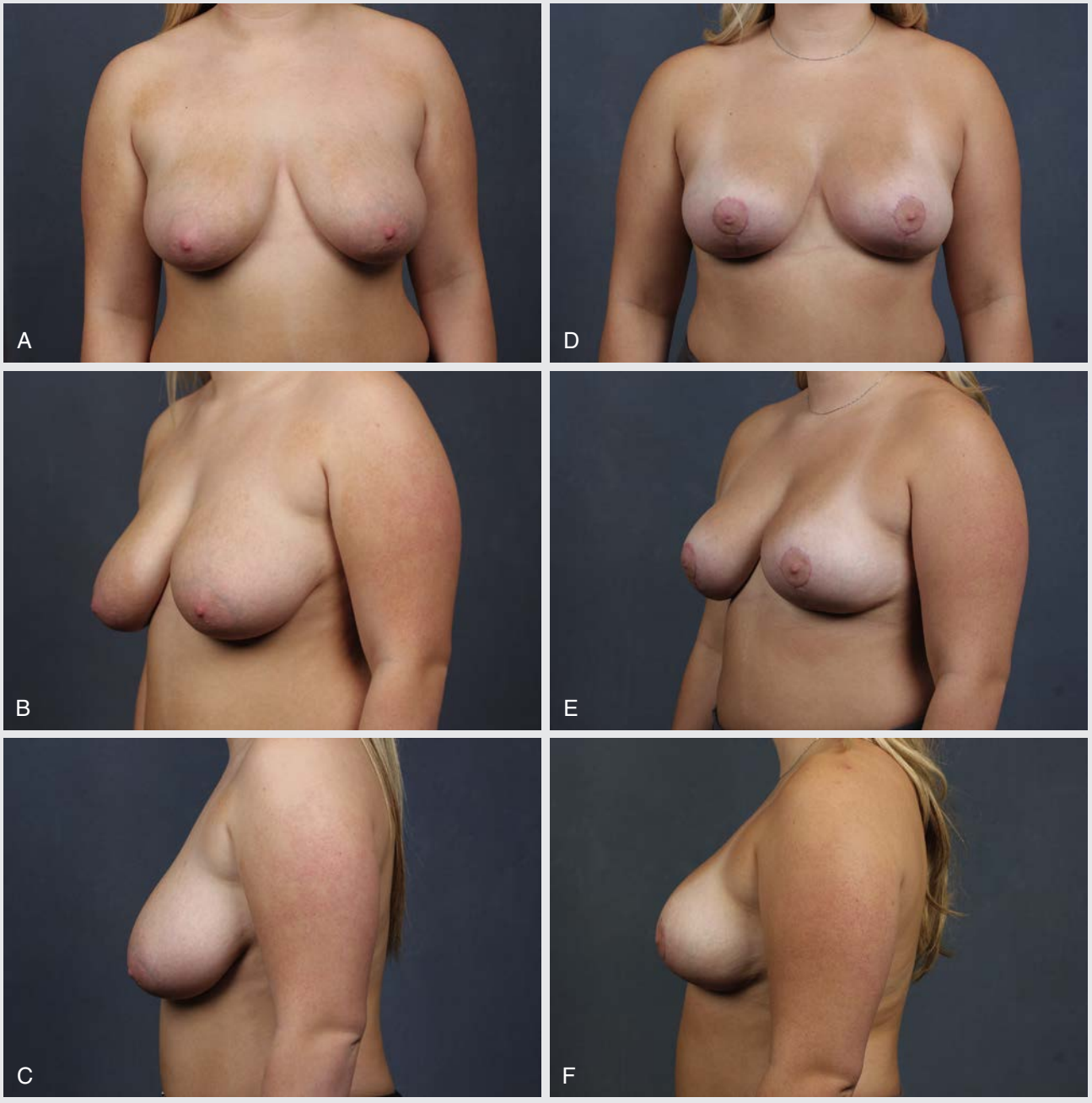
CASE 15.1

A 64-year-old patient presented desiring more uplifted and smaller full C cup breasts. She presented with asymmetric grade III ptosis with a sternal notch–nipple distance of 34 cm on the right and 32 cm on the left (Case 15.1A–C). Because of the amount of ptosis requiring significant NAC elevation greater than 6 cm, an inferior pedicle inverted-T mastopexy reduction was performed. The inferior pedicle was supported with mesh support (GalaFLEX). She has uplifted stable, symmetric breasts with no bottoming out, as demonstrated in her 4-month postoperative results (Case 15.1D–F).



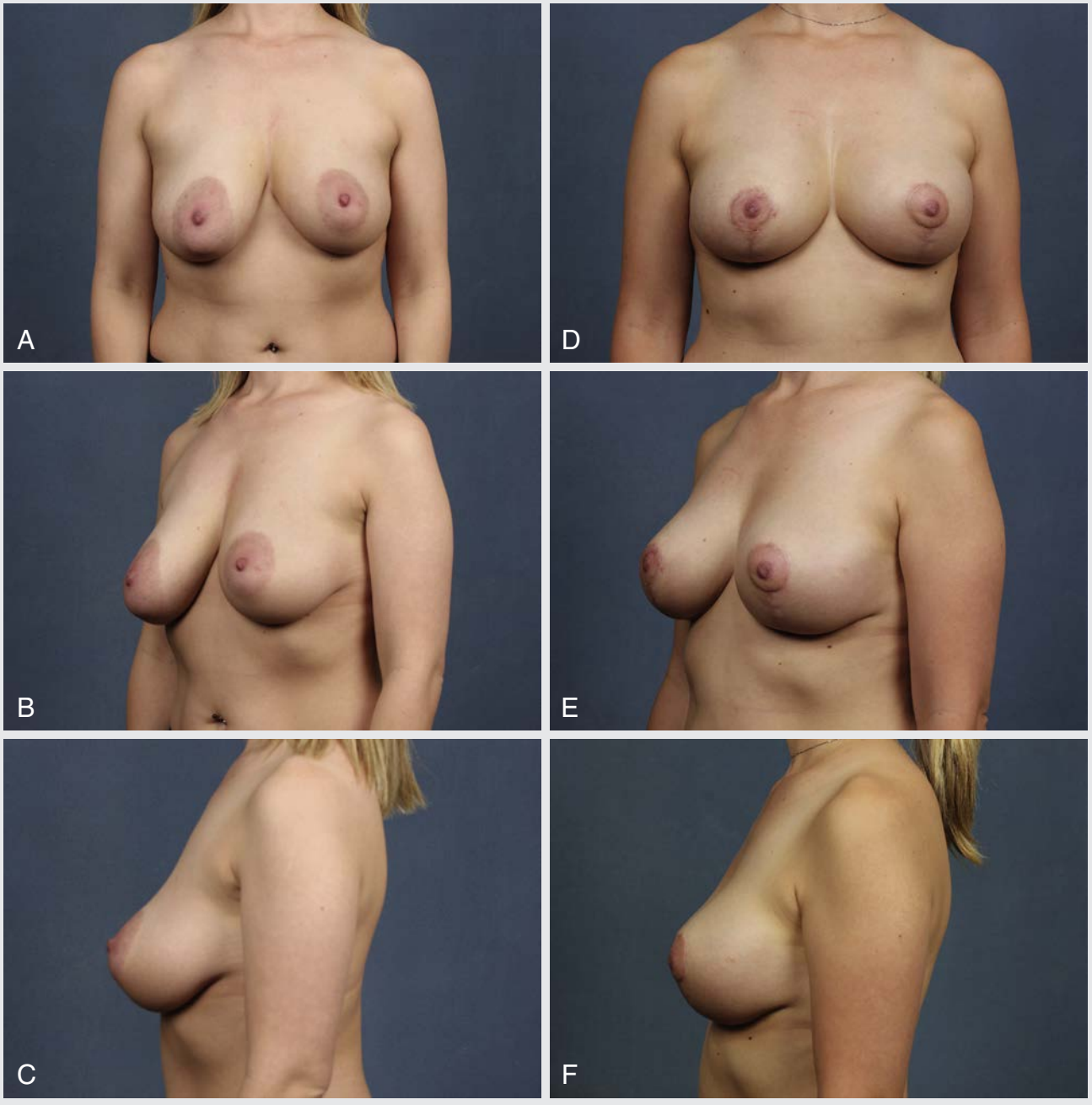
CASE 15.2

20-year-old Female presented with 34DD cup breasts desiring a smaller, more uplifted appearance. Her SN-N distance was 26 cms with grade II ptosis, thus only requiring a few centimeter NAC elevation. A superior pedicle inverted-T mastopexy was performed with a lower island flap auto-augmentation (Ribeiro flap). Her postoperative photographs demonstrate an uplifted C cup with good upper pole volume.



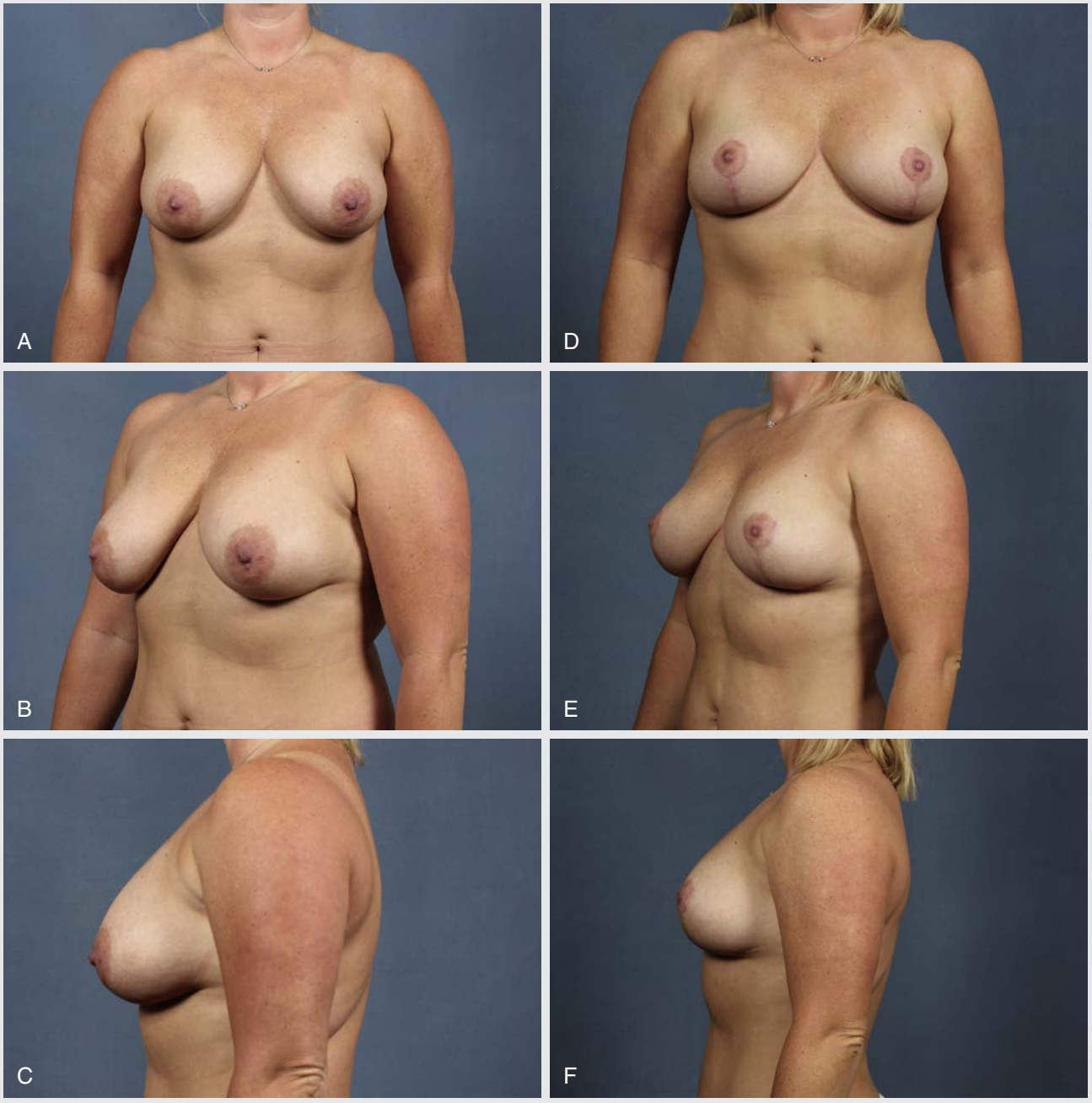
CASE 15.3

35-year-old wearing a 32DD cup complained of saggy, heavy breasts. She desired a an uplifted, full C cup look. She underwent a superior pedicle inverted-T mastopexy with removal of 152 g from the right and 86 g from the left breast. Her 3 month results reveal good uplifted volume with improved symmetry.



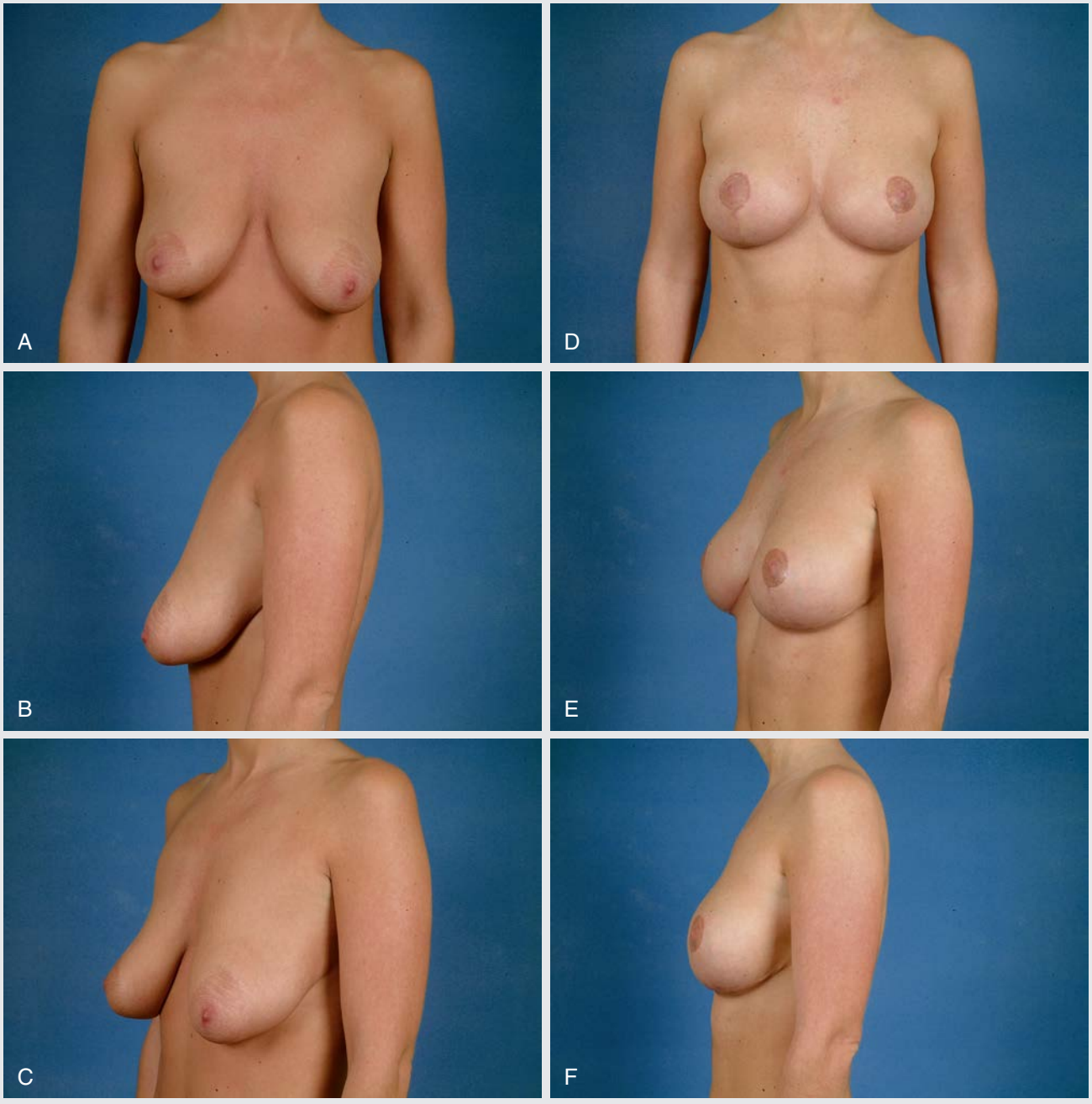
CASE 15.4

40-year-old female who desired an uplifted, smaller look. She underwent an inferior pedicle inverted-T mastopexy with removal of 124 g from the left and 153 g from the right breast. She achieved an uplifted, full C cup breasts. She maintained good volume and support of the breast seen in her postoperative photographs.



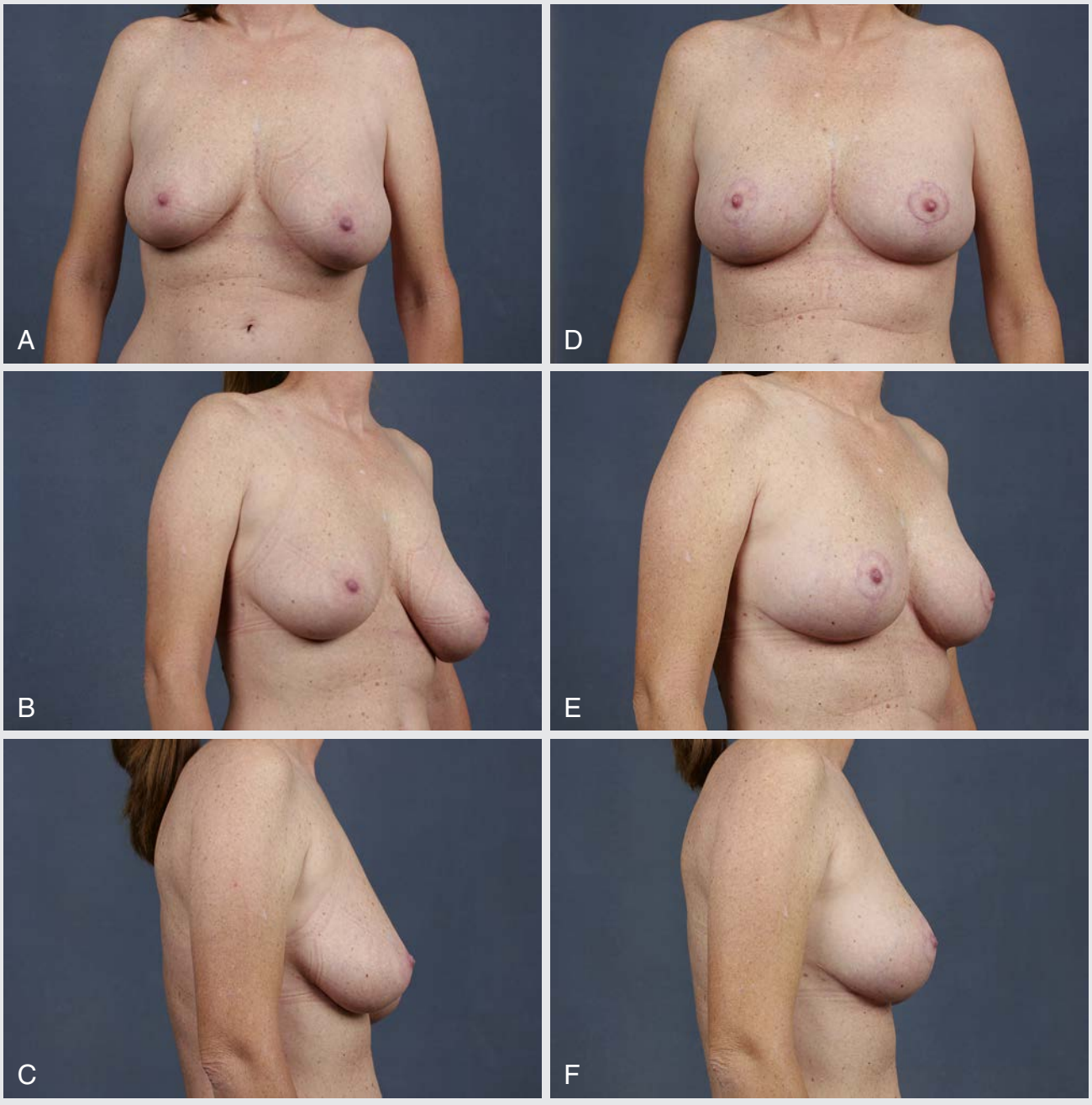
CASE 15.5

28-year-old wearing a 34C cup desired to be more uplifted but wanted to remain the same size. Her SN-N distance was 27 cm on the left and 25 cm on the right. Although she was a candidate for either a superior pedicle or inferior pedicle, we performed an inferior pedicle inverted-T mastopexy with central pedicle stabilizing sutures but without mesh. She achieved a very attractive appearance, but with only modest upper pole volume. Since her lower pole is extremely stable, the limitations to the upper pole are secondary to the quality and volume of breast tissue present and not loss of lower pole support. Her postoperative results are seen at six months with great shape and volume.



CASE 15.6

38-year-old patient wearing a 34DD with a desired goal of a C cup. Her SN-N was 25cm right and 27 cm on the left. A superior pedicle was chosen for her to give upper pole volume and restore symmetry to her breast. The left breast volume removed was 362 g and the right breast volume removed was 154 g. Good retention of upper pole volume post-op after debulking the lower pole during surgery.



Postoperative Care and Expected Outcomes

The patients are instructed to leave all dressings on for 24 hours. The wraps are then removed, and a sports bra is worn for the following 4 weeks. Dressing changes with antibiotic ointment and gauze are used over incisions for 1 week. Patients are allowed to shower after 48 hours. The contour tape is removed at day 4–7. Nylon sutures around the areolae are removed 5–7 days postoperatively. The subcuticular Monocryl sutures are clipped on the ends as they exit the skin at 2 weeks. Scar management with silicone gel or silicone sheeting is initiated on all patients at 2 weeks. Patients are allowed to resume activities of daily living almost immediately. Exercise is usually allowed at 4 weeks, with heavy lifting at 6 weeks.

Patients are counseled that they can expect swelling and firmness to develop as the breasts heal. The breasts will continue to soften over time and relax over the first few months. The results are fairly stable after 6 months, but scars can continue to improve over the first year and some additional relaxation of the breast with loss of upper pole volume can continue for even longer. Whereas the inferior pedicle shape looks relatively normal shortly after the procedure, superior pedicle technique may take longer to obtain its natural shape.

Management of Complications

Early complications are infrequent with mastopexy procedures. The most concerning complication is ischemia to the NAC or skin flaps. If recognized in the operating room, all sutures should be removed to look for improved circulation, with improved color, capillary refill, and pinprick bleeding. It is important to ensure the pedicle is free of tension and not twisted or compromised. Topical nitroglycerin or dimethylsulfoxide (DMSO) can be used to improve venous outflow. If the closure is too tight because of the volume present under the flaps, consideration should be made to resect more volume in an attempt to reduce the closure tension. If any doubt exists, the NAC can be left unattached and closed the following day in the clinic. Although conversion to a free nipple graft could be done if inadequate pedicle flow is achieved through all of the previously mentioned efforts, this is far more common in a breast reduction and should be extremely rare in a mastopexy procedure.

An occasional patient may develop a hematoma usually within the first 24 hours, but a late hematoma at day 10–14 is also occasionally encountered as activity level increases and the clots present on the ends of the cauterized vessels begin to dissolve. A very small hematoma can be allowed to resolve on its own, but any substantial hematoma should be explored, evacuated of blood, and drained. Small amounts of blood within the pocket in a mastopexy without a breast implant is generally less concerning because there is not potential for capsular contracture. Seromas are generally managed conservatively with serial aspiration until resolved.

Secondary Procedures

Late sequelae include poor scarring, recurrent ptosis, bottoming out, asymmetry, contour deformities, fat necrosis, and loss of upper pole volume. These may require revisional procedures to improve the final aesthetic outcome. Most procedures are delayed at least 6 months or longer to allow for soft tissue remodeling and stabilization of the results. Scars are often the product of excessive tension on the closure and postoperative swelling and often can be improved with scar revisions when the environment for scar maturation is more optimal. Lower pole stretch deformities and recurrent ptosis are managed with a revision of the mastopexy with or without the addition of some additional support from a mesh or acellular dermal matrix. Fat necrosis is often simply monitored if it is small and not deforming the shape of the breast. If the area of fat necrosis impairs the shape or softness of the breast or is interfering with cancer surveillance, excision of the involved area is appropriate.

Loss of upper pole volume is the most common late finding after a mastopexy, whether the inferior pedicle or the superior pedicle. Loss of the upper pole can be secondary to relaxation and loss of lower pole support or simply the result of the lack of stable, firm volume in the breast envelope. A breast augmentation is the most reliable procedure to provide stable upper pole volume and cleavage. Surgeons often will stage their procedure, performing a mastopexy as the initial procedure, followed by a breast augmentation 6 months or more postoperatively. Fat grafting also can be performed to improve volume in the upper pole and cleavage but does little to improve breast projection and is less reliable than a breast implant.

Conclusion

With proper preoperative evaluation and employing accurate surgical techniques, excellent results can be achieved with either a superior- or inferior-based inverted-T mastopexy in appropriately selected patients. The inverted-T mastopexy can be mastered by most surgeons and creates a postoperative appearance at the end of the procedure that most accurately predicts the final results of the mastopexy. The significant advantages of the superior pedicle technique in appropriately selected patient are the parenchymal shaping and lower breast pole unloading. The inferior pedicle technique is easy to master and quite versatile but is generally reserved for patients in whom superior or superomedial pedicle technique is not as feasible, including the need for significant NAC elevation or potential loss of the superior pedicle blood flow from previous procedures such as a biopsy or mastopexy.

SUMMARY BOX

Pearls for Success

- The inverted-T mastopexy can be performed with an inferior or a superior/superomedial pedicle.
- Drawings are performed preoperatively as a guide, with intraoperative adjustments expected.
- The inferior pedicle is the most versatile with all degrees of ptosis.
- The superior pedicle is reserved for modest mastopexy, with a NAC elevation limit of 5–6 cm.
- Lower pole volume can be resected or auto-augmented to the upper pole with superior pedicle.
- Mesh can be used to reinforce the inferior pedicle, reducing the stretch of the lower pole postoperatively.
- Resecting all extra skin through an inverted-T technique provides the most accurate appearance of the breast at the end of the procedure.
- Upper pole volumes are less stable with a mastopexy alone, and patients should be counseled on the expected outcome.

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16

Breast Augmentation and Mastopexy

NATHANIEL L. VILLANUEVA, ZIYAD S. HAMMOUDEH, AND W. GRANT STEVENS

Introduction

One-stage breast augmentation combined with mastopexy is a challenging operation with numerous potential complications. Augmentation expands the breast volume, and mastopexy reduces the skin envelope; thus, these operations produce opposing forces when performed simultaneously. The combination of procedures as a single stage was initially described over 50 years ago.[1,2] However, augmentation mastopexy has been met with stark criticism in the literature by prominent plastic surgeons until as recently as the past decade with warnings such as "surgeon, beware"[3,4] when performed primarily and a "recipe for disaster"[5] when mastopexy is performed secondarily in previously augmented patients.

Over the past decade, safe performance of augmentation mastopexy as a one-stage operation has greatly increased after landmark articles by the senior author showing acceptable complication and revision rates.[6–9] In recent years, the safety of primary augmentation mastopexy has been further validated by several authors.[10–13] Secondary augmentation mastopexy in the previously augmented patient also can be performed successfully.[14,15] The terms *secondary* and *revisional* augmentation mastopexy lack standard definitions in the literature. We define *secondary* to mean simultaneous augmentation mastopexy performed on a breast that previously underwent any type of surgery. We define *revisional* as a subcategory of secondary augmentation mastopexy that refers to immediate surgical correction of a problem or late surgery to improve the results of a previous augmentation mastopexy.

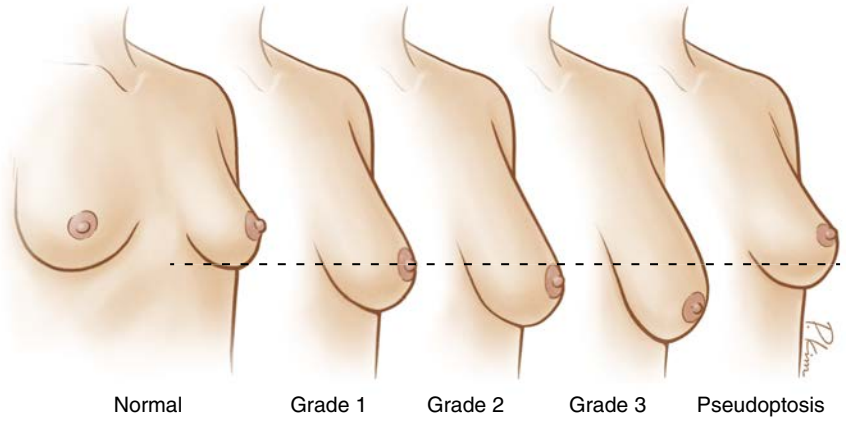
Throughout this chapter, ptosis grades are described according to the Regnault classification (Fig. 16.1). Depending on the degree of ptosis, a mastopexy can be performed by a crescent, circumareolar, circumvertical, or Wise pattern or other approach (Fig. 16.2). Each approach has its own utility in both primary and secondary augmentation mastopexy based on each patient's individual anatomy. The focus of this chapter will be on the circumvertical (often simply referred to as *vertical*) technique for primary augmentation mastopexy.

The circumvertical approach is designed as a superior pedicle based on perforators from the second and/or third intercostal vessels (Fig. 16.3). The circumvertical technique often requires a short horizontal wedge of skin in the inframammary fold (IMF) to shorten the nipple-to-IMF distance, thus creating an inverted-T incision pattern at the time of closure. For simplicity, we describe these two approaches as an "owl" and "owl with feet" design, respectively, because of their rudimentary resemblance to the bird. The "body" of the owl refers to the circumvertical pattern, and the "feet" refer to the short horizontal limb at the inferior extent of the circumvertical pattern near the IMF. Unlike a Wise pattern mastopexy, in which the vertical limbs become progressively further apart as they approach the IMF, the vertical limbs taper together with the "owl" techniques as they approach the IMF. Guidelines regarding patient selection for each of these augmentation mastopexy techniques and technical aspects of the procedure are outlined in this chapter.

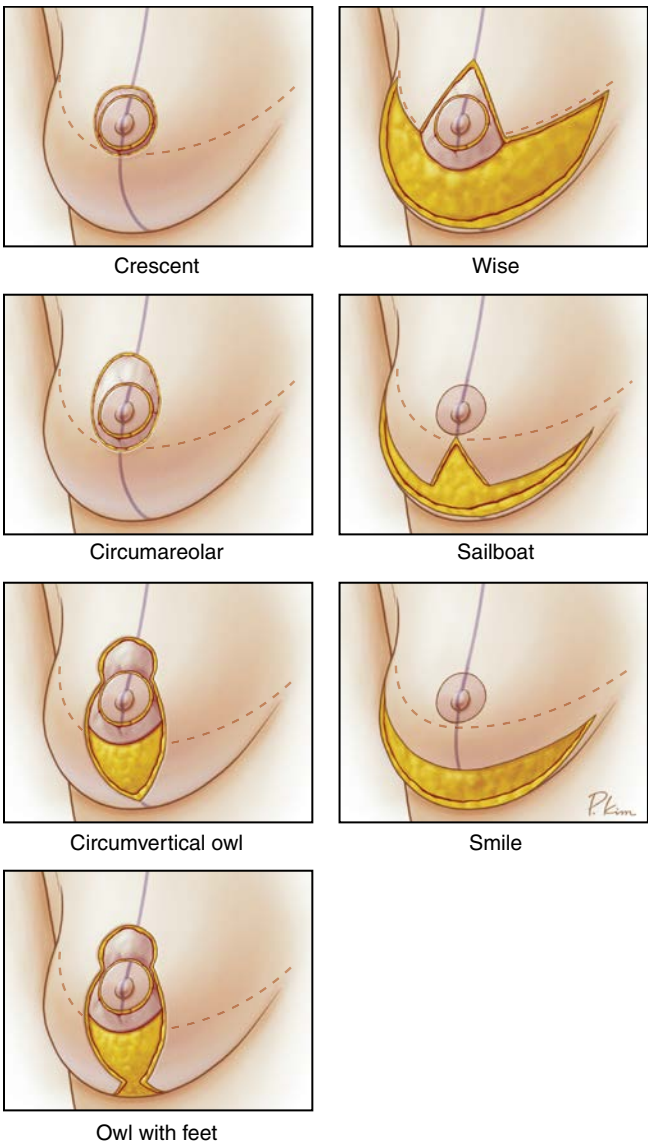
Indications and Contraindications

Patients with breast hypoplasia and ptosis are considered candidates for augmentation mastopexy (Fig. 16.4). Patients with Regnault grade I ptosis who require only 1–2 cm of elevation of the nipple–areolar complex (NAC) with *minimal* laxity of the lower pole of the breast may be candidates for a crescent or circumareolar mastopexy. Patients with Regnault grade II or III ptosis who require more than 2 cm of NAC elevation or patients with grade I ptosis or pseudoptosis with *substantial* laxity in the lower pole are better treated with a circumvertical pattern. Therefore, the nipple position and grade of ptosis alone do not determine the best mastopexy technique to apply; the amount of lower pole laxity is the most important consideration as to whether a vertical mastopexy pattern would be best.

In patients presenting for breast augmentation, there is a common misperception that insertion of larger implants in a patient with mild ptosis or pseudoptosis will suffice as an alternative to the additional scars of a mastopexy, but that is incorrect (Fig. 16.5). Patients undergoing breast augmentation may elect that option to avoid scars and be satisfied accepting some persistent lower pole laxity with greater upper pole fullness; however, the lower pole laxity cannot be corrected



• **Fig. 16.1** Regnault classification of ptosis. (Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. Clin. Plast. Surg. 42, 505–518.)



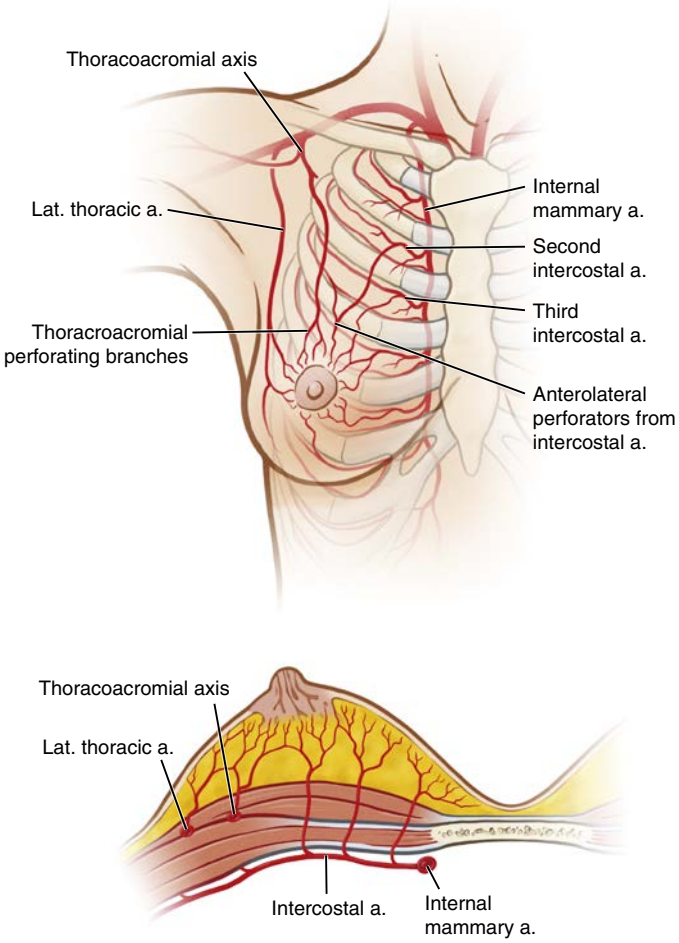
• **Fig. 16.2** Types of mastopexy incisions. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)

with a larger implant alone, and the patient will potentially be subjected to the detrimental effects of an implant that is too large for her breast. In patients desiring a more lifted breast, the addition of an implant can help create a larger, rounded breast shape with greater upper pole fullness via an augmentation mastopexy.

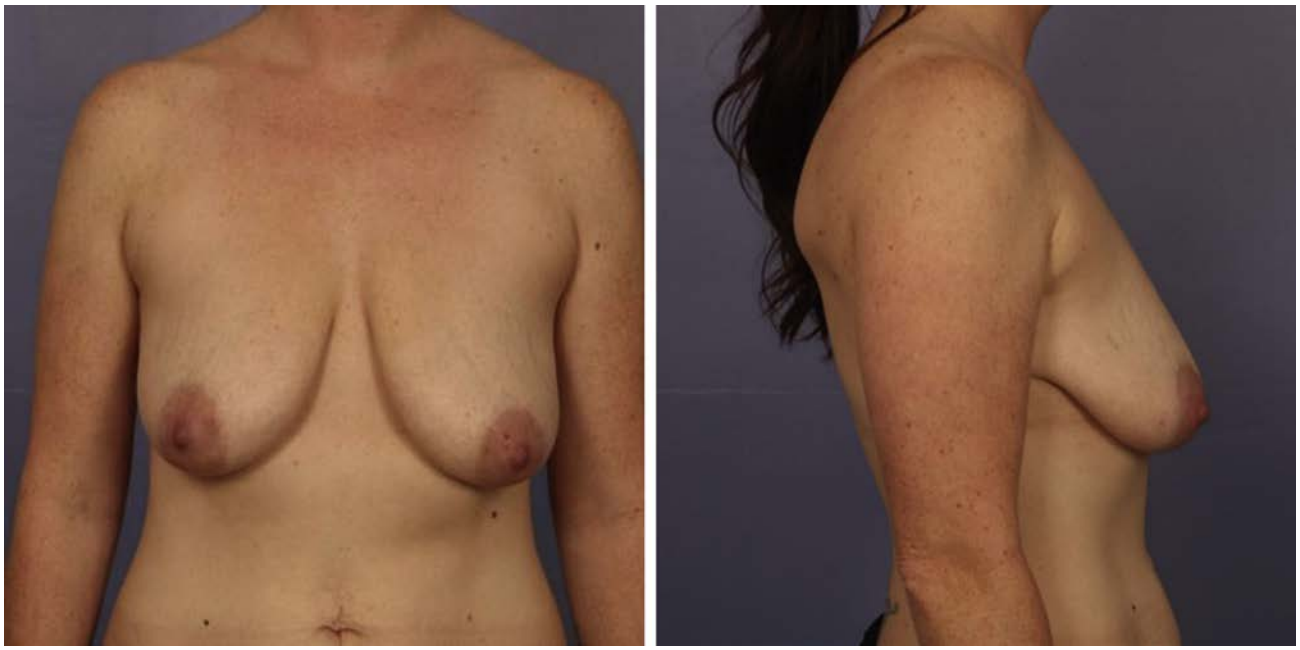
Patients with a tuberous breast often benefit from an implant plus circumareolar mastopexy because of the characteristic anatomic features of their breasts (e.g., amorphous breast shape, constricted lower pole, superiorly positioned IMF, large herniating areola). A circumvertical approach is usually not advisable in the tuberous breast because the lower pole is already overly tight and the low-appearing NAC position is relative to an IMF that is anatomically too high. In such tuberous breast cases, lowering the IMF with an implant will correct the position of the NAC relative to the fold, and a circumareolar mastopexy can be used to reduce the large areola size and flatten its herniation.

Patients with very large areolae relative to their breast width should be approached with caution for a one-stage circumvertical augmentation mastopexy (Fig. 16.6). If the areola width is greater than half the breast width, there is unlikely to be enough skin to allow closure of the vertical limbs of the mastopexy with the additional volume of an implant (Fig. 16.7). In such cases, the surgeon has to choose between two options: (1) design a circumvertical pattern that will allow complete removal of the areola and perform a mastopexy only with insertion of an implant as a second-stage operation or (2) design a circumvertical pattern that does not completely remove the areola but allows an implant to be inserted in a single stage, knowing that a revision procedure will be required at a later date to remove the remaining areola skin along the vertical scar. In such cases, attempting to completely remove the entire areola and insert a sizeable implant can result in excessive tension on the closure with wound breakdown and extrusion of the implant.

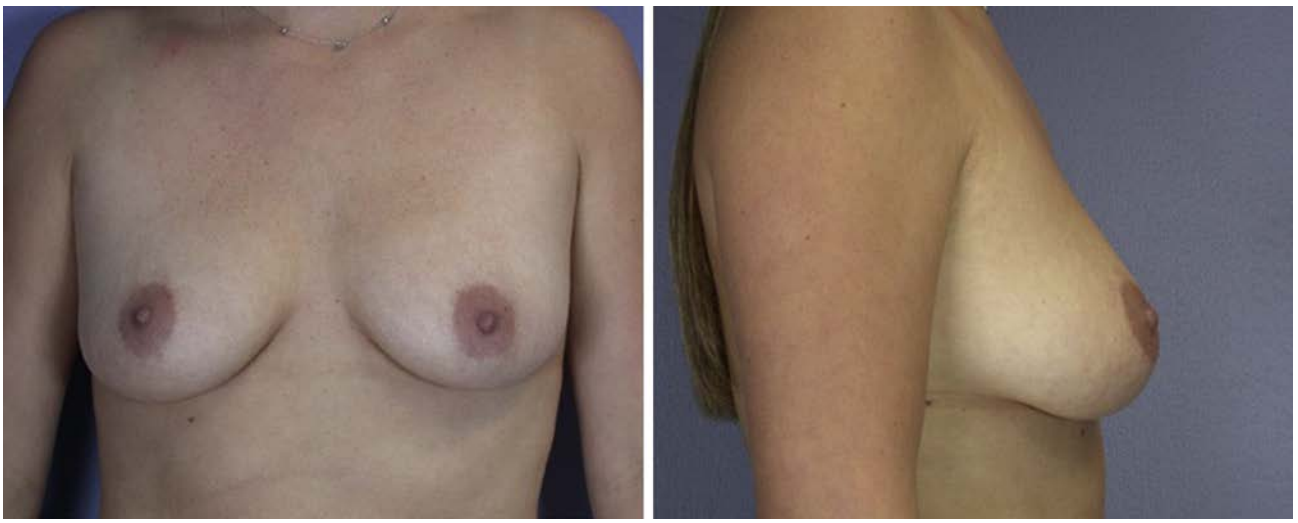
Patients with a very long distance from the native nipple position to desired new nipple position superiorly may be better candidates for staged rather than one-stage



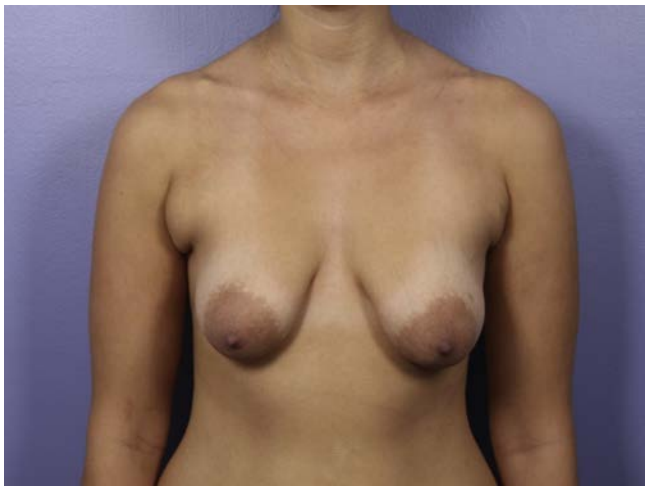
• **Fig. 16.3** Breast vascular anatomy. *a,* Artery; *lat,* lateral. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)



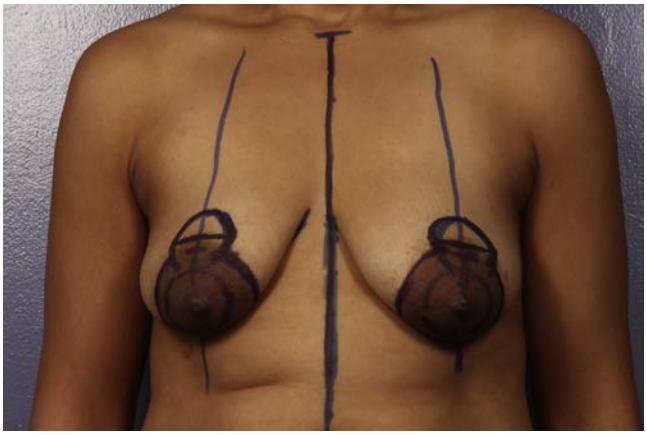
• **Fig. 16.4** Patients with breast hypoplasia and ptosis are considered candidates for augmentation mastopexy.



• **Fig. 16.5** There is a common misperception that insertion of larger implants in a patient with mild ptosis or pseudoptosis will suffice as an alternative to the additional scars of a mastopexy, but that is incorrect.



• **Fig. 16.6** Patients with very large areolae relative to their breast width should be approached with caution for a one-stage circumvertical augmentation mastopexy.



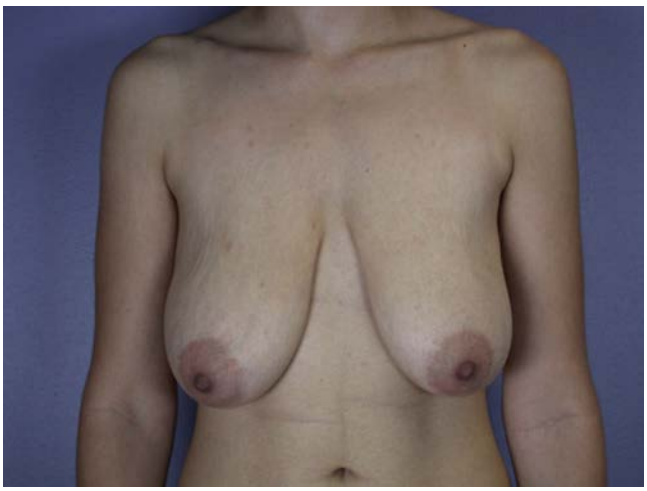
• **Fig. 16.7** Preoperative markings for a circumvertical mastopexy in a patient with large areola diameters (right 7.5 cm, left 8.0 cm) relative to her breast widths (right 12.0 cm, left 13.0 cm). The desired nipple position was elevated 1 cm superior to the transposed IMF position to allow complete removal of the areola. Mastopexy only was performed in the first stage because of an inability to also accommodate an implant with the very wide circumvertical resection pattern required to completely remove the areolar skin.

augmentation mastopexy (Fig. 16.8). As the pedicle length increases for a relatively narrow pedicle width, there is a potential for impaired NAC perfusion. These patients may require greater skin resection by a Wise pattern before augmentation in a second stage.

Other contraindications include patients with an American Society of Anesthesiologists (ASA) classification of 3 or higher, patients who are emotionally unstable, and those who do not accept the possibility of revision surgery. Smoking cessation for at least 2 weeks before and after surgery is recommended to minimize the chance of potential nipple perfusion–related problems.

Preoperative Evaluations and Special Considerations

When assessing these patients, initial questions are geared toward each patient's desired breast size and



• **Fig. 16.8** Ideal candidate for two stage augmentation mastopexy because of the long distance from native nipple position to desired nipple position.

shape. Patients who are satisfied with their current breast volume and would like better shape/positioning of the breasts are best suited for a mastopexy alone. Patients who desire larger breasts in addition to better shape/positioning and increased upper pole fullness are considered for augmentation mastopexy. Patients who desire smaller breasts are considered for reduction, which can be combined with an implant in certain circumstances in a fashion similar to that with an augmentation mastopexy. Standard questions regarding breast health are also asked, such as information on recent mammograms, previous breast surgery, and family history of breast cancer. Medications that can increase bleeding or impair wound healing are held for 2 weeks before surgery. Patients 30 years of age and older are referred for a mammogram preoperatively. Patients younger than 30 years of age with a strong family history of breast cancer also receive preoperative breast imaging.

A thorough breast examination is performed to assess for any pathologic condition, and standard breast measurements are made. Preoperatively, vertical measurements are made from nipple-to-IMF because the areola diameter is not uniform and varies from patient to patient. Intraoperatively, vertical measurements are made from inferior areola–to-IMF because the radius from the nipple to areola border is created to be about 2 cm (i.e., 4 cm areola diameter). A circumvertical "owl" is planned when the nipple-to-IMF distance is relatively short at approximately 7 cm or less on manual stretch by the surgeon's hand. An "owl with feet" is planned when the nipple-to-IMF distance is greater than 7 cm on stretch; in such cases, the short horizontal wedge is typically adjusted intraoperatively toward the end of the operation to achieve the desired areola-to-IMF distance bilaterally (details of these markings are described later in the surgical techniques section). The patient should be counseled preoperatively that the resulting shape of the breast takes priority over the presence or absence of a small horizontal scar hidden in the IMF.

Patients who are candidates for augmentation mastopexy and have asymmetry may consider circumvertical mastopexy of the smaller breast, reduction of the larger breast by a superior pedicle technique, and insertion of the same style/volume implant bilaterally to optimize shape and symmetry. The superior pedicle reduction technique suspends the NAC in a similar fashion to the circumvertical mastopexy technique described in this chapter. Please refer to the indications section of Chapter 17 on the superior pedicle breast reduction for a more complete description of that technique for management of patients with ptosis and asymmetry.

Selecting the most appropriate implant for each patient is an important decision that begins preoperatively. This decision is not as easily determined in patients undergoing augmentation mastopexy as it is for patients undergoing augmentation only with three-dimensional imaging because the tissue dynamics can change greatly with the opposing forces of simultaneous augmentation mastopexy. Therefore, patients are asked to bring photographs of breasts they like to the preoperative visit so the plastic surgeon can understand the size/shape the patient prefers to achieve a similar size/shape intraoperatively. This greatly improves communication and understanding of expectations to minimize the revision rate for size/shape reasons. You may find that some patients prefer a very long, well-rounded nipple-to-IMF distance and slightly upward-pointing nipple, whereas others prefer a more traditional breast shape.

Several sizer and implant volumes should be available on the day of surgery because of the lower predictability of the tissue dynamics with augmentation mastopexy. A round implant is typically preferred, but an anatomic implant can be used in special circumstances. Use of a textured implant may offer some advantage in preventing capsular contracture. However, a textured implant is also more likely to remain in the superior position in which it was placed during surgery, although the breast tissue is likely to re-descend with gravity over time, potentially leading to a "waterfall" ("snoopy") deformity. A moderate-profile implant is most commonly preferred. A high-profile implant is less frequently used because the recruitment of ptotic breast tissue onto the implant with the mastopexy typically provides satisfactory projection, and the increased projection puts greater tension on the vertical incision closure. For that reason, some surgeons prefer a low-profile implant with an increased width/height (greater cleavage and upper pole fullness) for a given volume. Ideally, the same style/volume implant is inserted bilaterally because the width/height of the implant greatly affects each breast's shape. In cases of preoperative breast asymmetry, a small reduction of the larger breast is typically preferred (rather than placing a larger implant in the smaller breast) so the same implant can be inserted bilaterally to achieve the greatest possible symmetry.

Preoperative selection of the plane of dissection for implant insertion (subpectoral versus subglandular versus subfascial) also must be determined. We typically avoid the subglandular plane because of the capsular contracture risk and prefer either the subpectoral or subfascial planes. The primary advantage of the subpectoral plane is preservation of the perforators coursing through the pectoralis major muscle by the thoracoacromial vessels whereas the subfascial plane avoids animation deformity and has minimal postoperative pain. The subfascial plane can be a good choice in appropriately selected patients who require minimal elevation of the NAC (e.g., pseudoptosis) and desire a relatively small implant to maintain as much vascularity to the pedicle as possible. Patients undergoing subfascial implant also should have adequate soft tissue coverage in the superior pole.

Surgical Technique

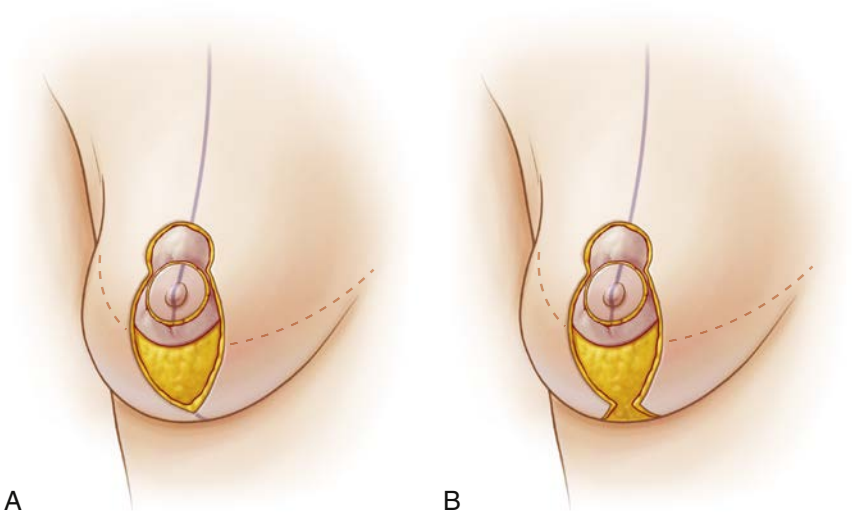
The patient is marked preoperatively in the standing position. The chest midline, breast meridians, and IMFs are marked for reference. When the NAC is located medial to the breast meridian, as is commonly the case with massive weight loss or severe deflation of the breasts after childbirth

and breastfeeding, the circumvertical marking is altered to adequately include the NAC and allow it to be repositioned along the breast meridian in a more cephalad position. Biparietal obstetric calipers are used to accurately transpose the position of the IMF onto the breast mound by measuring from a fixed position at the sternal notch. The new nipple position is typically marked directly at the level of the transposed IMF marking or 1 cm cephalad to the transposed IMF marking. This determination is made based on each patient's unique anatomic features and her preferred breast aesthetic from the photographs she selected preoperatively.

For patients with a relatively wide and/or superiorly positioned NAC combined with lower pole laxity, the new nipple position often needs to be placed 1 cm superior to the transposed IMF marking to allow the circumvertical pattern to completely encompass the NAC (Fig. 16.9A). A long nipple-to-IMF distance created by marking the keyhole for the NAC in a slightly more cephalad position than desired because of the patient's anatomy can be corrected later intraoperatively; the nipple-to-IMF distance can be decreased to the desired set length at the end of the operation with removal of skin inferiorly by the short horizontal wedge of skin at the IMF (i.e., the addition of feet to the owl (see Fig. 16.9B). The height of the body of the owl is extended inferiorly to a sharp point at or just cephalad to the IMF. The width of the body of the owl is determined by the degree of skin laxity via skin pinch in the lower pole. This width is difficult to precisely predict because it requires anticipation of the implant volume to be inserted and is largely based on experience rather than quantitative measurement. However, there are a few guidelines that can be followed to achieve success with this marking.

For surgeons just starting out, it would be prudent to remove the minimal volume of skin that allows the circumvertical pattern to completely encompass the areola at the start of the operation, because more skin can always be removed later in the operation with "tailor-tacking" after the desired implant is inserted. Particularly in a patient who desires the maximum possible augmentation for her breast dimensions, the narrowest possible circumvertical width should be designed to preserve as much skin as possible to allow the largest volume implant possible. Designing the body of the owl too wide will limit the volume of implant that can be inserted and potentially risk wound breakdown along the vertical incision and implant exposure. Similarly, the use of a Wise pattern in such a situation can lead to a deficiency of skin that limits the volume of implant that can be inserted and increases the risk of breakdown at the T-junction. A keyhole marker is used to design the new NAC shape, which is slightly wider transversely than it is vertically (approximately 5 cm transversely by 4 cm vertically) because the transverse width will decrease as the skin edges are brought together at the time of closure. A short transverse limb at the IMF is marked for local injection, but its exact dimensions are not determined until the end of the operation.

In the operating room, the patient is positioned supine on the operating table with the arms out. The breasts are injected with a dilute local anesthetic solution consisting of 30 mL of 2% plain lidocaine and 1 mL of 1:1000 epinephrine mixed into a 250 mL bag of normal saline. Care is taken to avoid deep injection in the vicinity of the pedicle and superior pole. A 42-mm circular template is placed over the areola on tension. The skin within the keyhole marking and around the areola in the distribution of the superior



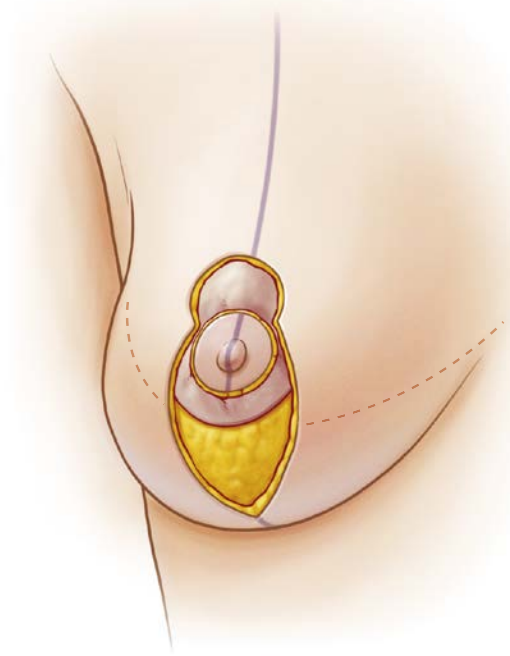
• **Fig. 16.9** Circumvertical mastopexy. The skin within the keyhole marking and around the areola in the distribution of the superior pedicle is de-epithelialized. The skin within the circumvertical marking is excised full-thickness from the inferior edge of the areola to the IMF. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)

pedicle is de-epithelialized. The skin within the circumvertical marking is excised full-thickness from the inferior edge of the areola to the IMF (Fig. 16.10). The de-epithelialized epidermis is incised full-thickness at the medial and lateral edges of the keyhole and around the areola to allow the areola to be elevated superiorly into the keyhole. The areola is then sutured at the 12-o'clock position of the keyhole to keep it out of the way of the parenchyma dissection ("hitch stitch") (Fig. 16.11). The breast parenchyma is then incised vertically with a no. 10 blade scalpel initially and then with electrocautery with deeper dissection approaching the chest wall, creating medial and lateral breast pillars. A 1- to 2-cm cuff of breast parenchyma is kept intact at the IMF and not vertically incised to act as a barrier between the skin and implant pocket at the T-junction (Fig. 16.12). Therefore, even if there is a small skin breakdown at the T-junction, this small cuff of breast parenchyma will prevent a direct path to the implant.

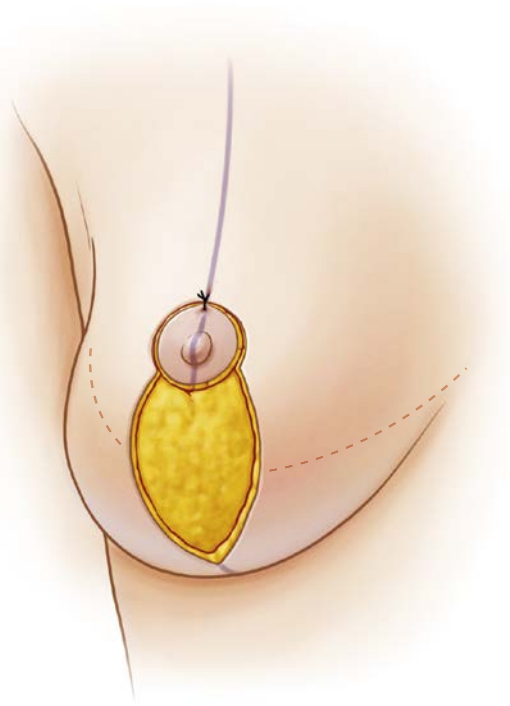
Once the pectoralis major muscle is identified, dissection is continued inferiorly with electrocautery along the chest wall until the IMF is reached. The IMF should not be lowered. A subpectoral or subfascial plane is then developed in the standard fashion. Sizers are inserted into the pocket, and the skin edges are temporarily approximated to assess the overall breast size/shape (Fig. 16.13). The same steps are then performed in the contralateral breast. Once the desired implant is selected bilaterally, the pockets are irrigated via the surgeon's standard antiseptic technique and the permanent implants inserted.

The medial and lateral pillars are closed in two layers to seal off the implant pocket, starting from the IMF upward toward the areola with a running locking 2-0 Vicryl suture and then back down toward the IMF in a nonlocking fashion with the same suture (Fig. 16.14). The skin of the vertical incision is tailor-tacked with staples to achieve the appropriate lower pole contour bilaterally. Additional horizontal skin excess may need to be removed along the vertical incision to achieve the desired contour. A flat lower pole is desirable intraoperatively, because the lower pole skin will expand postoperatively and create a rounded shape with time as a result of the weight of the implant. Failure to adequately tighten the lower pole skin to a flat contour can result in persistent lower pole laxity that reappears over the first few months as the swelling resolves.

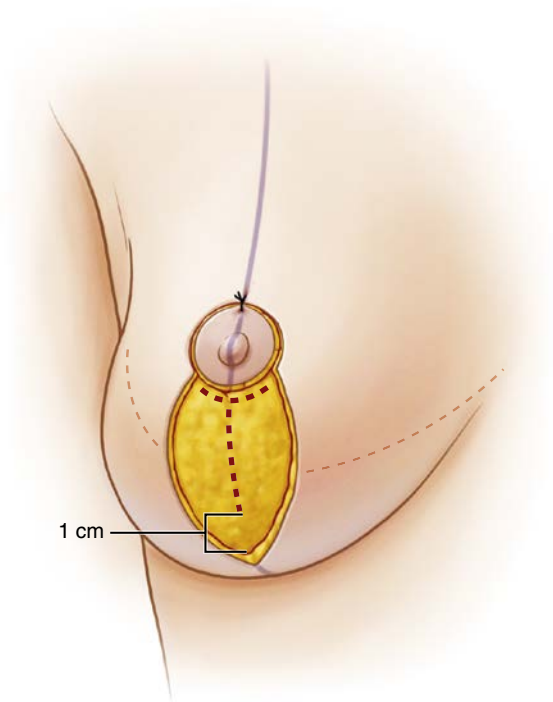
To avoid bunching of the skin on each side of the vertical incision and better facilitate closure, skin flaps 1–2 cm thick are dissected with minimal undermining on each side of the vertical incision using a scalpel. These medial and lateral skin flaps are brought together at the T-junction. The flap dissection is typically bloodless because of the use of epinephrine in the dilute local anesthetic injected at the



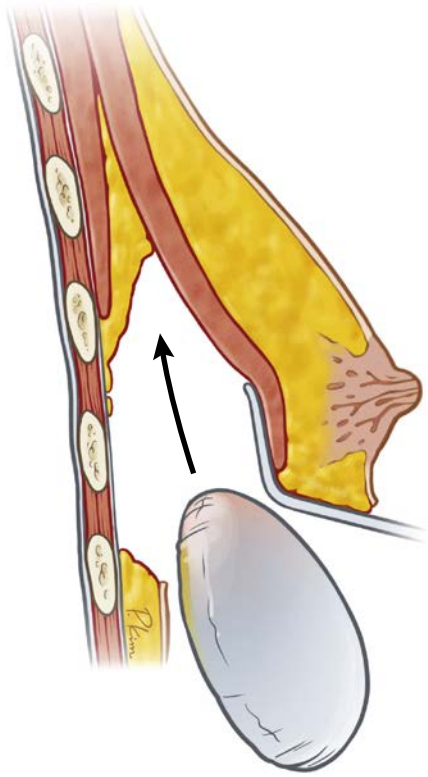
• **Fig. 16.10** The hitch stitch. The areola is sutured at the 12-o'clock position of the keyhole to keep it out of the way of the parenchyma dissection. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)



• **Fig. 16.11** Parenchymal dissection. The breast parenchyma is incised vertically creating medial and lateral breast pillars. A 1- to 2-cm cuff of breast parenchyma is kept intact at the IMF and not vertically incised to act as a barrier between the skin and implant pocket at the T-junction. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)



• **Fig. 16.12** Subpectoral dissection and implant placement. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)



• **Fig. 16.13** Pillar sutures. The medial and lateral pillars are closed in two layers to seal off the implant pocket, starting from the IMF upward toward the areola *(black arrow),* with a running locking 2-0 Vicryl suture and then back down toward the IMF in a non-locking fashion with the same suture. (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)

beginning of the operation and prevents potential thermal injury to the skin with the use of electrocautery.

The decision is then made about the need for a horizontal wedge excision to remove vertical skin excess and decrease the distance from the inferior areolar border to the IMF. It is important to recognize that the areola-to-IMF distance will become longer with the effect of gravity on the implant postoperatively. A ruler is used to measure the areola-to-IMF distance from superior to inferior. The desired areola-to-IMF distance should be 5–7 cm (i.e., 5–6 cm for a C cup, 6–7 cm for a D cup) on implant stretch (no additional manual stretch provided by the surgeon's hand), which corresponds to a nipple-to-IMF distance of 7–9 cm. The skin inferior to the desired length is marked for a horizontal wedge excision bilaterally. The skin is excised and temporarily stapled. The horizontal wedge excision will also lower a nipple that is higher than desired. When first performing augmentation mastopexy, you may elect to sit the patient upright at this point to ensure appropriate breast shape and satisfactory symmetry before suture closure; however, after becoming more experienced with this procedure, these determinations often can be reliably made with the patient in the supine position. The skin along the limbs and around the areola is closed with 3-0 Monocryl simple interrupted deep dermal sutures followed by a 3-0 Monocryl running subcuticular stitch.

Postoperative Care and Expected Outcomes

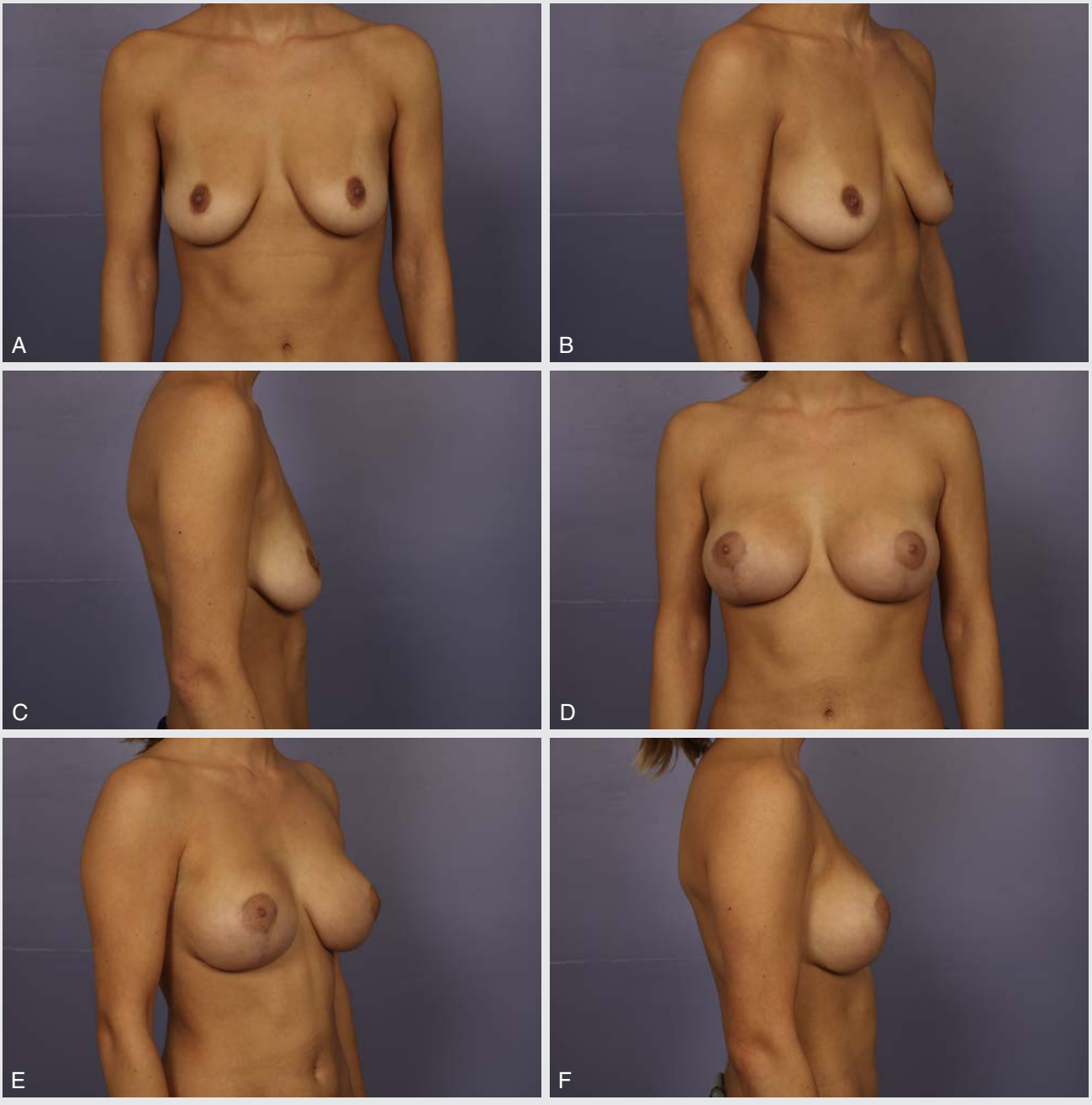
Patients are routinely discharged home with follow-up as an outpatient in the office the next day. In a retrospective review of 615 patients (1192 breasts) who underwent augmentation mastopexy (63% primary, 37% secondary) in our practice over a 20-year period, the most common complications were poor scarring (5.7%), wound-healing problems (2.9%), deflation (2.4%), capsular contracture of Baker grade III (2.4%) or greater, and areola asymmetry (1.9%), with a mean follow-up of 17.4 months.[8] There were no cases of nipple loss (defined as loss or hypopigmentation of >10% of the areola) or major flap loss (defined as skin flap necrosis > 2 cm). The mean age of patients was 39 years and mean body mass index was 22.7 kg/m^2. A subpectoral pocket was used in 97% of the patients. Four different techniques were used for mastopexy design: inverted-T (60%), circumareolar

(27%), vertical (10%), and crescent (3%). A revision procedure was performed in 16.9% of patients (14.5% when excluding circumareolar mastopexy). Implant-related complications accounted for 62% of revisions, with half of those being for implant size change. The number/percentage of patients with implant-related and tissue-related complications are summarized in Tables 16.1 and 16.2, respectively. These findings are similar to the pooled data reported in a meta-analysis of 4856 primary augmentation mastopexies.[12]

Case Examples

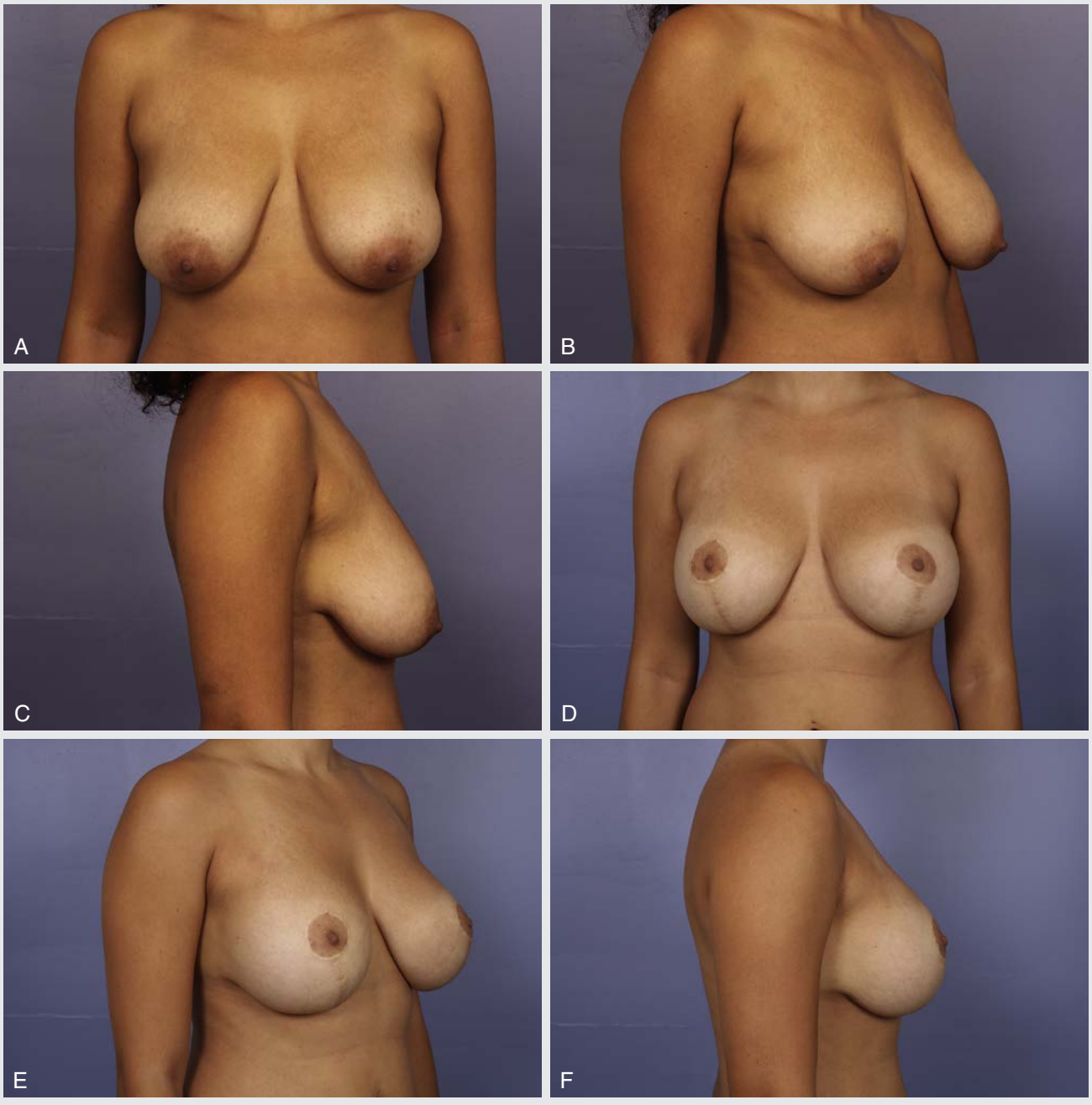
CASE 16.1

This 27-year-old woman underwent augmentation mastopexy with 215-cc moderate-profile round, textured implants in a subfascial plane bilaterally. Preoperative photographs are shown in Case 16.1A–C. Postoperative photographs at 6 months are presented in Case 16.1D–F.



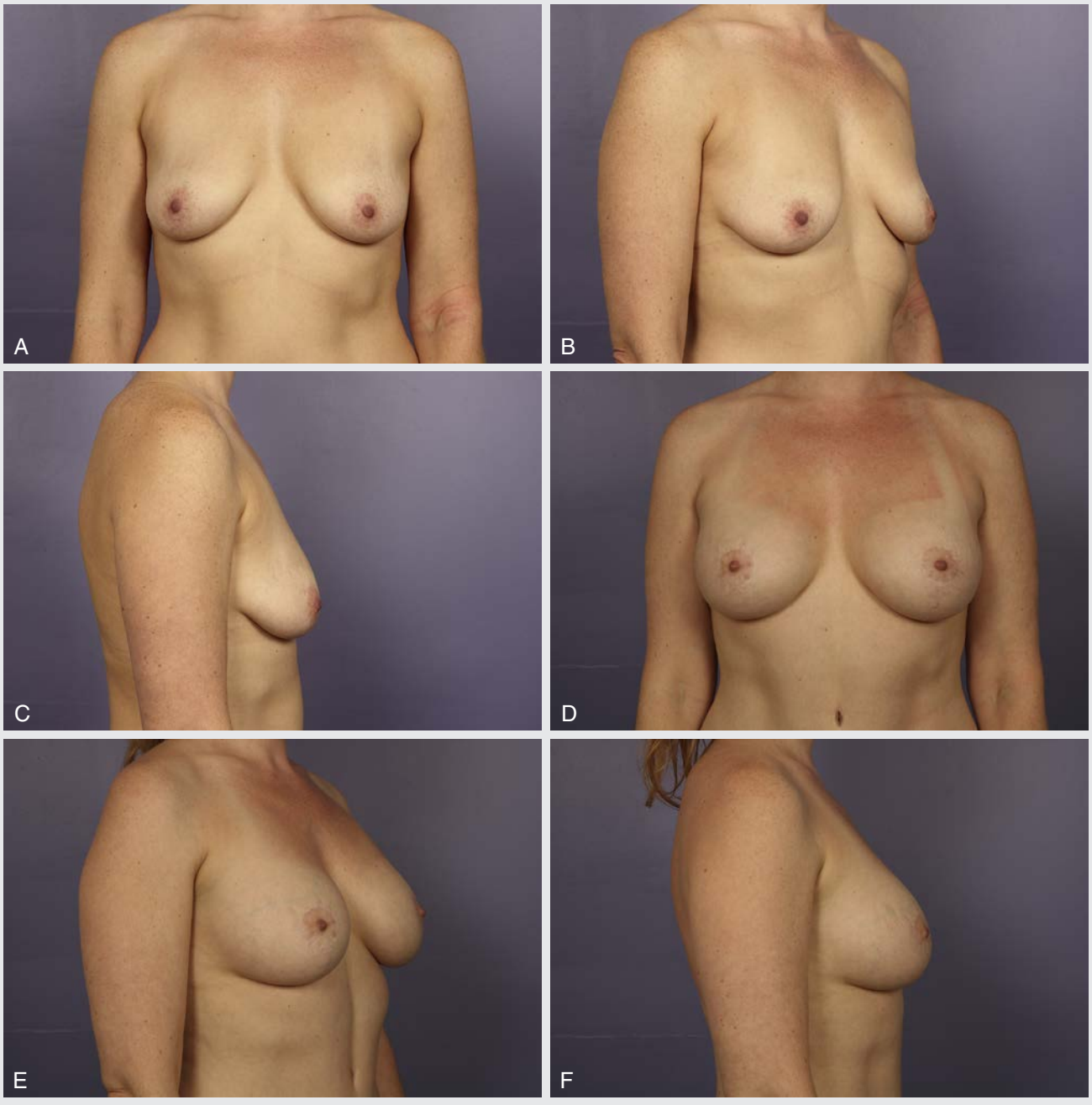
CASE 16.2

This 36-year-old woman underwent augmentation mastopexy with 305-cc moderate-profile round, textured implants in a subpectoral plane bilaterally. Preoperative photographs are shown in Case 16.2A–C. Postoperative photographs at 2 years are shown in Case 16.2D–F.



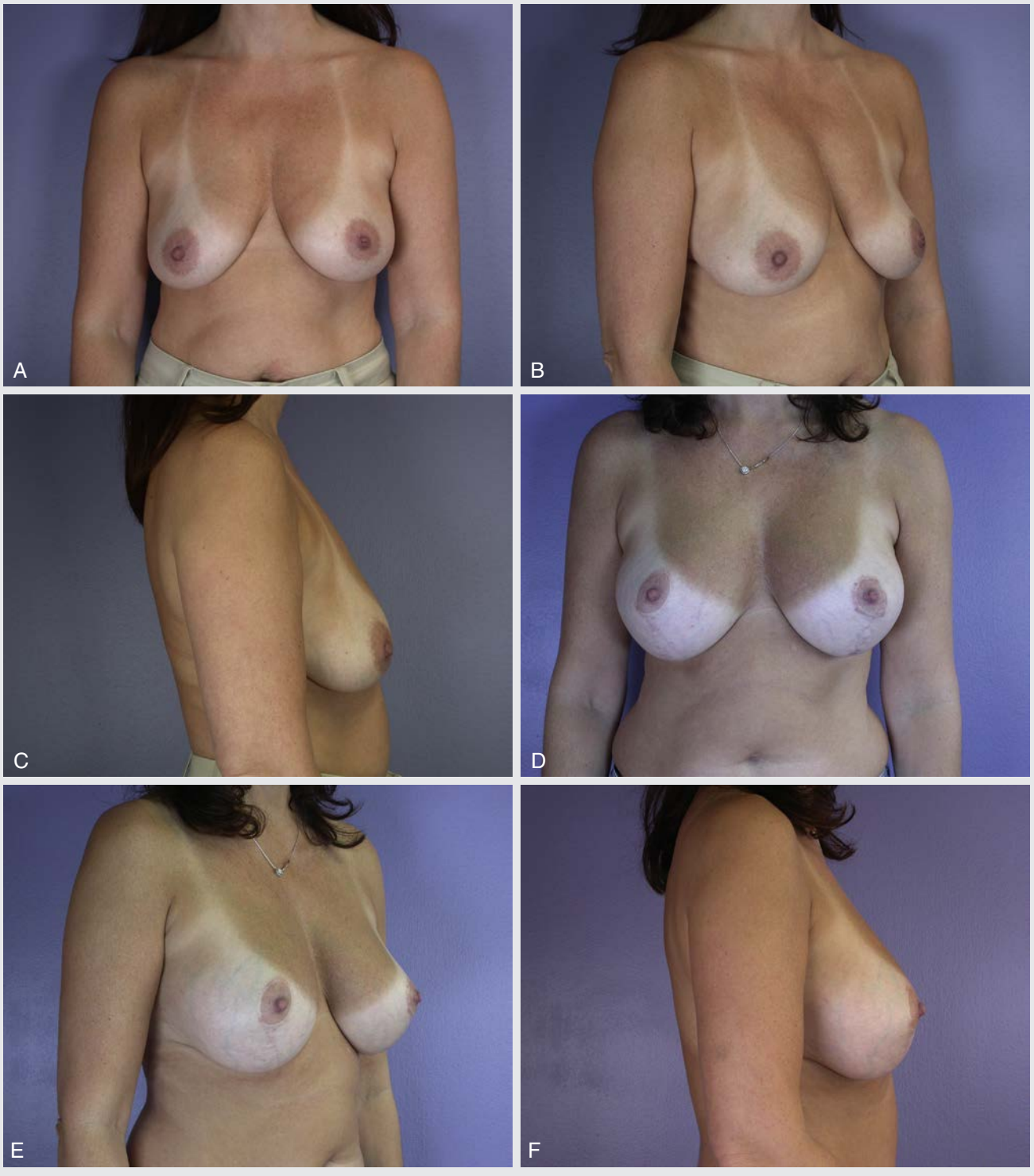
CASE 16.3

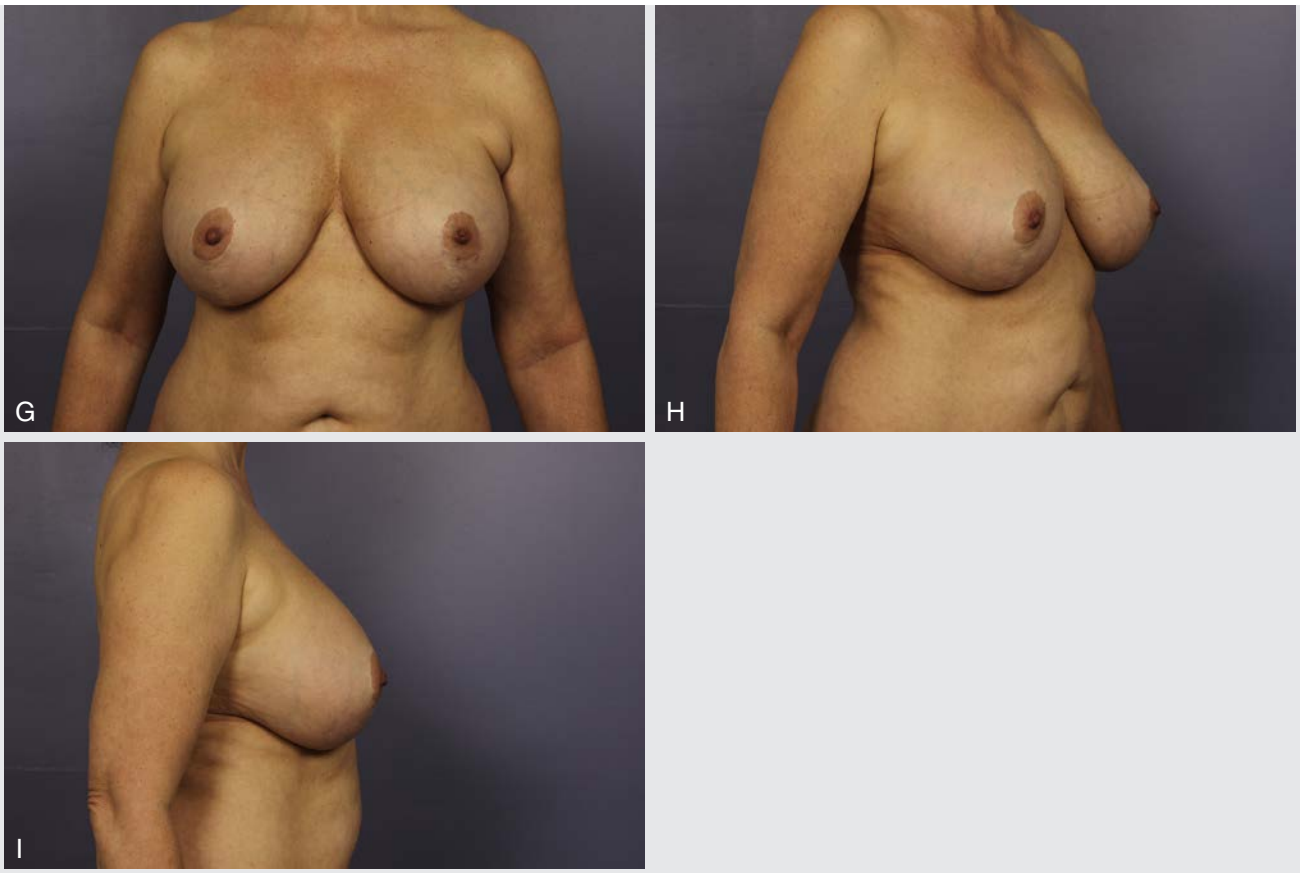
This 34-year-old woman underwent augmentation mastopexy with 253-cc moderate-profile round, textured implants in a subpectoral plane bilaterally. Preoperative photographs are presented in Case 16.3A–C. Postoperative photographs at 3 years are shown in Case 16.3D–F.

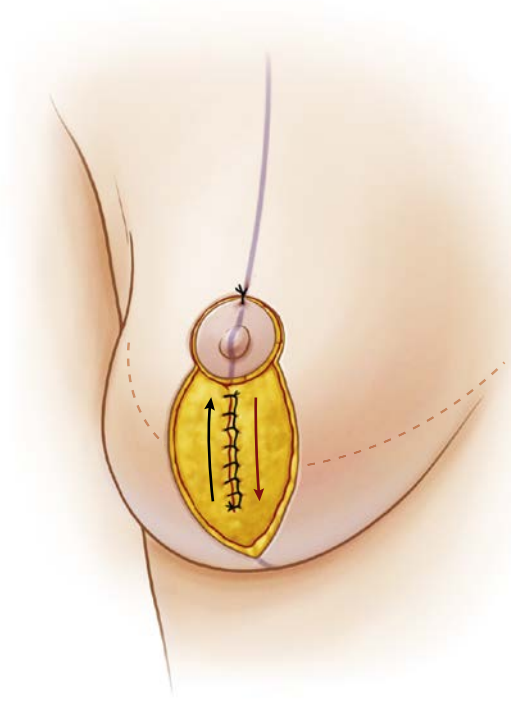


CASE 16.4

This 44-year-old woman underwent augmentation mastopexy with 354-cc moderate-profile round, textured implants in a subpectoral plane bilaterally. Preoperative photographs are presented in Case 16.4A–C. Postoperative photographs at 1.5 years are shown in Case 16.4D–F. Postoperative photographs at 13 years are shown in Case 16.4G–I.







• **Fig. 16.14** Pillar sutures. The medial and lateral pillars are closed in two layers to seal off the implant pocket, starting from the IMF upward toward the areola *(black arrow),* with a running locking 2-0 Vicryl suture and then back down toward the IMF in a non-locking fashion with the same suture (red arrow). (Redrawn from Spring, M.A., Hartmann, E.C., Stevens, W.G., 2015. Strategies and challenges in simultaneous augmentation mastopexy. *Clin. Plast. Surg.* 42, 505–518.)

Management of Complications

The most concerning immediate potential complication is related to NAC perfusion. This may be related to epinephrine when arterial insufficiency is identified intraoperatively, which will resolve as the epinephrine wears off and application of a warm sponge is used intraoperatively to promote vasodilation. Venous congestion is more common postoperatively as the effects of swelling affect the lower pressure venous system. Impaired NAC perfusion in the postoperative period can be managed by first releasing the sutures surrounding the NAC and applying topical nitroglycerin ointment. If a hematoma is suspected, the patient should be returned to the operating room for evacuation of the hematoma. The need to remove the breast implants to relieve the pressure on the pedicle and improve perfusion would be very rare but could be considered as a last resort. Hyperbaric oxygen could also be considered as an adjunctive treatment.

Secondary Procedures

The most common indications for revision were desire to change implant size (5.0%), poor scarring (4.7%), and implant deflation (2.4%).[8] The number/percentage of each indication for revision augmentation mastopexy is summarized in Table 16.3. Minor revision procedures to improve scarring or areolar asymmetry can be corrected under local anesthesia in the office. Implant-related revisions for style/

TABLE 16.1 Implant-Related Complications[a]

Complications	No. of Patients (%)	Types of Implant			
		Silicone		Saline	
		Textured	Smooth	Textured	Smooth
Deflation	15 (2.4)	0	0	10 (63)	5 (33)
Capsular contracture (Baker grade ≥III)	15 (2.4)	10 (67)	0	3 (20)	2 (13)
Implant palpability	4 (0.6)	1 (25)	0	2 (50)	1 (25)
Implant malposition	2 (0.3)	2 (100)	0	0	0

[a]Data denote the number (and percentage) of patients.
From Stevens, W.G., Macias, L.H., Spring, M., Stroker, D.A., Chacon, C.O., Eberlin, S.A., 2014. One-stage augmentation mastopexy: a review of 1192 simultaneous breast augmentation and mastopexy procedures in 615 consecutive patients. *Aesthet. Surg. J.* 34, 723–732.

TABLE 16.2 Tissue-Related Complications

Complication	No. of Patients (%)
Poor scarring	35 (5.7)
Wound-healing problems	18 (2.9)
Areola asymmetry	12 (1.9)
Recurrent ptosis	8 (1.3)
Loss of nipple sensation	8 (1.3)
Significant infection	7 (1.1)
Breast asymmetry	7 (1.1)
Pseudoptosis	5 (0.8)
Hematoma	4 (0.6)
Partial areolar depigmentation	3 (0.5)
Persistent ptosis	3 (0.5)

From Stevens, W.G., Macias, L.H., Spring, M., Stroker, D.A., Chacon, C.O., Eberlin, S.A., 2014. One-stage augmentation mastopexy: a review of 1192 simultaneous breast augmentation and mastopexy procedures in 615 consecutive patients. *Aesthet. Surg. J.* 34, 723–732.

TABLE 16.3 Indications for Revision

Indication	No. of patients (%)
Desire to change implant size	31 (5.0)
Poor scarring	29 (4.7)
Implant deflation	15 (2.4)
Recurrent or persistent ptosis	7 (1.1)
Capsular contracture (Baker grade ≥III)	7 (1.1)
Breast asymmetry	6 (1.0)
Implant infection	3 (0.5)
Implant malposition	3 (0.5)
Exchange for silicone implants	2 (0.3)
Areola asymmetry	1 (0.1)
TOTAL	

From Stevens, W.G., Macias, L.H., Spring, M., Stroker, D.A., Chacon, C.O., Eberlin, S.A., 2014. One-stage augmentation mastopexy: a review of 1192 simultaneous breast augmentation and mastopexy procedures in 615 consecutive patients. *Aesthet. Surg. J.* 34, 723–732.

size change, deflation, malposition, or capsular contracture require a return to the operating room and replacement of implants. Substantial downsizing of implants and persistent/recurrent ptosis can be corrected with a secondary augmentation mastopexy procedure.

Patients undergoing secondary augmentation mastopexy often require unique incision patterns tailored specifically to their tissue needs (see Fig. 16.2). In patients seeking secondary augmentation mastopexy the NAC often remains at the elevated position created by the primary augmentation mastopexy, but the tissue in the lower pole has developed laxity and/or descended over time (e.g., waterfall deformity). These patients require tightening of the tissue laxity but do not require elevation of the NAC; many of them actually require shortening of the height of the NAC from the IMF. For patients requiring shortening in a vertical and horizontal direction, a "sailboat" mastopexy can be used. For patients who require shortening in a vertical direction only, a "smile" mastopexy can be used. Patients who have had massive weight loss are more likely to require a secondary procedure as a result of tissue quality.

Conclusion

The one-stage augmentation mastopexy technique described in this chapter can be performed safely with excellent aesthetic outcomes in appropriately selected patients with mammary hypoplasia and ptosis. Understanding the pertinent anatomy and avoiding potential pitfalls is essential for achieving optimal patient outcomes. Patients should be counseled about the potential need for revision surgery, which is relatively low compared with the guarantee of a second operation with a staged approach.

SUMMARY BOX

Pearls for Success

- Patients with Regnault grade I ptosis who require only 1–2 cm of elevation of the NAC with minimal laxity of the inferior pole of the breast may be candidates for a crescent or circumareolar mastopexy.
- Patients with Regnault grade II or III ptosis who require more than 2 cm of NAC elevation or pseudoptosis with substantial laxity in the lower pole are better treated with a circumvertical pattern.
- Patients with a tuberous breast often benefit from an implant plus circumareolar mastopexy because of the characteristic anatomic features of their breasts.
- A circumvertical approach is usually not advisable in the tuberous breast because the lower pole is already overly tight and the low-appearing NAC position is relative to an IMF that is anatomically too high.
- In patients who are candidates for a circumvertical augmentation mastopexy, a short transverse limb of skin resection is planned when the nipple-to-IMF distance is greater than 8 cm and adjusted intraoperatively to shorten the nipple-to-IMF distance to the desired length bilaterally.
- If the areola width is greater than half the breast width, there is unlikely to be enough skin to allow closure of the vertical limbs of the mastopexy with the additional volume of an implant, so patients with these anatomic characteristics are typically staged.
- Patients are asked to bring photographs of breasts they like to understand their size/shape preferences, and several sizer/implant volumes should be available because the exact implant size desired is not as easily determined as for patients undergoing breast augmentation only with three-dimensional imaging because the tissue dynamics can change greatly with the opposing forces of simultaneous augmentation and mastopexy.
- A moderate-profile round implant is most commonly preferred because ptotic breast tissue is recruited onto the implant with the mastopexy to increase projection while avoiding potential excessive tension on the vertical incision that can occur with a high-profile implant.
- In cases of preoperative breast asymmetry, a small reduction of the larger breast so that the same implant can be inserted bilaterally is typically preferred to achieve the greatest possible symmetry.
- A vertical incision is made through the breast parenchyma to insert the implant, leaving a 1- to 2-cm cuff of parenchyma inferiorly such that a wound separation at the T-junction will not result in exposure of the implant, which can occur if the implant is inserted by a transverse inframammary incision.

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SECTION 4

Breast Reduction and Reshaping

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17

Breast Reduction—Superior Pedicle Technique

NATHANIEL L. VILLANUEVA, ZIYAD S. HAMMOUDEH, AND W. GRANT STEVENS

Introduction

Superior pedicle breast reduction is the authors' technique of choice in patients who qualify for its use. Numerous advantages of this technique make it ideal for many patients.[1] Advantages of the superior pedicle technique include a reliable vascular pedicle. The superior pedicle receives blood supply from the internal mammary vessels that branch at the second and/or third intercostal space and course to the nipple–areola complex (NAC) at a depth of 1–1.5 cm.[2] A central mound pedicle is also maintained with perforators entering the NAC from deep by the pectoralis major muscle (thoracoacromial vessels).

The superior pedicle breast reduction technique allows resection of the ptotic, inferior portion of the parenchyma that weighs down the breast. Therefore, this technique unloads the mass at the lower pole and preserves superomedial fullness of the breasts, as desired by many women for enhanced cleavage. Unlike the inferior pedicle technique, which relies on maintaining lower pole parenchyma inferior to the NAC and elevation of the pedicle against gravity, the superior pedicle technique allows the NAC to remain suspended from the breast parenchyma above (cephalically) with removal of the heavy breast tissue inferiorly. Thus, a superior pedicle is thought to have less vulnerability to the force of gravity with less "bottoming out" over time.

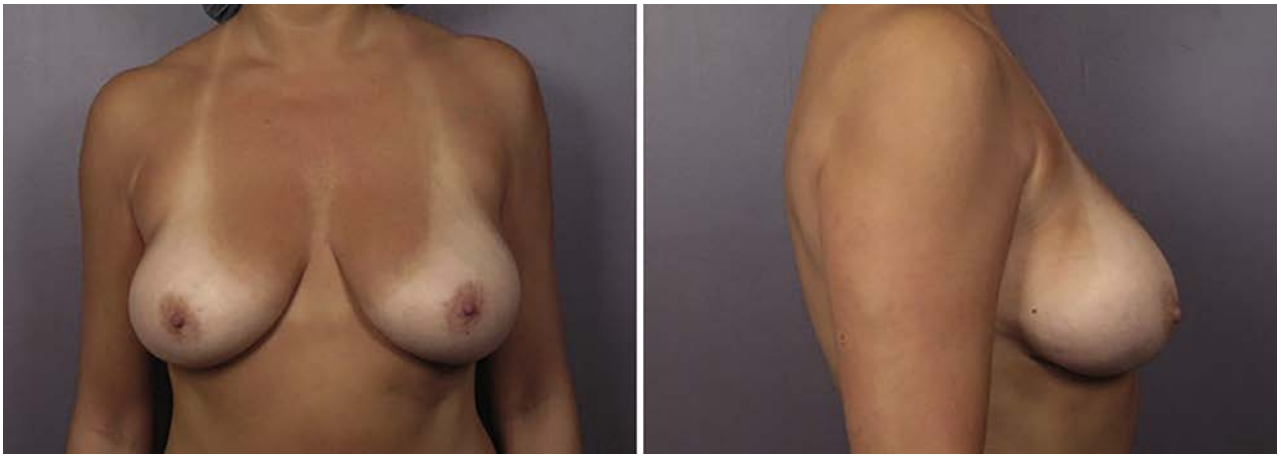
This fundamental difference allows the superior pedicle breast reduction to maintain a more youthful mammary shape over long term. When performed in the manner described, the superior pedicle technique allows a more efficient use of operative time with a smaller area of de-epithelialization required compared with that in the inferior pedicle technique. There is no rotation of the pedicle required to bring the NAC into the keyhole (as is performed with a superomedial, medial, or lateral pedicle) and thus no potential risk of kinking the pedicle when in-setting the NAC. With the superior pedicle technique, the NAC is brought directly straight through the vertical incision from beneath the skin surface without twisting or turning the NAC. A large amount of breast parenchyma is kept attached to the NAC, so this technique is favorable in younger women who may want to breastfeed in the future and has minimal chance of disruption of erogenous sensation to the nipple.

Disadvantages of the superior pedicle breast reduction technique include a limited amount of breast tissue that can be resected in patients with very large, ptotic breasts. The NAC is located within the vertical portion of the inverted-T design and not undermined, which limits resection ability relative to other breast reduction techniques. Medial and lateral breast pillars are not created like in some of the other techniques; thus, breast parenchyma is not removed centrally deep to the NAC. With the superior pedicle technique, tissue is removed almost exclusively from the inferior pole with an extended resection superolaterally along the axillary tail of the breast to remove some additional undesired lateral breast volume. Because breast tissue is not removed centrally, the breast width can be narrowed only to a limited extent. Thus, the superior pedicle technique relies on advancement of medial and lateral skin flaps toward the T-junction and resection of the axillary tail, to decrease the horizontal dimension of the breast.

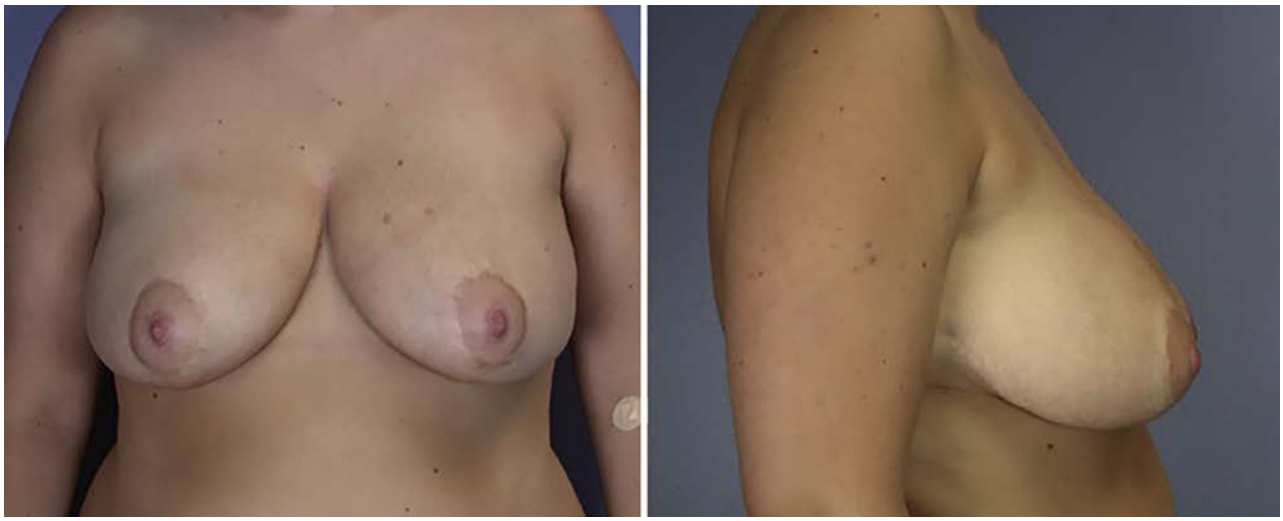
As with the inferior pedicle technique, the need to undermine skin to create medial and lateral flaps of uniform thickness without tension at the T-junction is a potential disadvantage of the superior pedicle technique. Considering these advantages and disadvantages, appropriate patient selection is important based on the following indications and contraindications that make some women more ideal candidates than others for a superior pedicle breast reduction approach. Guidelines regarding patient selection and technical aspects of the procedure are outlined in this chapter.

Indications and Contraindications

Patients with Regnault grade I or II ptosis or pseudoptosis and an estimated resection weight of 600 g or less are considered candidates for a superior pedicle breast reduction in the authors' practice. Patients requiring minimal elevation of the NAC are extremely well suited for this technique. Within these standard



• **Fig. 17.1** Younger women with very glandular breasts and minimal to no ptosis who desire breast reduction can be a difficult surgical problem.



• **Fig. 17.2** Patients who previously underwent primary breast reduction with residual/recurrent macromastia but a NAC at an appropriately lifted level are often good candidates for a secondary breast reduction using a superior pedicle technique.

guidelines, there are also three unique situations in which the superior pedicle reduction technique is particularly ideal.

Younger women with very glandular breasts and minimal to no ptosis who desire breast reduction can be a difficult surgical problem; there are very few reduction pedicles available that allow substantial volume reduction in women who do not need much elevation of the NAC (Fig. 17.1). For instance, a superomedial, medial, or lateral pedicle cannot be designed in the standard fashion when the nipple is already at an appropriate elevated position preoperatively (i.e., minimal to no ptosis). An inferior pedicle can be performed in such a situation but is not ideal. Furthermore, these young patients are not good candidates for liposuction-only breast reduction to remove volume without changing NAC position because of the glandular rather than fatty nature of their breast tissue that prevents effective suction-assisted lipectomy.

Patients who previously underwent primary breast reduction with residual/recurrent macromastia but with a NAC at an appropriately lifted level are often good candidates for a secondary breast reduction using a superior pedicle technique (Fig. 17.2). The superior pedicle technique maintains central perforators from deep to the NAC; therefore, a superior pedicle can be used for a secondary breast reduction after a previous primary breast reduction with an inferior pedicle.

Limitations of use of the superior pedicle technique exist in patients needing very large reductions with long distances from the nipple to the inframammary fold (IMF). In such patients, tissue rearrangement to elevate the nipple into the desired position becomes more difficult, with increased concerns regarding vascularity of a long, narrow pedicle. Therefore, patients with Regnault grade III ptosis (NAC at the inferior-most aspect of the breast) are generally not good candidates for a superior pedicle technique. The NAC is simply positioned too low on the heavy inferior pole tissue that weighs down the breast.

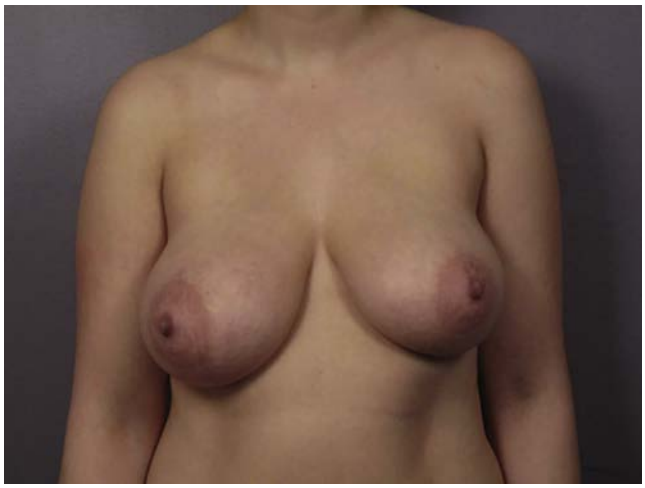
Very large reductions in patients with Regnault grade II or III ptosis and a very long nipple-to-IMF distance in which the NAC is inferior to the previously described

triangle can be candidates for a superomedial, medial, or lateral pedicle because tissue deep to these pedicles is typically resected to reduce volume and allow rotation of the NAC into the keyhole; however, there are also concerns for impaired perfusion of the NAC with these pedicles when their lengths are very long and narrow in patients with gigantomastia and grade III ptosis. For patients not meeting the previously described indications, an inferior pedicle technique with a wider pedicle width (e.g., 10 cm) may be a better alternative.[3,4] Very large areolas (e.g., width greater than 8 cm) are not an absolute contraindication to a superior pedicle reduction, but they require a wider triangle base to completely remove the darker pigmented areolar skin and thus greater undermining of medial and lateral flaps to allow closure at the T-junction. Similar to other breast reduction techniques, contraindications include active smoking and other conditions that could have a deleterious effect on pedicle/flap perfusion and potential nipple vascular compromise.

Preoperative Evaluations and Special Considerations

A thorough history is important when assessing these patients. Patients are asked about their symptoms associated with mammary hyperplasia. Specifically, they are asked about the presence of back/shoulder pain, rashes in the IMFs, bra strap shoulder grooving, and changes in weight. Questions regarding breast health are also assessed such as recent mammograms, previous breast surgery, and family history of breast cancer. A thorough breast examination is performed to assess for any pathologic conditions, and standard breast measurements (sternal notch–to-nipple distance, nipple-to-IMF distance, breast width, and areola width) are recorded. The patient's body mass index (BMI) is also calculated. To help the surgeon gauge the patient's goals, patients are asked about their bra size preoperatively and desired bra size postoperatively. The weight of the breast to be removed in grams is estimated based on these measurements and patient goals. When submitting for insurance coverage, the Schnur scale is often used to determine the weight of tissue needed to be removed to meet insurance requirements. Medications that can increase bleeding or impair would healing are held. Patients 30 years of age and older undergo a preoperative mammogram. Patients younger than 30 years of age with a strong family history of breast cancer also undergo preoperative breast imaging.

Achieving a satisfactory aesthetic outcome can be challenging in patients who present for a breast lift with substantial breast asymmetry (e.g., greater than 100-g difference between the breasts) (Fig. 17.3). These patients are often well-suited for a standard vertical mastopexy in the smaller breast and a superior pedicle reduction in the larger breast because of the similarities in superior/central pedicle design in both breasts. Patients with mild breast asymmetry (e.g., less than 100-g difference between the breasts) can often



• **Fig. 17.3** A satisfactory aesthetic outcome can be challenging to achieve in patients who present for a breast lift with substantial breast asymmetry.

have the volume difference between the breasts corrected by removing parenchyma centrally from the vertical pillars of the larger breast. However, only about 50–100 g of tissue can be removed in this fashion. Therefore, patients with more than 100-g difference between the breasts can have the larger breast reduced by a superior pedicle technique that suspends the nipple in a similar fashion as a superior/central pedicle vertical mastopexy to allow for maximal possible symmetry postoperatively.

In the standard superior pedicle technique, the NAC should be within the designed triangle of the vertical limbs of the Wise pattern (not inferior to the triangle's borders) because all of the tissue inferior to the base of the triangle is resected and the NAC is not normally undermined with this technique. If the NAC is inferior to the base of the triangle, this technique would need to be modified to extend the pedicle inferior to the base of the triangle, preventing a standard medial-to-lateral transverse resection across the base of the triangle. Such modification would also likely require undermining of the NAC to allow it to elevate into position superiorly, which would sacrifice some of the deep central perforators to the NAC. This obstacle cannot be overcome by simply designing longer vertical limbs of the triangle because that would produce a nipple-to-IMF distance that is too long at the end of the operation. Because the vertical limbs of the triangle are typically designed to be about 8 cm long to allow for an appropriate nipple-to-IMF distance postoperatively, patients who require elevation of the nipple by 10 cm or more are generally not good candidates for a superior pedicle reduction technique.

Surgical Techniques

The procedure can be described in 17 steps, which are presented in Box 17.1 and demonstrated in the Video 17.1.

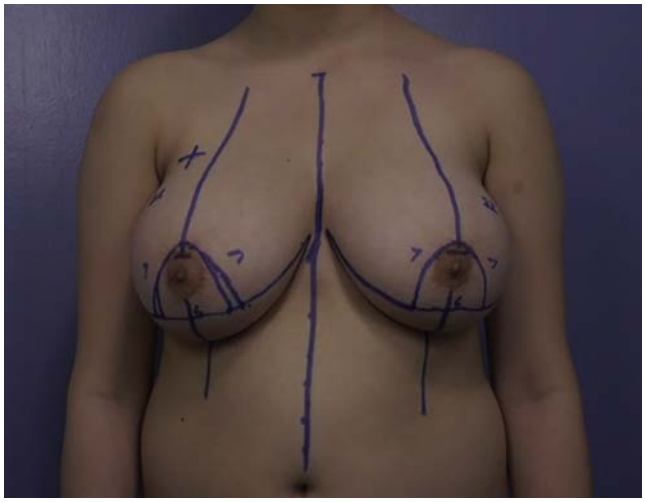
The patient is marked preoperatively in the standing position. The chest midline, breast meridians, and IMFs are marked for reference. Biparietal diameter obstetric calipers

• BOX 17.1 Steps for Superior Pedicle Breast Reduction

1. Mark the patient preoperatively.
2. Perform tumescent injection, excluding the central mound and superior breast.
3. Prepare and drape the patient.
4. Mark incision site of the NAC and the de-epithelialization area.
5. Make all incisions.
6. De-epithelialize the triangle surrounding the NAC.
7. Dissect inferior incision to the level of the de-epithelialized tissue along the chest wall.
8. Dissect the medial breast pillar.
9. Dissect the lateral breast pillar.
10. Pass specimen off sterile field for weighing.
11. Release through dermis superior to nipple.
12. Dissect caudal portion of the vertical limb until the flap reaches the inset medially and laterally.
13. Achieve hemostasis.
14. Consider drain placement.
15. Perform temporary closure with staples.
16. Apply cookie cutter to mark skin excision for final position of NAC.
17. Perform wound closure in layers.

are the authors' tool of choice to accurately mark the desired new nipple position at the level of the IMF. One prong of the calipers is placed on the sternal notch and the other prong placed posteriorly on the IMF at the breast meridian. The calipers are tightened to maintain this fixed length from sternal notch to IMF. The inferior prong is then transposed anteriorly onto the breast mound while the superior prong is maintained at the sternal notch to allow for a precise marking of the new nipple position at the level of the IMF. The calipers are then placed onto the contralateral breast to mark the new nipple position at the same level bilaterally. This approach avoids any subjectivity in transposing the level of the IMF onto the breast mound, thus reducing the potential for mismarking the desired new nipple position too cephalically or too caudally, which can occur with other less precise methods. A Wise pattern (excluding a NAC keyhole) is marked according to the amount of planned inferior pole resection. The keyhole for the NAC is not predetermined at the time of the markings, because its position will be adjusted intraoperatively at the time of NAC in-set. Medial and lateral vertical limbs are marked on each side of the patient's NAC, starting from an apex at the selected new nipple position and extending inferiorly. The limbs are tapered inward toward the meridian as they extend inferiorly to take tension off the T-junction at the time of closure.

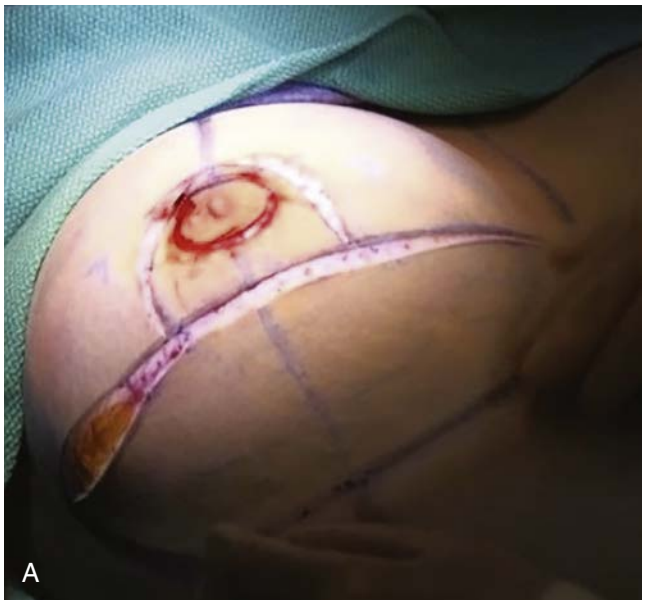
A length of 8 cm is typically selected for the vertical limbs (for a planned distance of 2 cm from the nipple to the inferior areolar border and 6 cm from the inferior areolar border to the IMF). A shorter length of 7 cm can be selected for the vertical limbs when a greater reduction of inferior pole tissue is desired (planned distance of 5 cm from the inferior areolar border to the IMF), particularly in patients with minimal to no ptosis such that the NAC is located just

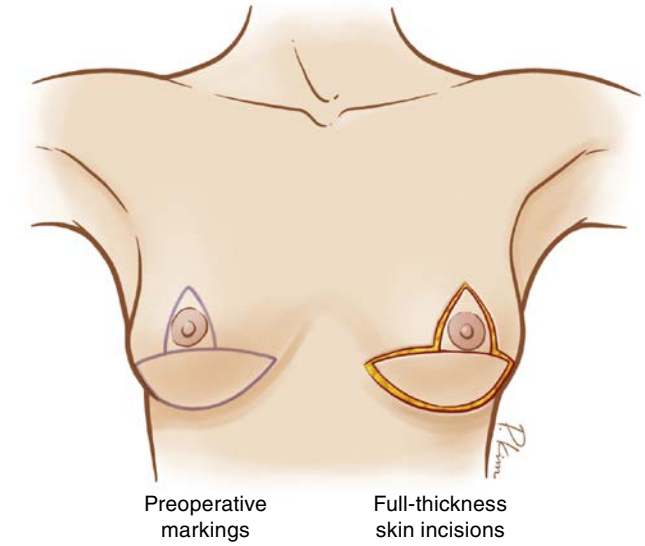


• **Fig. 17.4** Markings for a superior pedicle breast reduction in an 18-year-old patient with dense, glandular breasts and minimal ptosis. The chest midline, breast meridian, and IMF are marked for reference bilaterally. A short transverse mark representing the level of the IMF and desired new nipple position is made (just cephalad to each nipple in this case). Distance from the sternal notch to the desired new nipple position is measured and confirmed to be equal bilaterally (22 cm in this case). Medial and lateral vertical limbs are marked at 7–8 cm bilaterally (7 cm in this case) to form a triangular superior pedicle with an apex at (or 1 cm cephalad to) the level of the IMF (slightly cephalad in this case to include the superior border of the areola). The limbs of the isosceles triangle are tapered inward toward the meridian of the breast at their inferior extent for a width of 6–7 cm (6 cm in this case, initially marked slightly wider in the larger right breast). The inferior extent of the medial and lateral limbs is extended transversely to connect with the medial and lateral extent of the IMF, respectively; this designates the area of resection of the inferior pole. A plus sign is used to mark the larger breast for greater resection.

below or at the level of the IMF. The width between the inferior extent of the medial and lateral vertical limbs (base of the isosceles triangle) is typically designed to be 1–2 cm less than their length (e.g., 6–7 cm wide). However, this width may need to be increased in patients with very large areolas to completely remove the areolar skin. The width between the medial and lateral vertical limbs is designed to be the same in both breasts when the breasts are similar in size or designed slightly wider in the larger breast when there is substantial asymmetry. The markings are demonstrated in Fig. 17.4.

In the operating room, the patient is positioned supine on the operating table with arms out. After intubation, the breasts are injected with a dilute local anesthetic solution consisting of 30 mL of 2% plain lidocaine and 1 mL of epinephrine 1:1000 mixed into a 250-mL bag of normal saline. Care is taken to avoid deep injection in the vicinity of the pedicle and superior pole to allow assessment of NAC perfusion intraoperatively. The vasoconstrictive effects of epinephrine in the dilute local anesthetic solution allows the entire dissection to be performed sharply with a scalpel to improve efficiency of operative time and limit the thermal injury of electrocautery. The preemptive analgesic effect of lidocaine also helps with postoperative pain control.





• **Fig. 17.5** Incisions along the superior pedicle breast reduction markings, as (A) photographed intraoperatively in the right breast (same patient featured in Fig. 17.4) and (B) illustrated for the left breast.

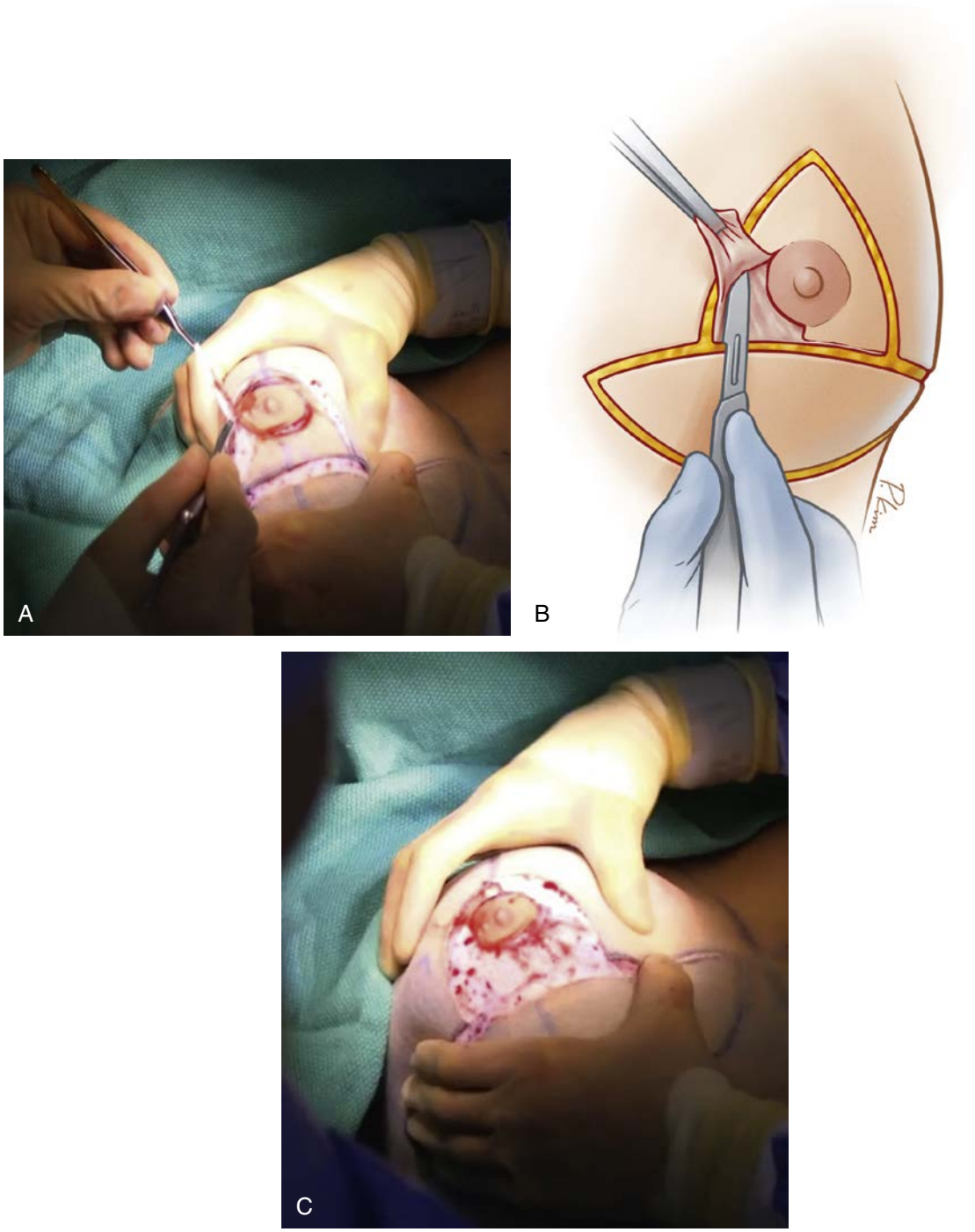
After the patient is prepped and draped, the breast is placed on tension around the NAC by an assistant, and a 42-mm circular template is used to mark the areolar incision. The areolar template marking and the vertical limbs around the pedicle are scored through the epidermis only with a no. 10 blade scalpel. The remaining markings are made full thickness through the dermis down to subcutaneous fat with the scalpel (Fig. 17.5A, B). The triangular pattern of skin around the NAC corresponding to the superior pedicle is de-epithelialized (Fig. 17.6A–C).

The breast is retracted superiorly with the surgeon's nondominant hand, and the inferior markings along the IMF are incised down to the chest wall. The scalpel is then angled parallel to the chest wall, and dissection is continued in a cephalad direction (Fig. 17.7A, B). A thin layer of adipose tissue is preserved on the pectoralis major muscle fascia to promote lymphatic drainage and decrease fluid production postoperatively. The cephalad dissection along the chest wall is stopped once the superior markings are reached. Dissection along the chest wall should not undermine the de-epithelialized triangle surrounding the NAC.

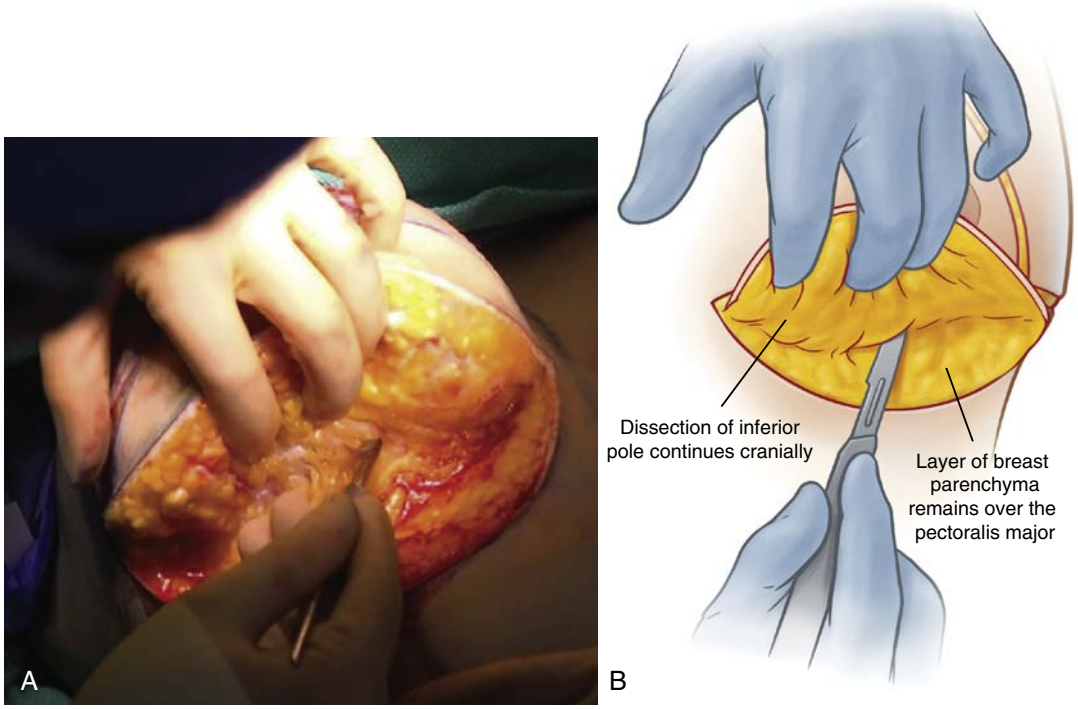
The breast is then retracted laterally, and the superior markings are incised down to the chest wall starting from medially and progressing toward the meridian of the breast (Fig. 17.8A, B). Once the meridian is reached, the breast is retracted medially and dissection is continued laterally. Laterally, the dissection is started straight down toward the chest wall; in the deep portion of the dissection, the scalpel is angled superiorly to excise the axillary tail of the breast that is the source of undesired lateral breast fullness (Fig. 17.9A, B). The lateral undermining can be continued as cephalad as needed to resect the required volume because the blood supply to the pedicle is not dependent on lateral vessels. The specimen is then removed, weighed, and sent for pathologic examination (Fig. 17.10A–C). Electrocautery is used at this point to coagulate any bleeding vessels.

The vertical limbs of de-epithelialized dermis of the pedicle are then incised with the scalpel into the subcutaneous tissue. Medial and lateral breast skin flaps are dissected on each side of the pedicle to achieve a uniform thickness of approximately 2 cm. Dissection of the flaps occurs along a natural plane determined by the superficial fascia enveloping the breast parenchyma (usually clearly visible as a discrete white layer deep to the flap dissection) and the yellow subcutaneous fat of the skin raised with the flap. The *medial* flap is created first by grasping the de-epithelialized dermis of the pedicle with a Kocher clamp and retracting laterally for counter tension as the flap is retracted medially with the surgeon's nondominant hand during scalpel dissection (Fig. 17.11A, B). The Kocher clamp is then placed on the medial aspect of the de-epithelialized dermis and retracted medially to create the *lateral* flap as the surgeon's nondominant hand retracts the flap laterally.

Dissection of the medial and lateral flaps should extend away from the pedicle only as far as necessary to sufficiently advance the flaps together toward the IMF for closure. Limiting the extent of this dissection is important to preserve blood supply to the pedicle and to the medial and lateral flaps that form the closure at the T-junction (Fig. 17.12A, B). There is often a small amount of additional breast tissue that can be removed laterally to further reduce the breast volume and still maintain a satisfactory amount of breast parenchyma to NAC (Fig. 17.13). The entire dissection is performed with a no. 10 blade scalpel with minimal bleeding because of the preoperative dilute local anesthetic injection, and hemostasis of any bleeding vessels is performed with electrocautery after completion of cold knife dissection. This also limits thermal injury to the pedicle and medial and lateral flaps. The medial and lateral flaps are brought together toward the IMF at the meridian of the breast with a penetrating towel clamp (Fig. 17.14A, B). The flaps are temporarily stapled in place. A drain is



• **Fig. 17.6** The triangular area surrounding the NAC corresponding to the superior pedicle is de-epithelialized. (A) Photograph intraoperatively in the right breast (same patient featured in Fig. 17.4) and (B) illustrated for the left breast. (C) Fully deepithelialized pedicle.



• **Fig. 17.7** The inferior marking along the IMF is incised straight down to the chest wall, and the scalpel is angled parallel to the chest wall to continue dissection toward the superior markings, as (A) photographed intraoperatively in the right breast (same patient featured in Fig. 17.4) and (B) illustrated for the left breast.

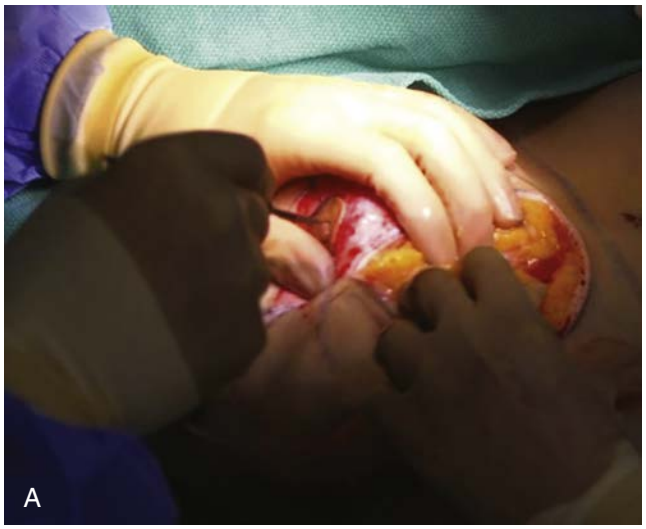
not routinely used, because there is typically minimal dead space. The same procedure is performed in the contralateral breast before setting the NAC position so it is at the same level on the breast mound bilaterally.

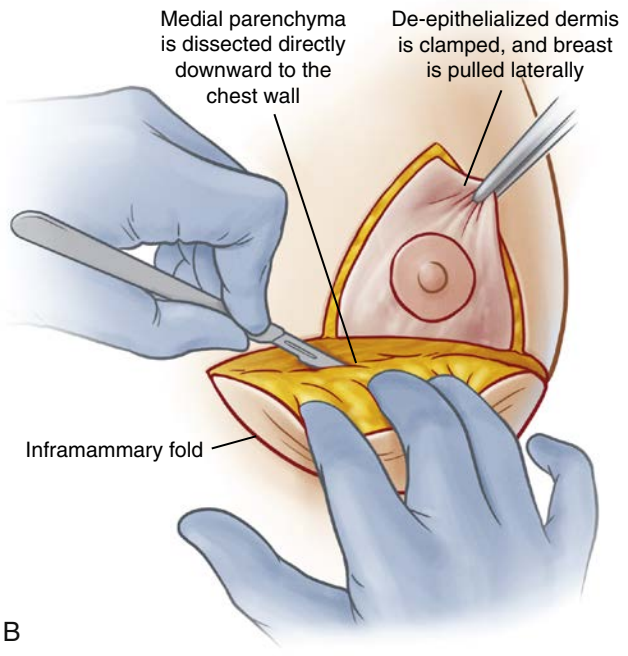
The new nipple position is typically selected at the apex of the vertical portion of the inverted-T incision using a 38-mm circular template centered over the apex. However, the NAC position can be adjusted at this point by moving the template slightly more cephalically or caudally along the vertical incision, as desired. The selected distance from the IMF to the inferior areolar border is marked with a ruler bilaterally to ensure symmetry. In most cases, 6 cm is selected as the distance from the IMF to the inferior areolar border when 8-cm limbs were marked preoperatively (or 5 cm is selected when 7-cm limbs were marked) because the distance from inferior areolar border to the nipple is approximately 2 cm (i.e., half the diameter of a 4-cm areola). The skin and subcutaneous tissue of the flaps marked with the template are excised. The NAC is brought to the skin surface and sutured in place. The staples are replaced with a suture closure in two layers (deep dermal and subcuticular) using absorbable monofilament sutures. The process of selecting the new nipple position and in-setting the NAC is demonstrated in Fig. 17.15A–D.

Postoperative Care and Expected Outcomes

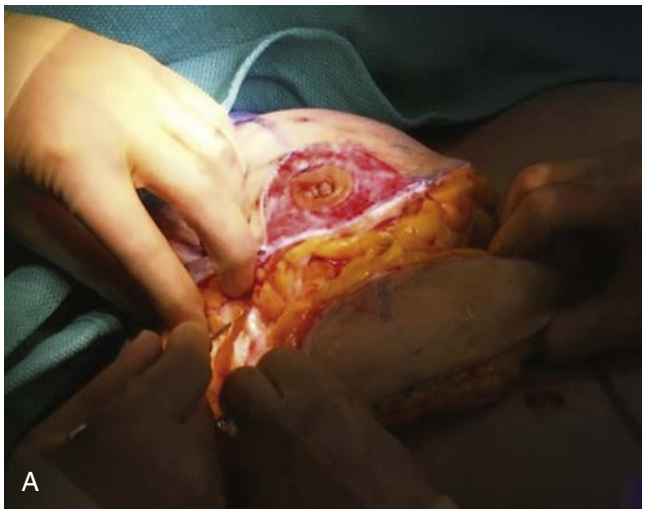
Patients are routinely discharged home after surgery with follow-up in the office the next day. The incisions are initially dressed with Steri-Strips that remain in place for the first 2 weeks. Once the incisions have adequately healed, the Steri-Strips are discontinued, and the patients are started on silicone-based scar therapy to maximize the aesthetic appearance of their scars. The patients return to the office at 1 day, 1 week, 2 weeks, 1 month, 3 months, 6 months, and 1 year postoperatively. Patients are encouraged to follow up annually thereafter.

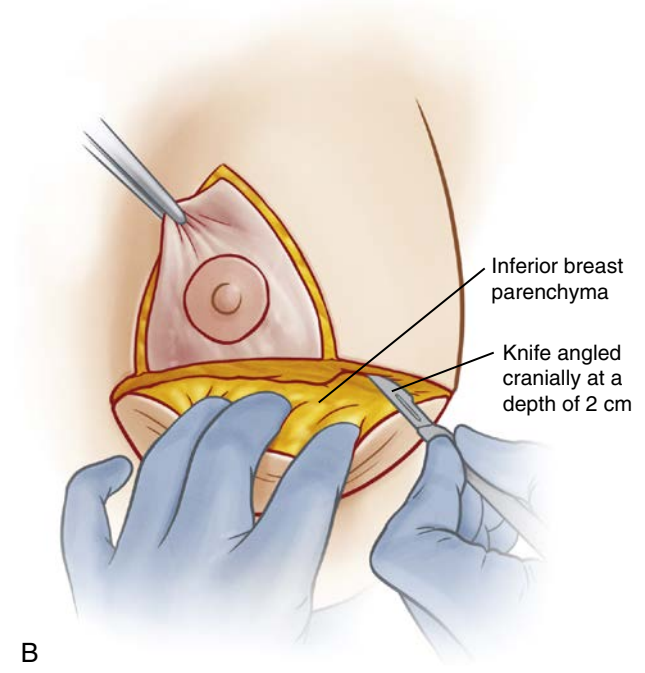
The results of this technique have been studied and produced excellent outcomes.[1] In 62 consecutive patients with a mean age of 40 years (standard deviation [SD] 12.5 years), mean BMI of 25 kg/m^2 (SD 2.9 kg/m^2) and mean sternal notch–to-nipple distance of 27.6 cm (SD 2.8 cm), the mean total resection weight was 406 g (SD 163 g), with a mean operative time of 112 minutes (SD 21 minutes).The most common bra cup size preoperatively was DD (range D to G; band range 32–40 inches). In a mean follow-up of 12 months, the overall complication rate was 11.3%.



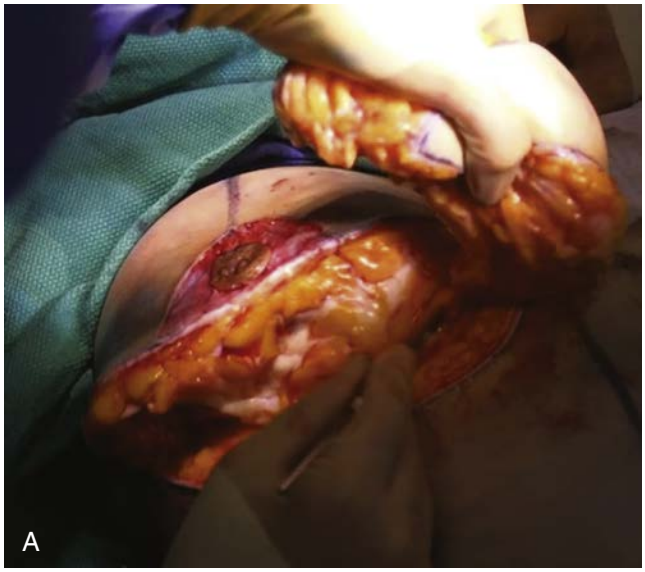


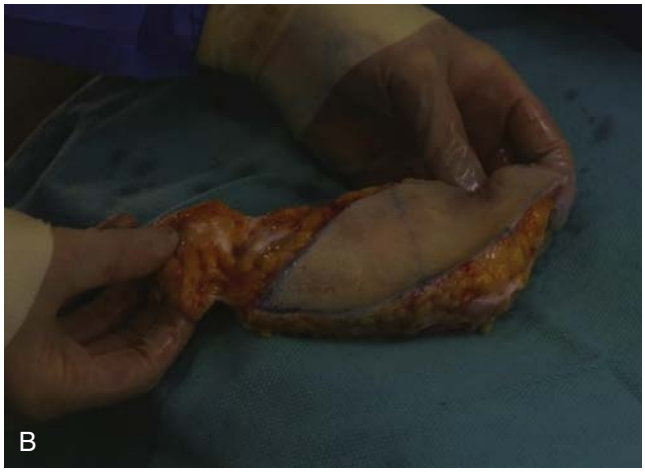
• **Fig. 17.8** Illustration of the medial dissection in the left breast. Medially, dissection is performed straight down in a deep direction toward the chest wall through the superior incision.

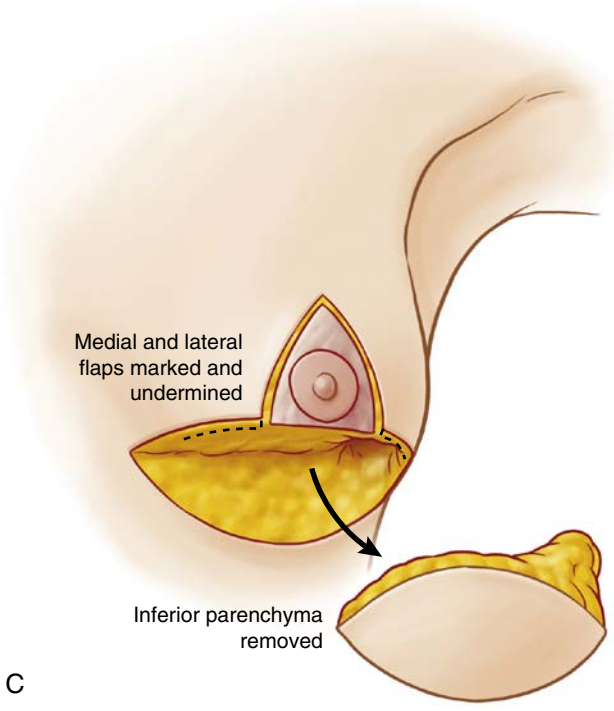




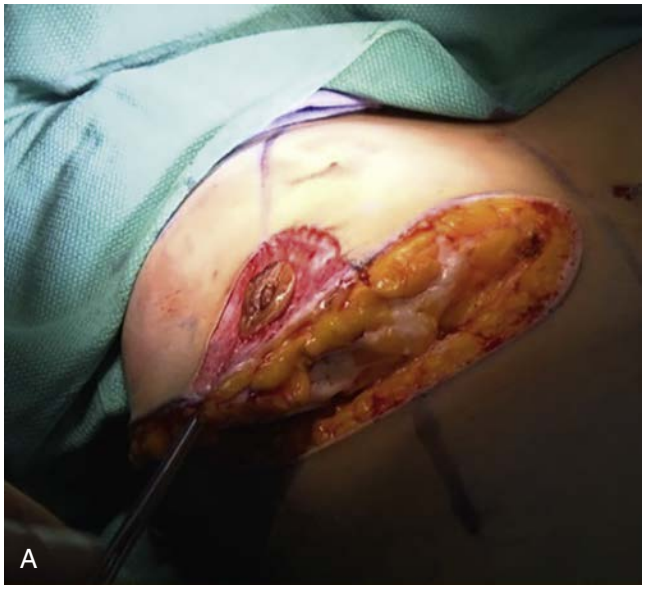
• **Fig. 17.9** Laterally, dissection is initially performed straight down toward the chest wall and then angled cephalically to resect the axillary tail of the breast, as (A) photographed intraoperatively in the right breast (same patient featured in Fig. 17.4) and (B) illustrated for the left breast.

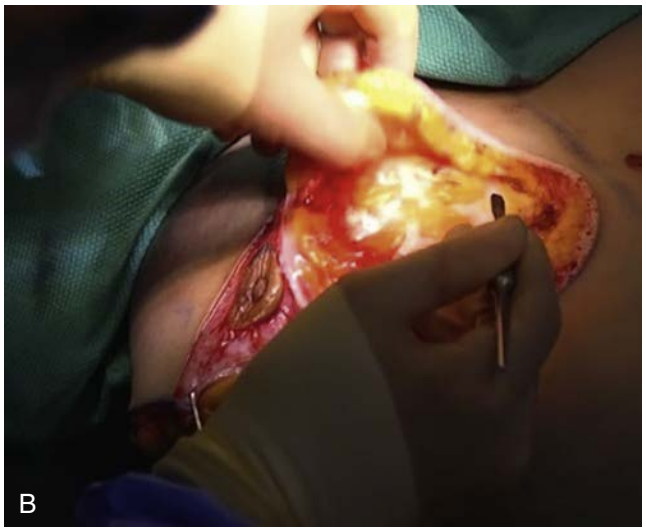




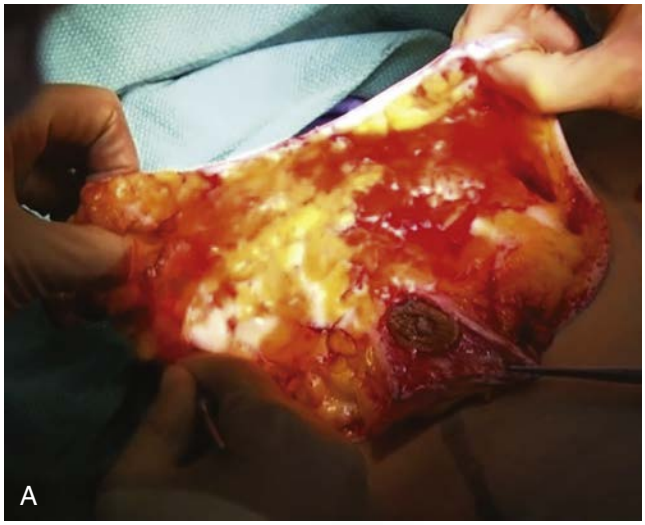


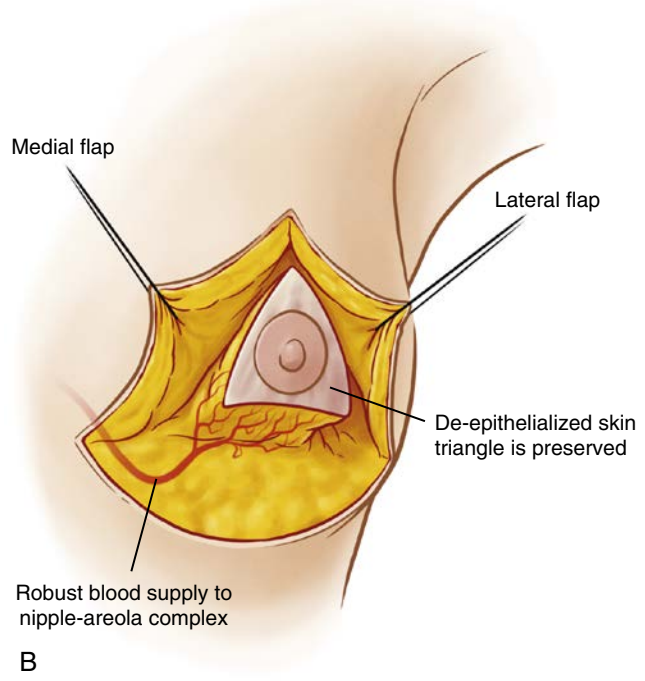
• **Fig. 17.10** Elliptical resection specimen of inferior pole breast skin and parenchyma, including parenchyma of the axillary tail of the breast laterally, as (A, B) photographed intraoperatively in the right breast (same patient featured in Fig. 17.4) and (C) illustrated for the left breast.



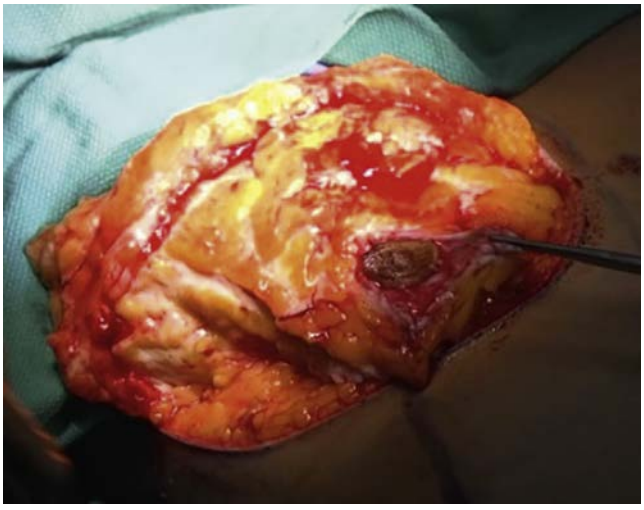


• **Fig. 17.11** Intraoperative photograph of the medial skin flap development in the right breast (same patient featured in Fig. 17.4). (A) The lateral aspect of the de-epithelialized dermis of the pedicle is grasped with a Kocher clamp and retracted laterally for counter tension. (B) The skin and subcutaneous tissue is grasped with the surgeon's nondominant hand and retracted medially while the surgeon raises a 2-cm-thick flap using the scalpel.

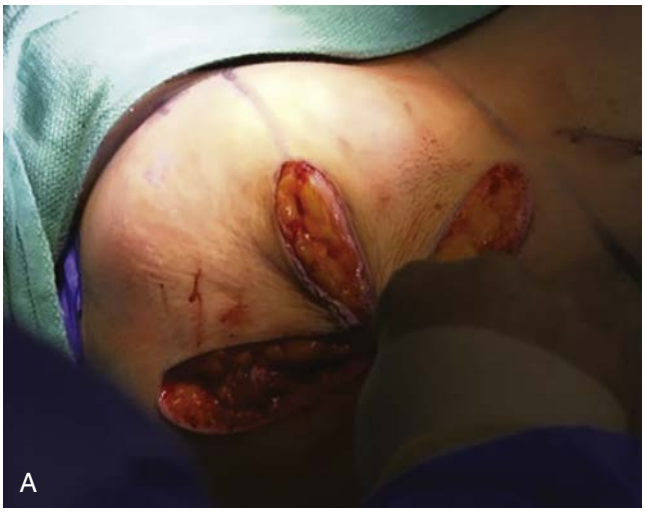


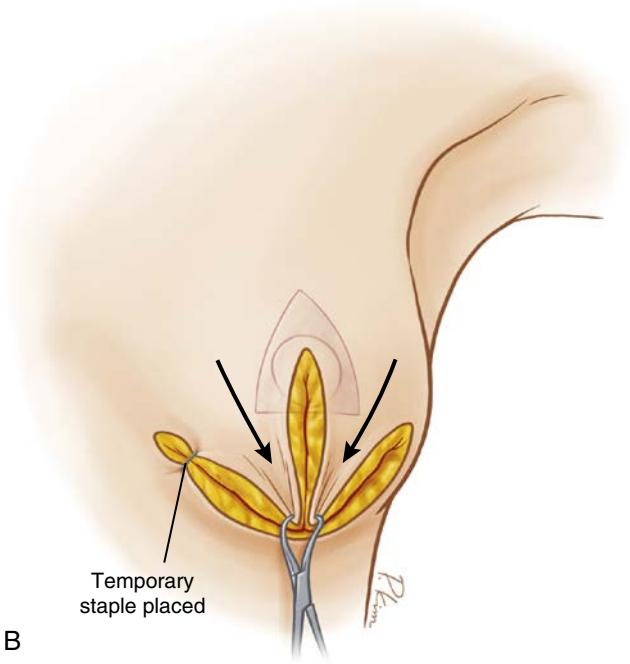


• **Fig. 17.12** Medial and lateral flaps raised in the right breast. (A) Intraoperative photograph (same patient featured in Fig. 17.4). (B) Illustration of the medial and lateral flaps raised with the associated blood supply to the nipple–areola complex in the left breast.

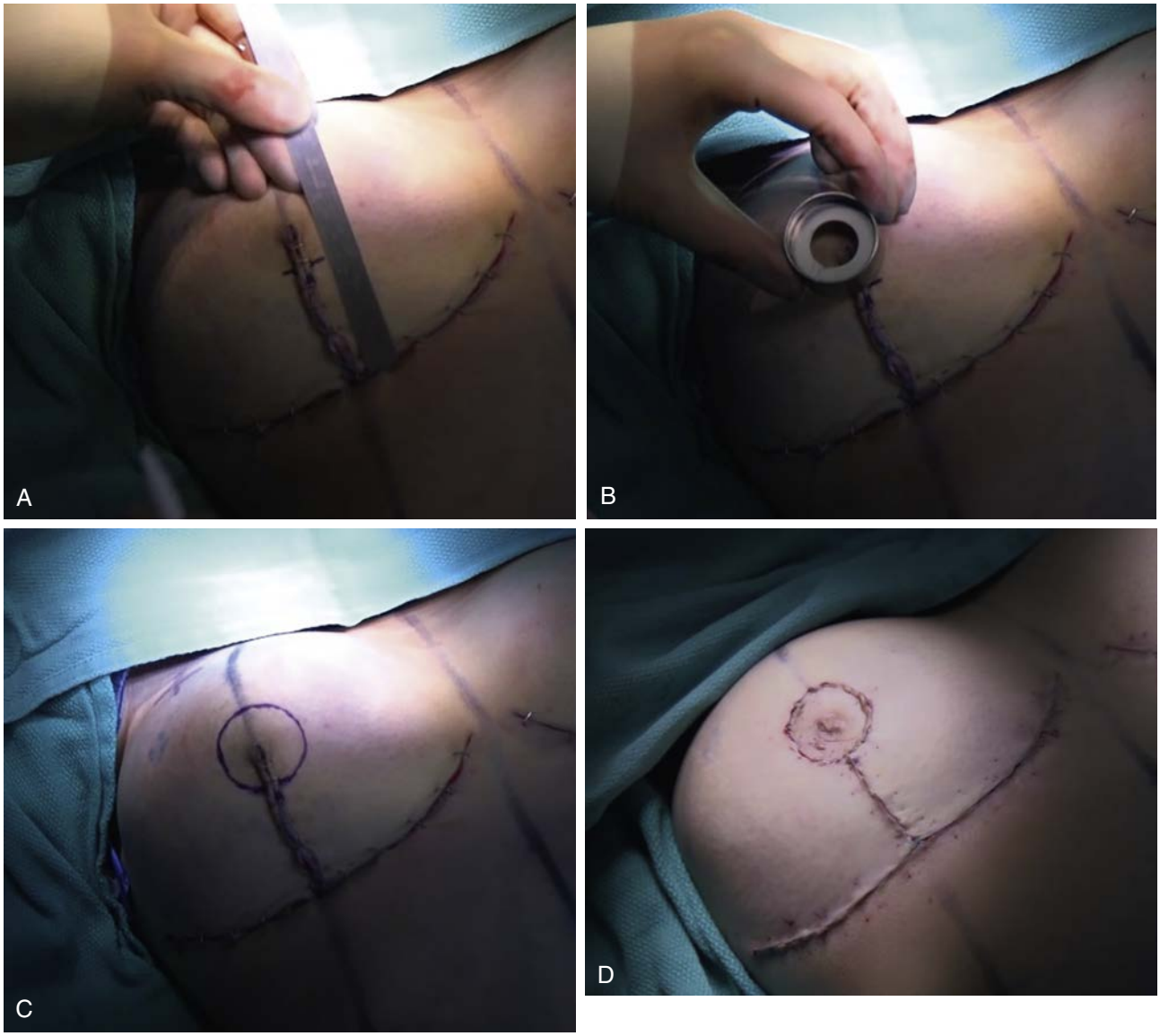


• **Fig. 17.13** Intraoperative photograph of the superior pedicle after flap dissection and parenchyma resection before closure in the right breast (same patient featured in Fig. 17.4).





• **Fig. 17.14** The medial and lateral flaps are brought together toward the T-junction with a penetrating towel clamp to ensure satisfactory flap dissection has been performed and breast shape is pleasing before closure, as (A) photographed intraoperatively in the right breast (same patient featured in Fig. 17.4) and (B) illustrated for the left breast.

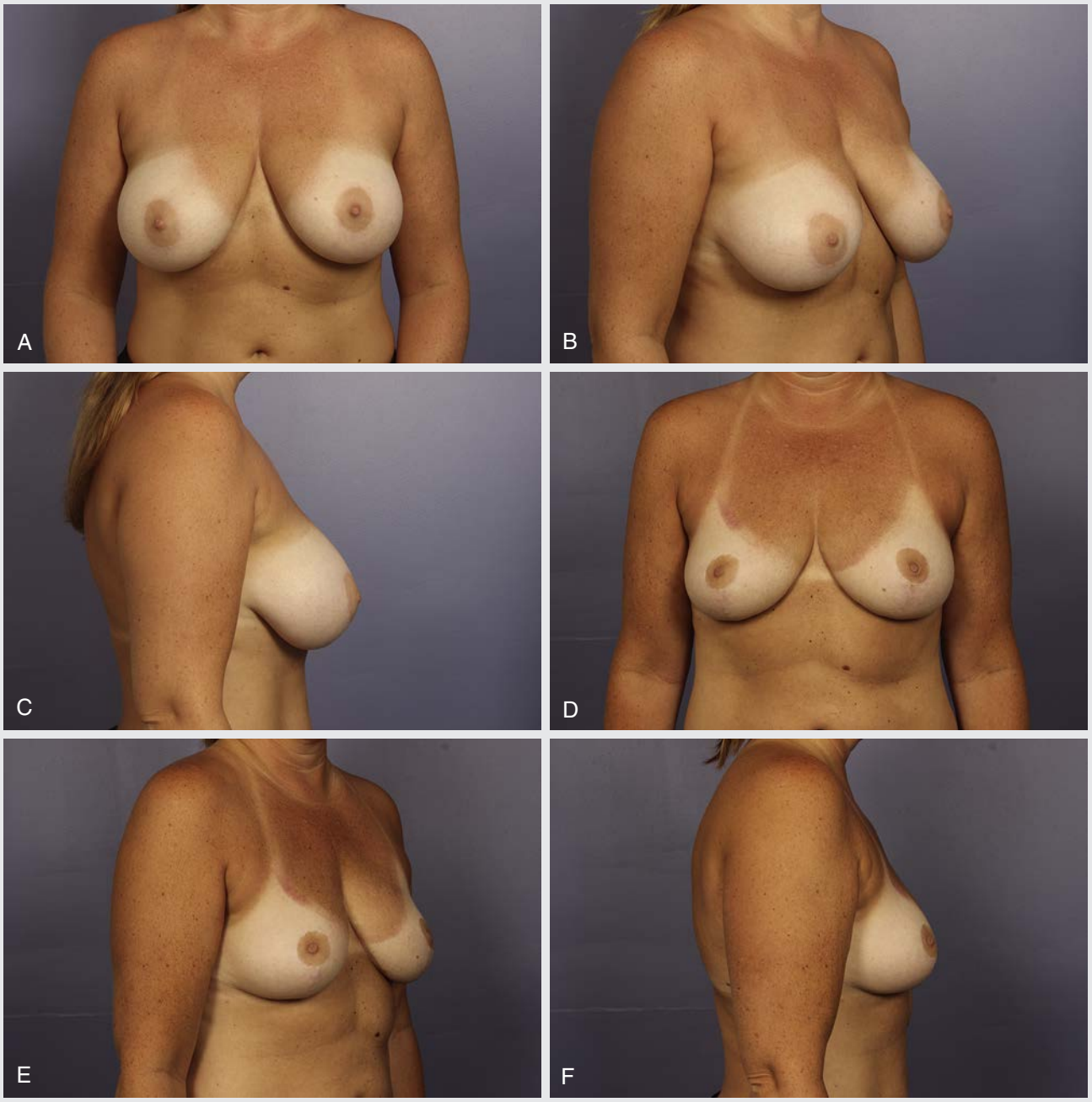


• **Fig. 17.15** Intraoperative photograph of markings for selecting the nipple–areola complex (NAC) position in the right breast. (A) The distance from the IMF to the inferior border of the areola is selected (5 cm in this case). (B) A 38-mm areola template is placed over the incision and (C) marked. (D) The template marking is incised, and the NAC delivered through the skin and sutured in place.

Case Examples

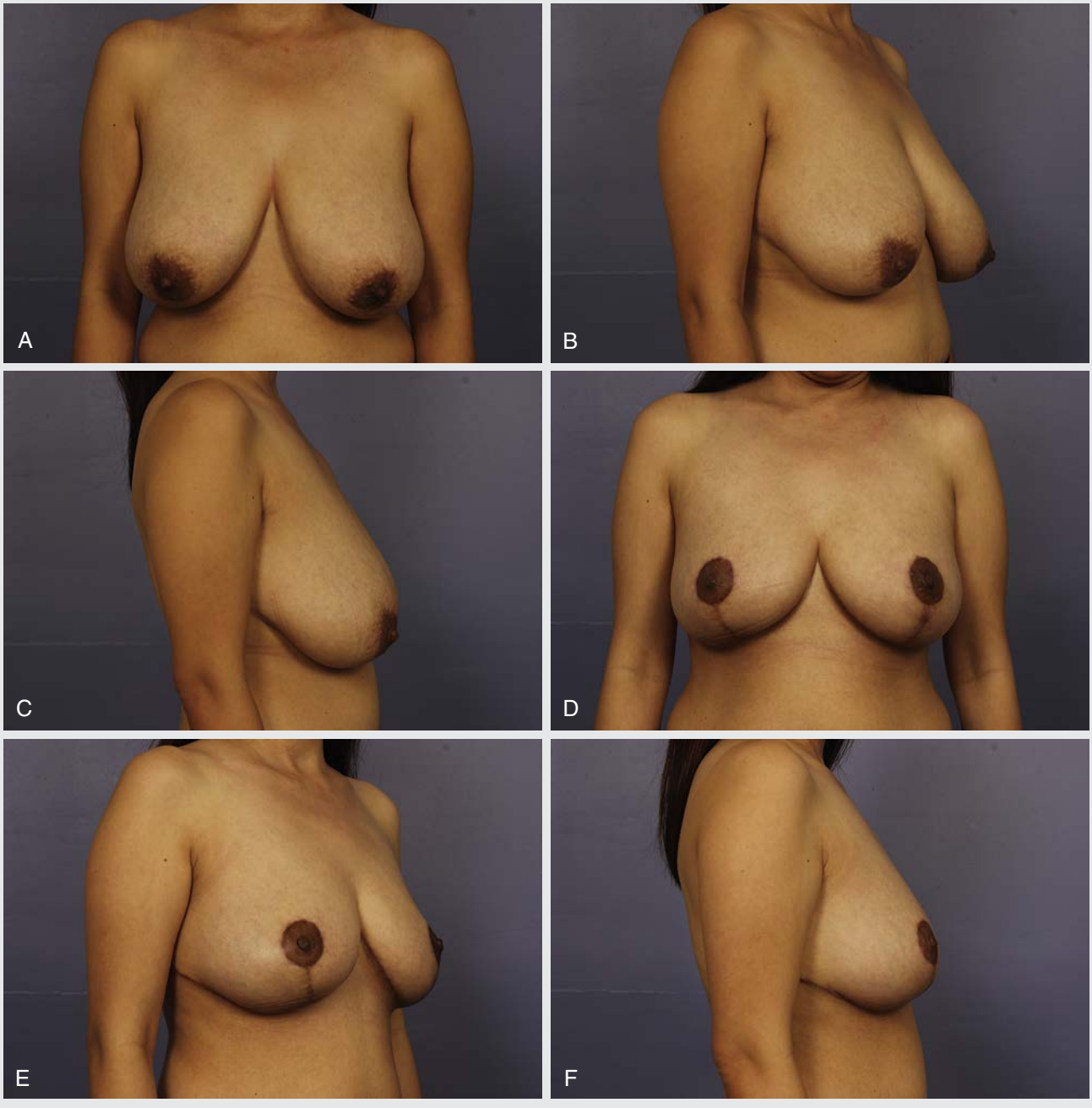
CASE 17.1

This 34-year-old woman with 36DD breasts underwent superior pedicle breast reduction with 376 g removed from the right breast and 347 g from the left breast. Preoperative photographs (Case 17.1A–C). Postoperative photographs at 22 months (Case 17.1D–F).



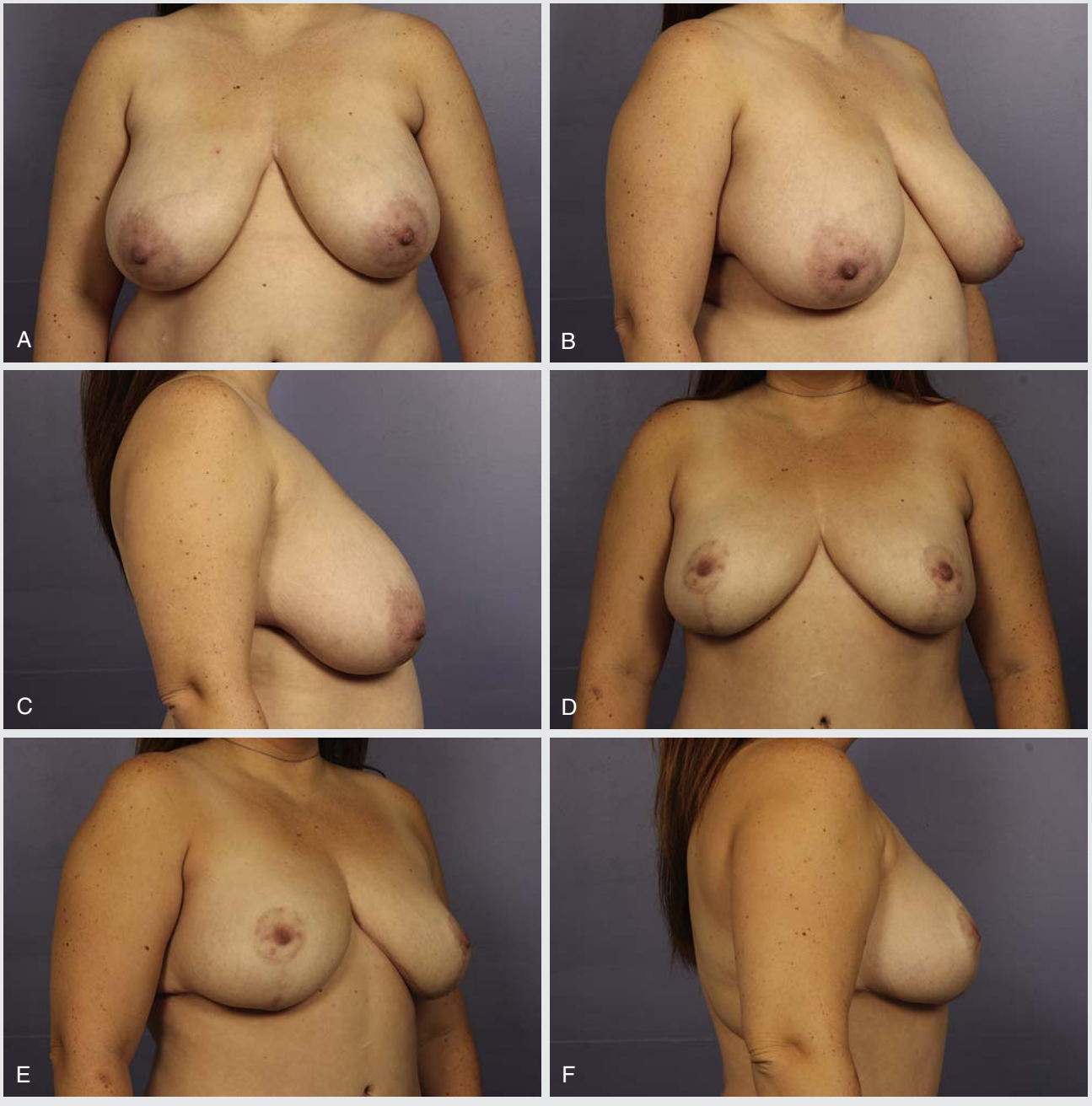
CASE 17.2

This 38-year-old Asian woman with 34DDD breasts underwent superior pedicle breast reduction, with 302 g removed from the right breast and 352 g removed from the left breast. Preoperative photographs (Case 17.2A–C). Postoperative photographs at 17 months (Case 17.2D–F).



CASE 17.3

This 35-year-old woman with 38DDD breasts underwent superior pedicle breast reduction with 598 g removed from the right breast and 588 g from the left breast. Preoperative photographs are shown in Case 17.3A–C. Postoperative photographs at 20 months are presented in Case 17.3D–F.



Management of Complications

In the previously mentioned study,[1] minor complications included one hematoma, one standing cone, three infections, and eight incisional breakdowns. One patient experienced unilateral NAC necrosis. When a hematoma occurs, the patient should be returned to the operating room in a timely fashion for washout, control of active bleeding, and re-closure to avoid nipple/skin loss and loss of aesthetic result. Infections are typically minor and effectively managed with antibiotics. When incisional breakdowns occur, they typically happen at the T-junction and are allowed to heal by secondary intention.

Secondary Procedures

Secondary procedures after the superior pedicle technique like all breast reduction techniques revolve primarily around patient dissatisfaction with postoperative breast size, asymmetry, and nipple position. Further reduction can be performed in either the horizontal or vertical direction by resecting more breast parenchyma via the vertical or transverse scars. If the patient desires more volume, particularly in the superior poles, a small implant can be inserted or fat grafting performed. These same principles can be used to also correct volume asymmetry. Residual or recurrent ptosis can be easily corrected via a minor superior pedicle, circumareolar, or crescent mastopexy.[5] Tightening the skin envelope in the case of recurrent ptosis and the addition of an implant to improve upper pole fullness can be performed simultaneously with relative safety.[6,7] The high-riding nipple is a difficult problem to correct, with various secondary procedures depending on the severity.[8,9]

Conclusion

The superior pedicle breast reduction described is an efficient technique for patients with mild to moderate macromastia. It is especially useful in patients who have lesser degrees of ptosis, requiring minimal transposition of the NAC. A youthful and aesthetically pleasing breast shape can be achieved by maintaining superomedial fullness and concomitantly provide symptom relief and improved quality of life.

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PEARLS FOR SUCCESS

- Patients with all grades of ptosis and an estimated resection weight of 600 g or less are considered candidates.
- Very large reductions in patients with long nipple-to-IMF distances should be approached with caution.
- Vertical limbs of 7–8 cm are marked preoperatively around the NAC to include 2 cm of areola inferior to the nipple and 5–6 cm from NAC inferior border to IMF at the end of the operation.
- Dissection is continued straight down to the chest wall along the IMF and then continued cephalad along the pectoralis major muscle fascia toward the pedicle.
- A thin layer of adipose tissue should be preserved on the pectoralis major muscle fascia to promote lymphatic drainage and decrease fluid production postoperatively.
- The superior dissection along the chest wall should be stopped at the superior markings to avoid undermining the pedicle and dividing perforators to the NAC.
- The lateral resection can be continued as cephalad as needed to remove volume because the blood supply to the pedicle is not dependent on lateral vessels.
- Dissection of the medial and lateral 2-cm-thick flaps should extend away from the pedicle only as far as necessary to sufficiently advance the flaps for closure.

18

Breast Reduction—Medial Pedicle Technique

LEE L.Q. PU

Introduction

Breast reduction can be performed for either functional or cosmetic reasons. Optimal size, shape, symmetry, and scarring, as four primary goals, should be applied to each type of breast reduction; for example, breast size after breast reduction should be as the patient desired and in proportion to the patient's body habitus. The shape after breast reduction should be cosmetically pleasing and long-lasting. Although the exact symmetry may be hard to achieve, most women desire a more symmetric result after breast reduction. It is also quite desirable to have minimal scarring after any type of breast reduction.

Medial pedicle breast reduction was promoted by Lejour[1] from Belgium, but the procedure has been popularized by Hall-Findlay.[2,3] However, the medial pedicle breast reduction has been criticized by many plastic surgeons, especially in North America, for its inconsistent cosmetic outcome and higher revision rate.[4–7] In addition, the learning curve for medial pedicle vertical breast reduction appears to be longer because many intraoperative adjustments should be done by the surgeon to produce a cosmetically acceptable final result.[8]

In this chapter, the author describes his preferred technique for medial pedicle breast reduction, emphasizing patient selection and several technical refinements of the surgical technique.

Indications and Contraindications

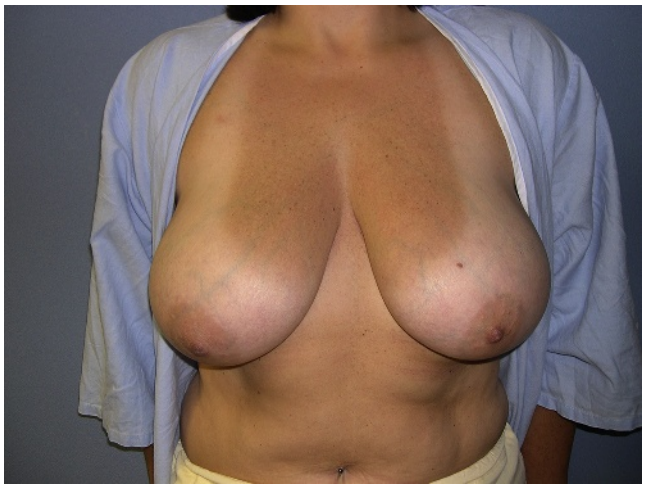
It is the author's opinion that medial pedicle breast reduction is not indicated for all patients.[9,10] In general, younger women with good breast skin condition (no stretch marks) and reasonably well-maintained round shape of the breast are good candidates for this type of breast reduction. (Fig. 18.1). The overall amount of breast tissue reduction may not be a critical issue, although the average weight of this type of breast reduction is usually between 300 and 500 g for each breast. However, the distance from nipple to inframammary fold (IMF) should be less than 10 cm. For patients who are relatively older and have poor breast skin condition and elongated breast shape, the classic inverted-T inferior pedicle breast reduction, not the medial pedicle breast reduction, should be performed for more predictable results (Fig. 18.2). Box 18.1 summarizes the indications for the medial pedicle breast reduction in the author's practice.

Preoperative Evaluation and Special Considerations

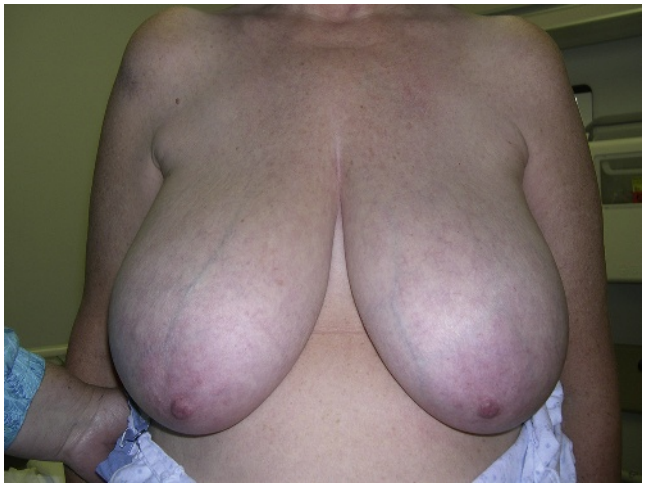
Unlike the classic inverted-T inferior pedicle technique, the medial pedicle breast reduction does require some special considerations and more intraoperative adjustments. For example, the new nipple position should be placed "lower" during the preoperative marking because the vertical technique in general has a tendency to place the nipple too high and to create more upper pole fullness after such a breast reduction. Therefore, the surgeon should pay particular attention to avoiding a high-riding nipple and inform the patient about the temporary appearance of the breast postoperatively.

The new IMF should be placed higher than the actual IMF, so the distance between the nipple and the IMF can be shortened. This distance can be shortened further by a running subcuticular closure. However, the distance between the nipple and the new IMF will never be 5–6 centimeters as after the classic inverted-T inferior pedicle breast reduction. Frequently it will be about 7–8 centimeters, so an optimal breast shape after reduction can be maintained.

The management of the excess tissue in the lower pole of the breast can be critical to the success of the medial pedicle breast reduction. The surgeon should pay attention to this important issue and develop a strategy or technique to properly remove the extra tissue in this part of the breast (Box 18.2).



• **Fig. 18.1** A typical good candidate for the medial pedicle breast reduction. In general, patients should be relatively young with good breast skin condition and reasonably well-maintained breast shape.



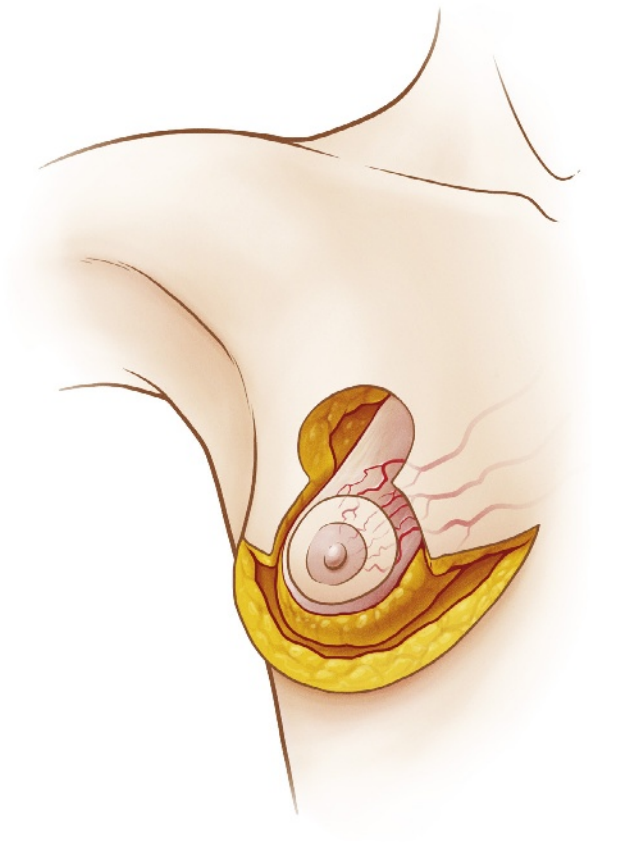
• **Fig. 18.2** A typical poor candidate for the medial pedicle breast reduction. In general, patients have less optimal breast skin condition and poorly maintained breast shape.

• BOX 18.1 Good Candidates for Medial Pedicle Breast Reduction

- Younger and healthy women (not for all women)
- Good breast skin condition (no stretch marks)
- Reasonably maintained breast shape (still round, no grade III ptosis)
- Moderate-sized breast reduction (less than 500 g)
- Relatively short distance from nipple to IMF (less than 10 cm)

• BOX 18.2 Special Considerations for Medial Pedicle Breast Reduction

- Place new nipple position "low"
- Create new but higher IMF
- More intraoperative adjustments
- Shorten vertical distance during closure
- Manage "excess" tissue in the lower pole
- May have temporary upper pole fullness



• **Fig. 18.3** Illustration showing the blood supply to the medial pedicle.

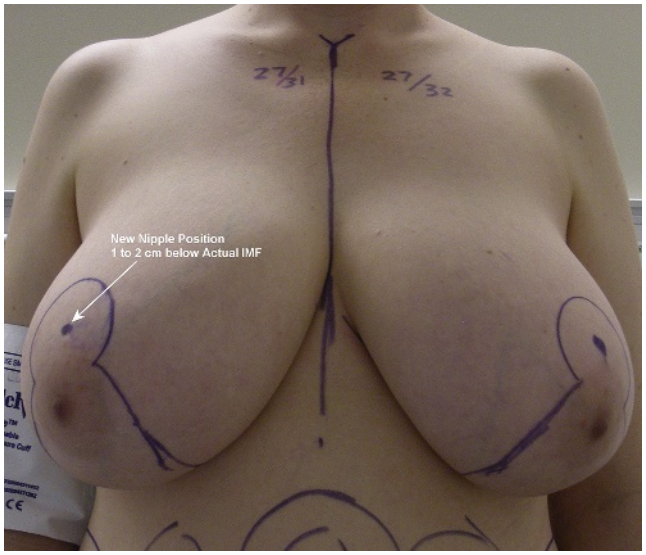
Surgical Techniques

Relevant Surgical Anatomy

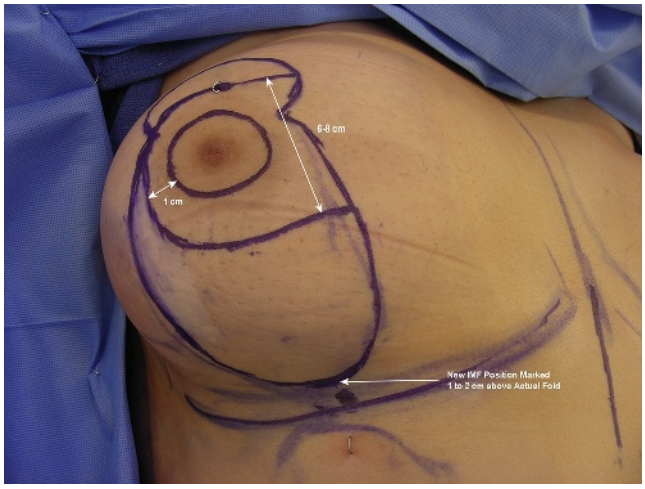
The breast is an ectodermal structure contained in a superficial fascial system. It is formed by about 20–25 individual lobules that connect to the nipple. The blood supply in general comes in from several directions. The main blood supply to the breast is based on medial branches of the internal mammary artery. The medial pedicle receives its blood supply from the perforators of the internal mammary vessels. The perforators in general provide a robust blood supply to the pedicle, so necrosis of the nipple–areolar complex is rare after a medial pedicle breast reduction as long as adequate pedicle width is maintained (Fig. 18.3). The veins of the breast rarely accompany the arteries. Much of the breast is drained by a superficial venous system that lies just under the dermis. The nipple is primarily innervated by the medial and lateral branches of the fourth intercostal nerve. However, the third and fifth intercostal nerves also contribute.[11]

Preoperative Markings

While the patient is in the upright position, the new nipple position should be marked first. However, unlike classic inverted-T inferior pedicle breast reduction, the new nipple position should be set at least 1 or 2 cm below the level



• **Fig. 18.4** Preoperative marking of the medial pedicle breast reduction. Please note that the new nipple position should be 1–2 cm below the level of IMF depend on the amount of reduction.*



• **Fig. 18.5** Intraoperative marking of the pedicle and new level of the IMF. Please note that the new level of IMF should be 1–2 cm above the actual level of the IMF depending on the amount of reduction.*

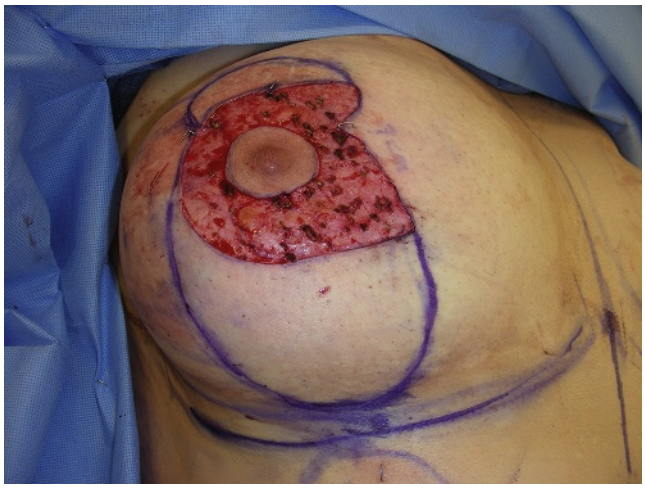
of IMF to avoid a high-riding nipple position after this type of the breast reduction. In addition, if the patient has good upper pole fullness, the new nipple position should be marked lower than as intended to avoid high-riding of the nipple. The circle around the new nipple position is marked with a Wise pattern marker as used by the author. This would make the diameter of the circle about 40 mm. The level of the new IMF is determined to be about 2 cm above the actual IMF. After this, the medial and lateral borders of the resection are marked by rotating the breast both medially and laterally in reference to the midline of the breast (Fig. 18.4).

Intraoperative Markings

While the patient is in the supine position, commonly under general anesthesia, the nipple–areola complex is marked with a 38- or 42-mm cookie cutter. The pedicle is then designed with the pedicle width between 6 and 8 cm depending on the breast size the surgeon wants to achieve after breast reduction. It is important to leave at least a 1-cm-wide area of breast tissue away from the proposed upper border of the nipple–areolar complex to avoid cutting into it. Ideally, the width of the pedicle should be marked in such a way that half of it is within the areola opening and the other half is within the area bounded by medial and lateral pillars (Fig. 18.5A). After the pedicle is marked, the new circle of the proposed nipple–areolar complex and also the medial and lateral markings of the proposed resected area in the breast are tested for easy approximation without tension.

Details of Procedure

For the medial pedicle vertical breast reduction, the area of de-epithelialization over the pedicle is much smaller and

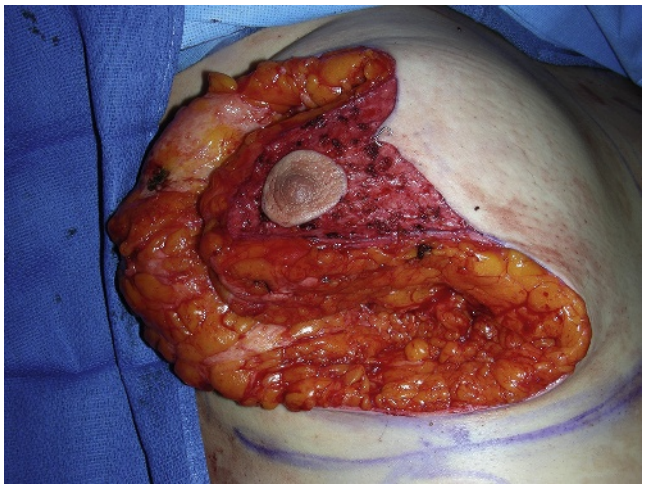


• **Fig. 18.6** Intraoperative view showing the completion of de-epithelialization over the pedicle on this side.

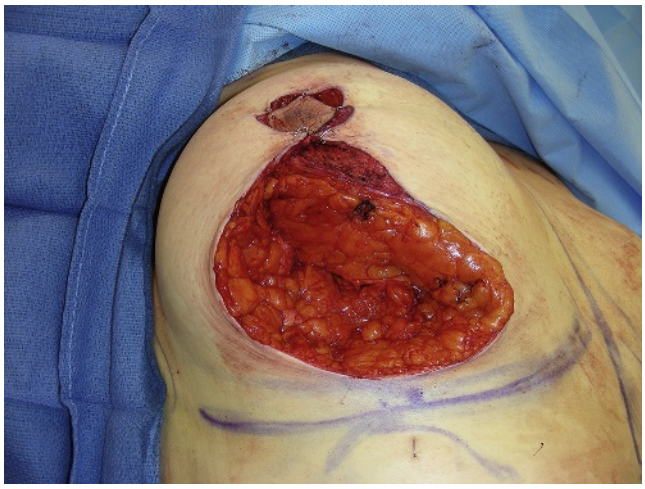
thus de-epithelialization can be quickly performed over the pedicle with either a knife or scissors as preferred by the surgeon (Fig. 18.6).

The lower portion of the breast tissue below the pedicle along with skin is resected first. The resection can be quickly performed down to the base of the breast, in close proximity to pectoral fascia, but it should not include the fascia so that nipple sensation can be better preserved postoperatively. The resection should be done with attention to preserve more tissue in the medial aspect of the breast.

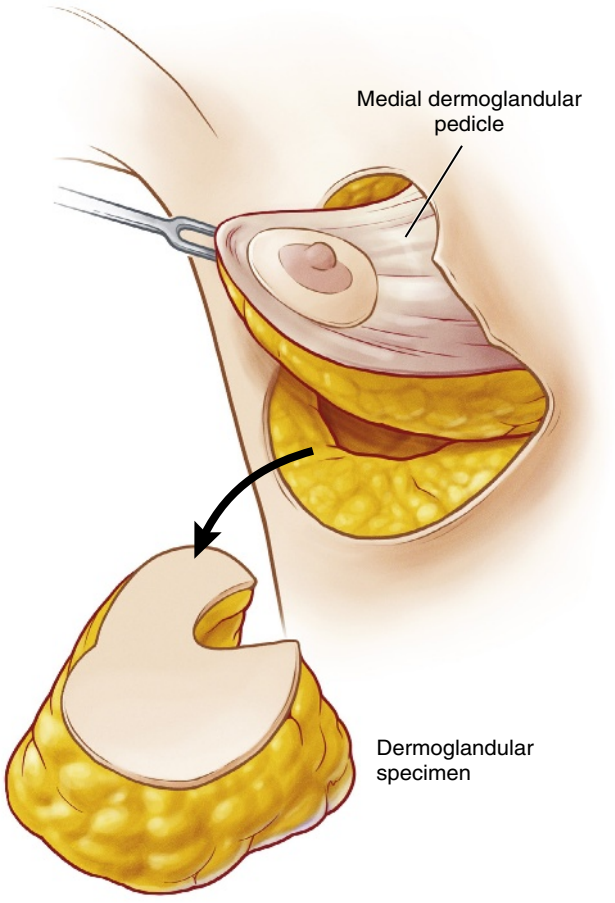
The superior portion of the breast tissue above the pedicle along with skin is excised accordingly, and the medial pedicle can be elevated (Fig. 18.7). Attention should be paid to ensuring the pedicle has adequate breast tissue bulk in width and thickness so an adequate blood supply can be maintained to the nipple–areolar complex. Additional resections of the breast tissue should be performed further both laterally to remove excess breast tissues and superiorly



• **Fig. 18.7** Intraoperative view showing the completion of the right breast resection during the medial pedicle breast reduction.



• **Fig. 18.9** Intraoperative view showing the completion of the pedicle rotation into the new position.



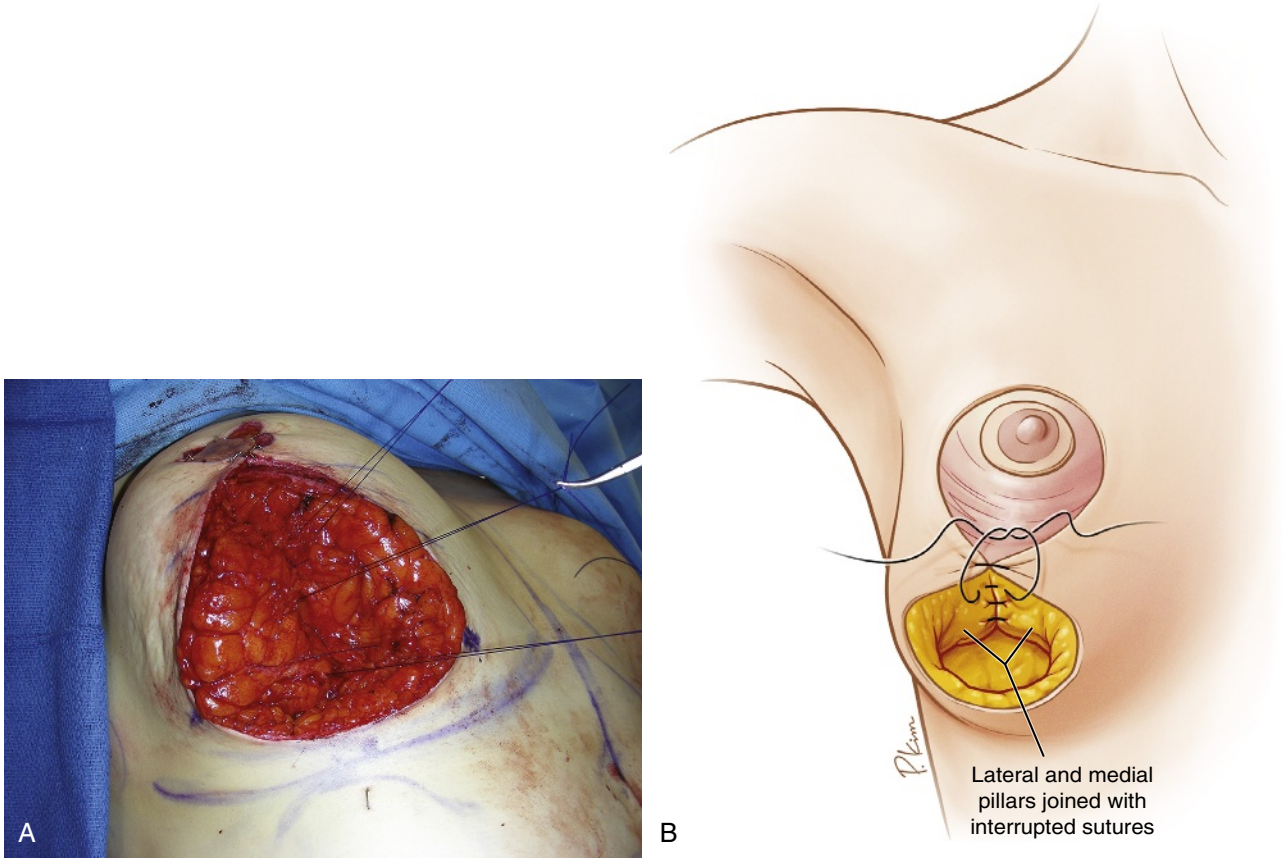
• **Fig. 18.8** Illustration showing the completion of the right breast resection before the pedicle inset and vertical closure.

to remove some deep breast tissues so that the pedicle can be rotated into the new position without too much tension (Fig. 18.8). Very often the pedicle can be debulked further to make its in-set easier.

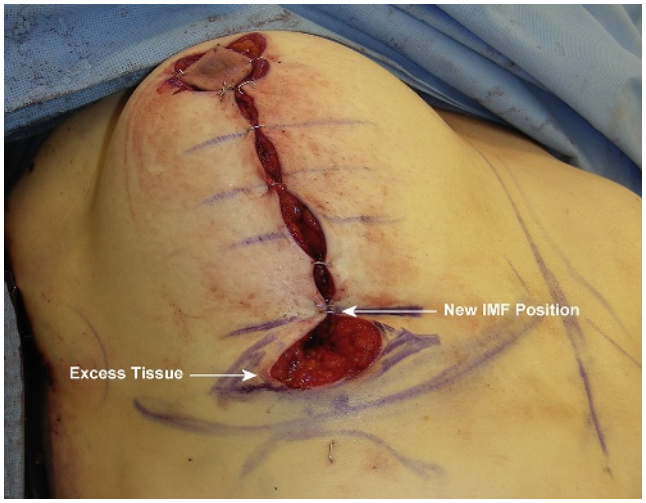
The closure of the breast after inset of the pedicle also can be performed relatively quicker. Once the new nipple–areolar complex circle is approximated with 2-0 PDS sutures, the pedicle can be rotated into the new position and the nipple–areolar complex can be quickly approximated to adjacent breast skin with skin staples (Fig. 18.9). The medial and lateral pillar closure is then performed with 2-0 PDS sutures in an interrupted fashion, starting from the base of the pedicle. In general, only three sutures are needed to approximate the medial and lateral pillars (Fig. 18.10A, B). After both medial and lateral pillars are closed, the skin can be approximated with skin staples. At this point, the position of the new IMF can be determined. The excess breast tissue in the lower pole of the breast located at the lower end of the vertical incision is identified and marked (Fig. 18.11).

Both breasts are then judged for their symmetry in terms of the size, shape, and projection while the patient is maintained in the upright position. The excess tissue marked in the lower pole of the breast can be managed successfully with aggressive defatting down to a few millimeters of subcutaneous fat, followed by placement of a purse-string suture with a 3-0 Monocryl suture to evenly fold excess skin together[9,12] (Fig. 18.12). A few simple interrupted approximations with a 5-0 chromic suture also can be added to make a smoother closure. Liposuction may be applied to remove excess fat in the lateral area of the breast if necessary. The vertical incision is usually closed in two layers. The deep dermal layer is approximated with several simple interrupted 3-0 Monocryl sutures, and the final skin closure is performed with 3-0 Monocryl sutures in the subcuticular fashion. During the vertical skin closure, some additional shortening can be achieved for the vertical distance (Fig. 18.13).

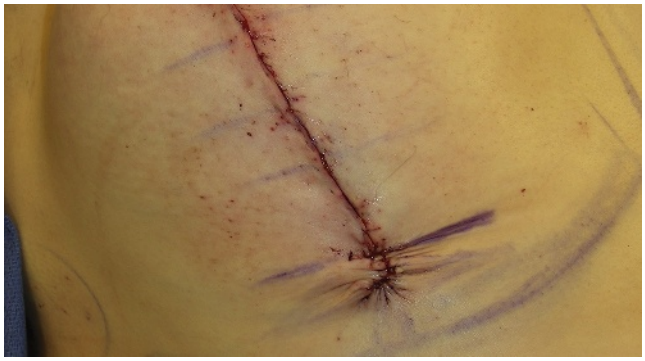
If for some reason there is more excess tissue in the lower pole of the breast and the closure in the lower pole of the breast with aggressive defatting and purse-string suture does not appear to be satisfactory, an L-shaped or a short inverted-T skin incision can be added at this point so that the appearance of the closure in the lower pole of the breast can be improved because more lower pole excess tissue of the breast can be removed in this way.[13,14] However, adding



• **Fig. 18.10** (A) Intraoperative view showing the placement of three pillar sutures for initial closure of the breast. (B) Illustration showing the approximation of both medial and lateral pillars of the breast during the closure.



• **Fig. 18.11** Intraoperative view showing the temporary completion of the pedicle in-set and vertical closure. In this breast, the new IMF is determined and the excess tissue in the lower pole of the breast is outlined.*

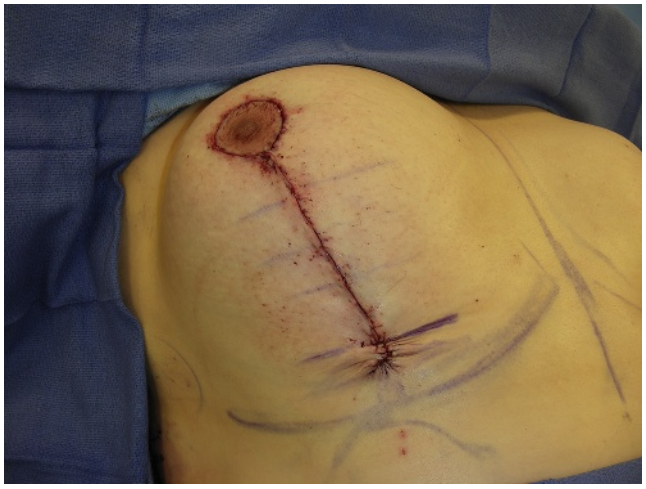


• **Fig. 18.12** Intraoperative view showing the completion of the closure. Note that the excess subcutaneous tissue in the lower pole of the breast is removed by defatting and the excess skin is approximated with purse-string suture. In this way, the contour of the lower pole after surgery appears to be satisfactory.

an L-shaped or short inverted-T incision may be indicated only for larger breast reduction or when one side of the breast is much larger than the other side. The average time for bilateral medial pedicle breast reduction in the author's practice is about 3 hours. For a video on this procedure, see Video 18.1.

Postoperative Care and Expected Outcomes

After surgery, Steri-Strips are placed tightly at the lower pole of the breasts to flatten the closure in this area. The rest of the incision will also be covered with Steri-Strips



• **Fig. 18.13** Intraoperative view showing the immediate results after bilateral medial pedicle vertical breast reductions in the same patient. Please note that the contour of the lower pole appears to be satisfactory on the operating room table.

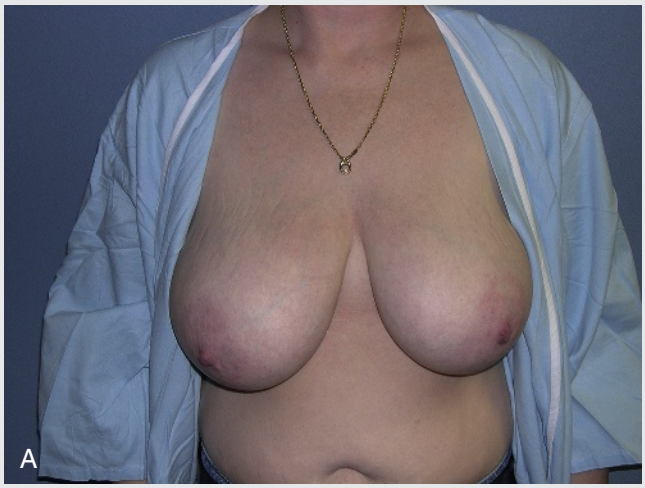
and a surgical bra applied to the patient. The patient should wear a surgical bra for 2–3 weeks until the incision has healed and will then convert to a new bra without a underwire. No drains are used for this type of breast reduction in the author's practice. The medial pedicle breast reduction is frequently performed by the author in an outpatient setting. The incision usually heals within 2–3 weeks, and the patient should avoid heavy lifting for 6 weeks.

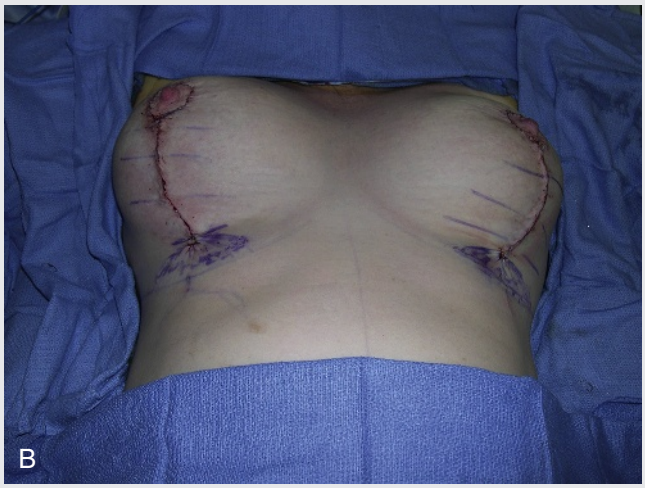
Both functional and cosmetic improvement can be achieved after a medial pedicle breast reduction. Problems related to wound healing occur less frequently. Scars are usually well tolerated by most patients. The patient's overall satisfaction is high, and minor revision has occurred in less than 5% in the author's experience.

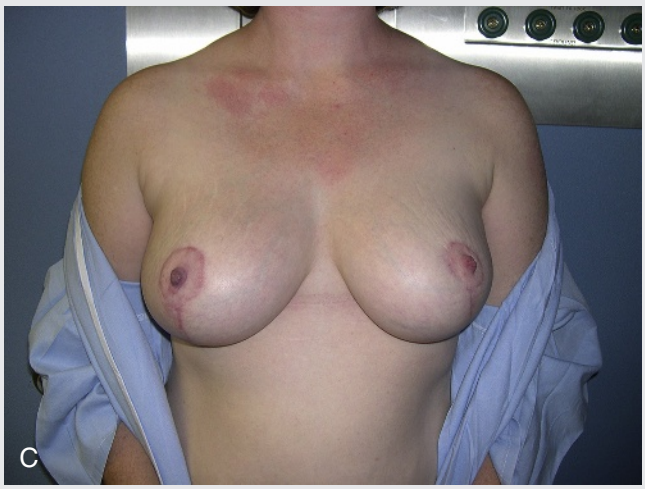
Case Examples

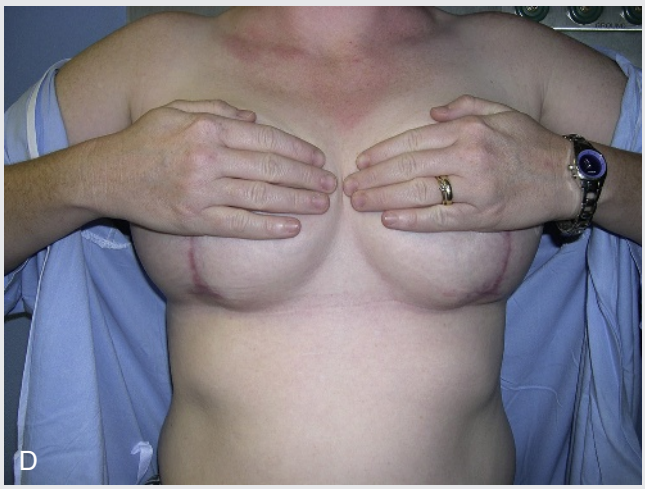
CASE 18.1

A 31-year-old white woman was offered a medial pedicle breast reduction for symptomatic macromastia because of her good skin quality and the favorable shape of her breasts (Case 18.1A). Her surgery went well, and the total amount of breast tissue removed from her right breast was 368 g and from the left breast 318 g (Case 18.1B). Her postoperative course was uneventful. The patient is quite happy with the overall cosmetic appearance and functional improvement during follow-up (Case 18.1C, D). She is shown preoperatively, immediate postoperatively, and 5 months postoperatively.





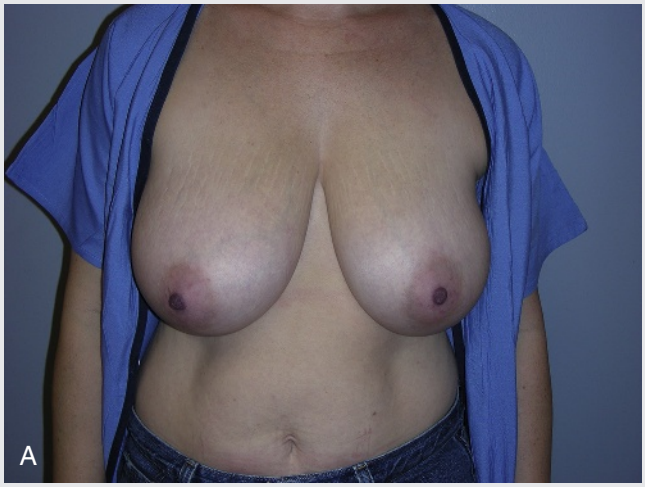




CASE 18.2

This 38-year-old white woman suffered from symptomatic macromastia, and a medial pedicle breast reduction was planned for this patient (Case 18.2A). Her surgery went well, and the amount of breast tissue removed from her right side was 475 g and from the left side 330 g (Case 18.2B).

Postoperative recovery was uneventful. The patient is quite happy with the overall cosmetic appearance and functional improvement during follow-up (Case 18.2C, D). She is shown preoperatively, immediate postoperatively, and 14 months postoperatively.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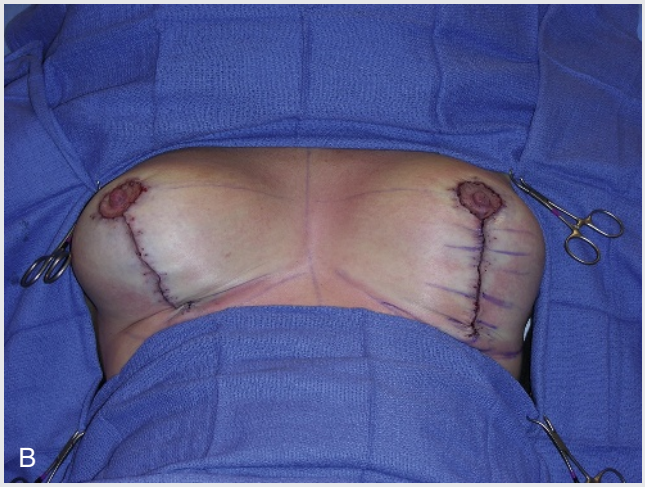
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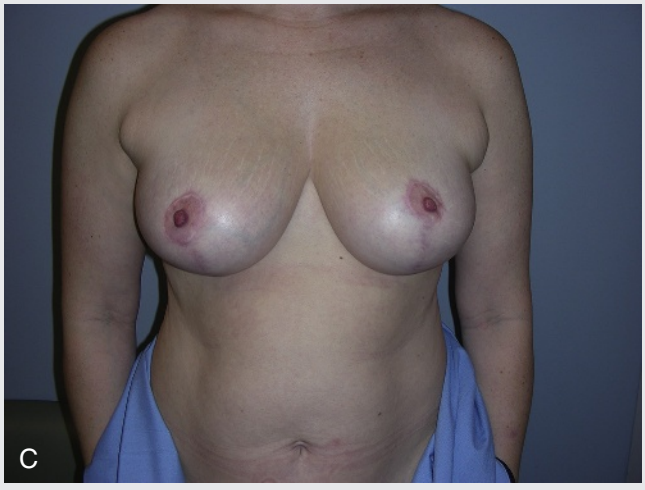
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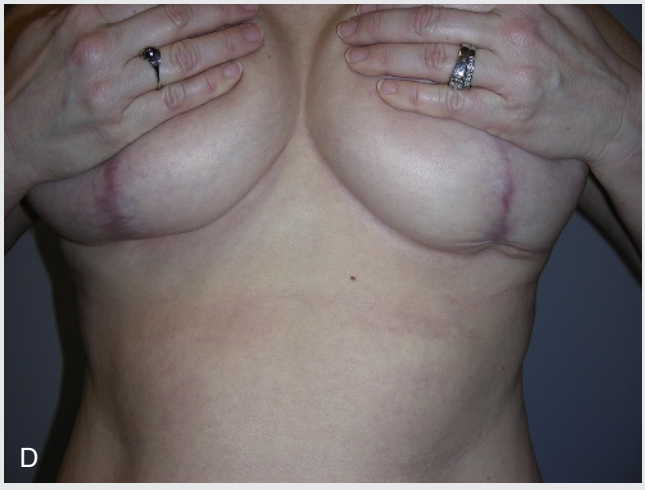
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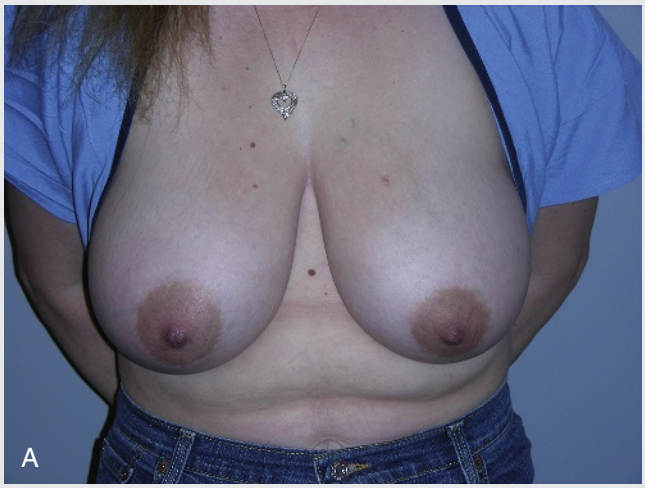
CASE 18.3

A 40-year-old white woman requested breast reduction with the shortest possible surgical incision (Case 18.3A). A medial pedicle breast reduction was performed successfully, and the amount of breast tissues removed from her right side was 635 g and from her left side 585 g (Case 18.3B). The patient was quite happy with the overall cosmetic appearance and functional improvement during follow-up (Case 18.3C, D). She is shown preoperatively, immediate postoperatively, and 18 months postoperatively.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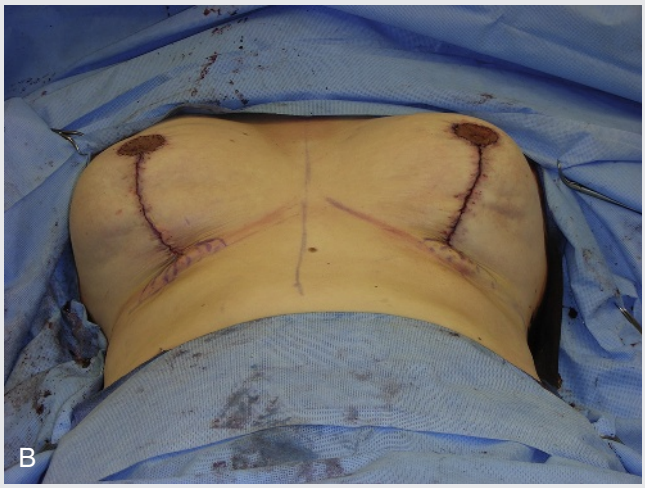
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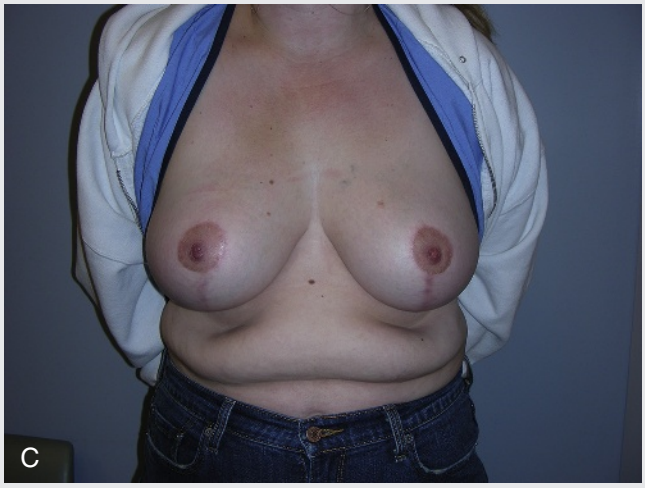
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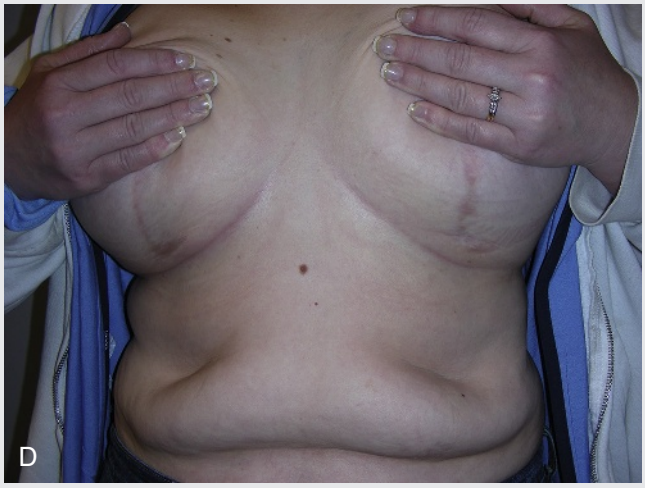
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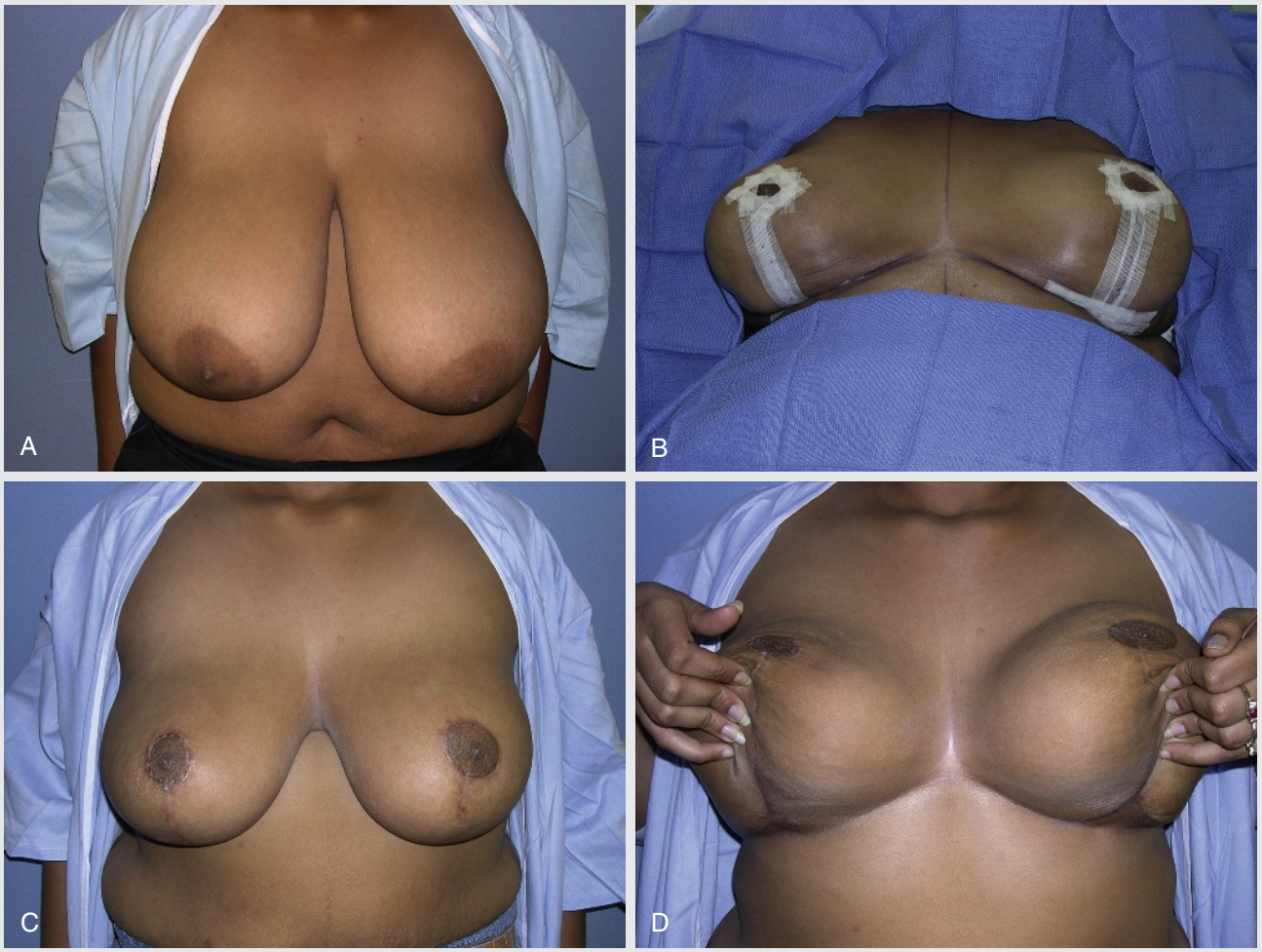
CASE 18.4

This 18-year-old woman of African descent was offered a medial pedicle breast reduction for progressive symptomatic macromastia because of her good breast skin quality and lack of significant breast ptosis (Case 18.4A) The surgery went well, and the amount of breast tissues removed from her right side was 855 g and from her left side 1029 g (Case 18.4B).

The patient's postoperative course was uneventful, and she was quite happy with the overall cosmetic appearance and functional improvement during follow-up (Case 18.4C, D). She is shown preoperatively, immediate postoperatively, and 3 months postoperatively.



Management of Complications

In general, complications after this type of breast reduction are less common than other types of breast reduction procedures. One relatively common complication after the medial pedicle breast reduction is delayed wound healing in the purse-string suture area. Depending on healing potential and degree of defatting performed, the patient may develop some skin necrosis in the area. This kind of complication usually just requires prolonged local wound care and can be managed in the office with proper dressing changes. No reoperation is ever required. Occasionally the patient may develop a hematoma or seroma as after any type of breast reduction surgery. These complications can be managed accordingly with either evacuation of hematoma or seroma in the office or in the operating room.

Secondary Procedures

In the medial pedicle breast reduction, the breast is "coned" once the medial and lateral pillars are approximated. Therefore, the breast tends to be overprojected immediately postoperatively. It is the author's observation that the final breast shape with more fullness in the lower pole will be achieved and better aesthetic contour seen after the overall breast parenchyma gradually settles down with time. However, it may take a longer time in certain patients for the breast parenchyma to settle down. Revision surgery to improve the breast shape should be postponed for 4–6 months until the final contour of the breast is established. The breast shape after such a breast reduction stands the test of time and can be satisfactory in the long term. The scarring is much less after medial

pedicle breast reduction. If a prominent scar developes in the purse-string area or if the contour of the lower breast appears to be less satisfactory to the patient or the surgeon, revision surgery can be easily performed in the office under local anesthesia.[9]

Conclusion

With proper patient selection and several refinements in the surgical technique, the medial pedicle breast reduction can be performed safely and effectively with functional improvement and a pleasing long-term cosmetic result. The overall complications of this type of operation are less common, but unfortunately there is a learning curve to perform the medial pedicle breast reduction. Nevertheless, such a breast reduction represents an evolving and promising technique and will gradually replace the classic inferior pedicle breast reduction in select patients.

PEARLS FOR SUCCESS

- Proper patient selection is critical for medial pedicle breast reduction.
- There is a learning curve before one can master the procedure.
- Good pedicle design is necessary to ensure adequate blood supply to the pedicle.
- Place new nipple position lower than the level of IMF.
- Place new IMF higher than the actual level of IMF.
- Be prepared to do some intraoperative adjustments.
- It may be necessary to shorten vertical distance during closure.
- Effectively manage the "excess" tissue in the lower pole of the breast.
- Expect temporary upper pole fullness of the breast after surgery.

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19

Breast Reduction—Inferior Pedicle Technique

LEE L.Q. PU

Introduction

Breast reduction can be performed for either functional or cosmetic reasons. Optimal size, shape, and symmetry and minimal scarring, as four primary goals, should be applied to any type of breast reduction; for example, the breasts after reduction should be as the patient desired and in proportion to the patient's body habitus. The shape after breast reduction should be cosmetically pleasing and hopefully long-lasting. Symmetry may be also important for most women after breast reduction.

Inverted-T inferior pedicle breast reduction was popularized in the 1970s in the United States.[1–3] It is still the most commonly performed breast reduction procedure in the United States.[4] The procedure itself can be suitable for almost all patients and in various breast sizes and shapes. Its design and surgical technique are reasonably consistent, and it can be performed in a standardized fashion. It is considered the most versatile but safe technique for breast reduction, with lower rates of complication or revision,[5,6] although prominent scarring or "bottoming-out" can be a concern over the long term.

This chapter describes the author's preferred technique for inverted-T inferior pedicle breast reduction. Several technical refinements of the surgical technique are described in detail. In addition, pearls to achieve an optimal outcome and management of complications after inferior pedicle breast reduction are discussed.

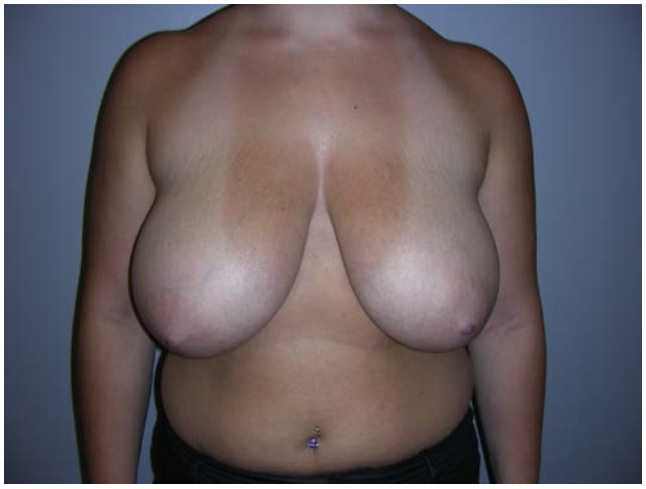
Indications and Contraindications

It is a common thought that classic inferior pedicle breast reduction is indicated for almost all patients regardless of breast size and shape (Fig. 19.1). For patients who are relatively older and have an elongated breast shape because of poor breast skin condition, the inverted-T inferior pedicle breast reduction can be selected for more predictable results (Fig. 19.2). The overall amount of breast tissue reduction may not be critical, although the average weight of this type of breast reduction is usually less than 1000 g from each breast. However, the distance from the suprasternal notch to the nipple should be less than 15 cm so that adequate blood supply to the nipple can be ensured based on the inferiorly based pedicle. If the distance is more than 15 cm, a free nipple graft procedure should be considered based on common standard practice. In general, the inverted-T pattern will remove excess breast skin from both vertical and horizontal orientations. Younger women with good breast skin condition (no stretch marks) may have a better long-term outcome, although the inverted-T inferior pedicle breast reduction has been criticized as resulting in a bottoming-out breast shape and an unsightly scar.

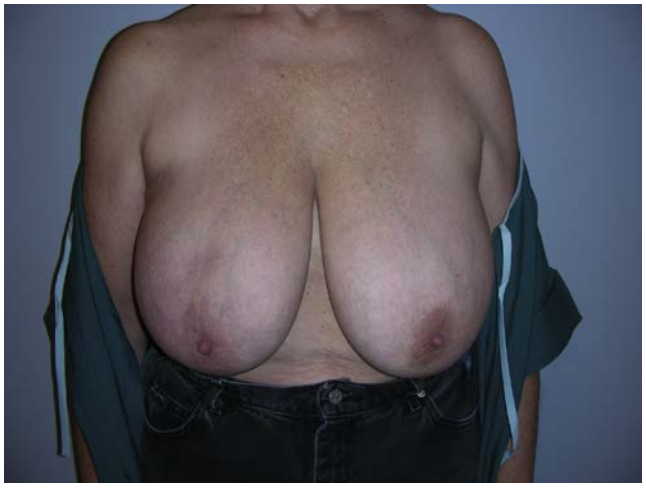
Preoperative Evaluation and Special Considerations

Unlike the medial pedicle breast reduction technique, the classic inverted-T inferior pedicle breast reduction has fewer special considerations and intraoperative adjustments. Each step of the procedure can be performed in a standardized fashion based on the preoperative and intraoperative markings (Fig. 19.3). However, several important points should be considered to achieve an optimal outcome after the inferior pedicle breast reduction. The new nipple position should be placed 1 cm lower than the level of the inframammary fold (IMF) to avoid a possible high-riding nipple. The inferior pedicle should be made sufficiently thick and may include the perforators from the central part of the breast to ensure robust blood supply to the nipple. The plication of the inferior pedicle can ensure upper pole fullness and easy in-set of the nipple–areola complex. The lateral horizontal incision should not be extended beyond the anterior axillary line for most cases.

The distance between the nipple and the IMF should be controlled to 5–6 cm for the classic inverted-T inferior pedicle breast reduction so future bottoming-out may be avoided. However, this also depends on patient breast skin quality.



• **Fig. 19.1** A typical good candidate for inverted-T inferior pedicle breast reduction.



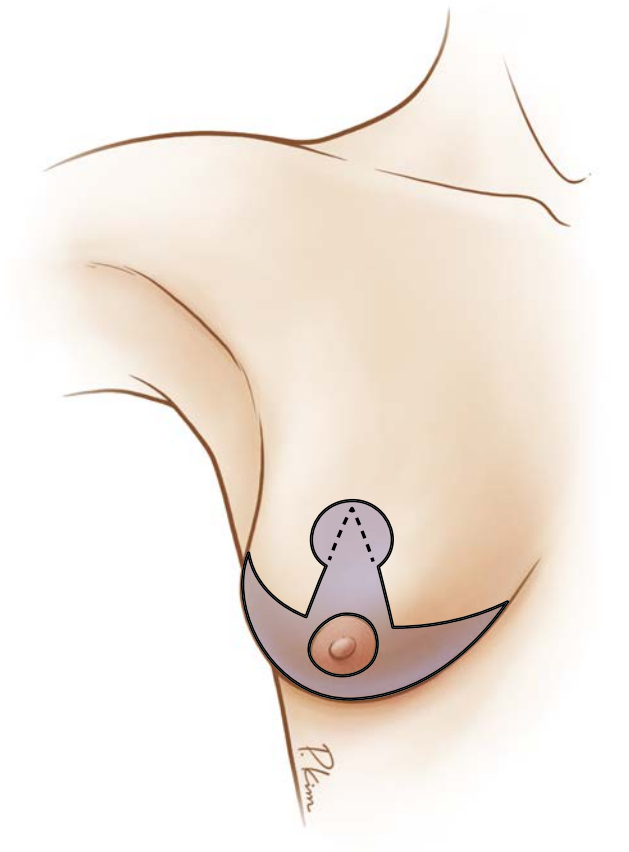
• **Fig. 19.2** A less typical candidate for the inverted-T inferior pedicle breast reduction. Although her breasts are quite large and ptotic, this technique can still be performed safely with reasonably good long-term results.

In management of the inverted-T closure in the lower pole of the breast, it is important to ensure primary healing because of the tension in this area after the closure. The surgeon should pay attention to this important issue and develop a strategy to reduce tension on the closure (Box 19.1).

Surgical Techniques

Relevant Surgical Anatomy

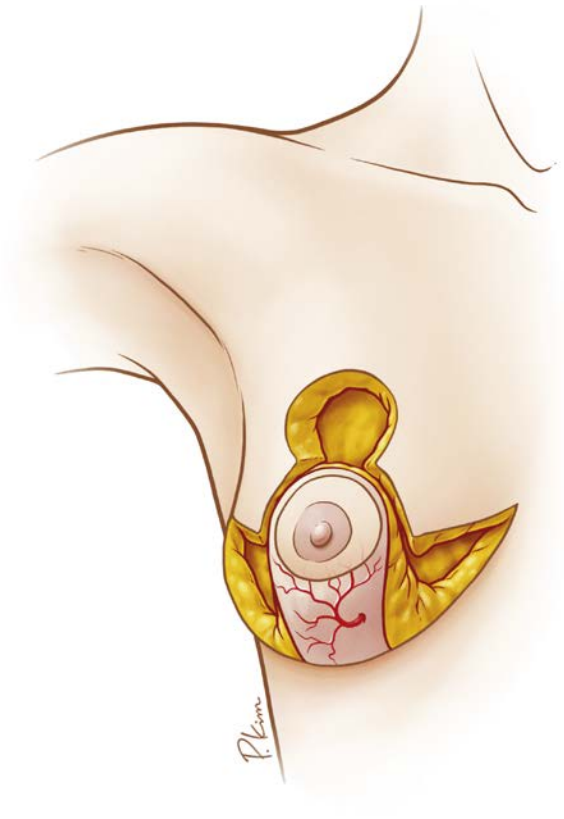
The relevant anatomy of the breast has been described in Chapter 18. Once again, the blood supply to the breast in general comes in from several directions. However, the main blood supply to the breast is based on the medial branches of the internal mammary vessels. The inferior pedicle receives its blood supply from the perforators through the pectoral muscle that come from the internal mammary vessels at the fourth intercostal space and may be accompanied by venae comitantes. There, perforators enter the breast just medial to the breast meridian approximately 4–6 cm above the IMF and provide adequate blood supply to the pedicle and nipple–areolar complex as long as adequate width



• **Fig. 19.3** Illustration showing the scar pattern of the inverted-T inferior pedicle breast reduction.

• BOX 19.1 Special Considerations for Inverted-T Inferior Pedicle Breast Reduction

- Procedure can be performed for all patients regardless of breast size and shape.
- It is a good choice for patients with elongated shape (severe ptosis) of the breast.
- Various amounts of breast reduction can be accommodated up to 1000 g for each breast.
- The distance from the suprasternal notch to nipple should be less than 15 cm.
- Proper intraoperative management of the pedicle size, shape, and length is important.
- Proper design of skin pattern and management of the inverted-T closure is important.
- Prominent scar and bottoming-out of the breast can be a problem.



• **Fig. 19.4** Illustration showing the blood supply to the inferior pedicle.

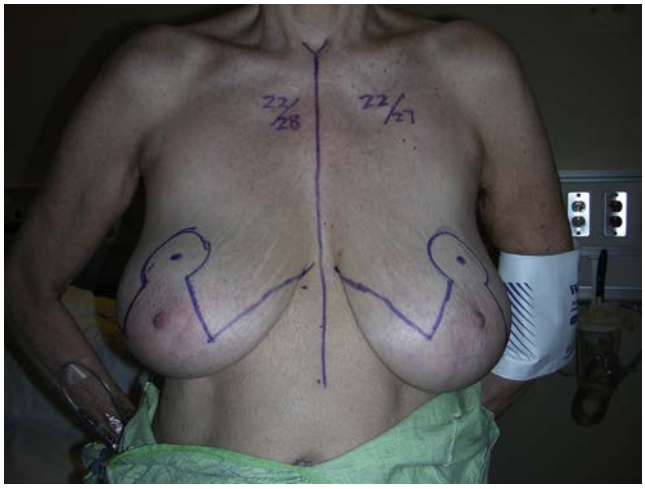
and thickness of the pedicle can be maintained (Fig. 19.4). Again, the nipple is primarily innervated by the medial and lateral branches of the fourth intercostal nerve. However, the third and fifth intercostal nerves may contribute as well.[7]

Preoperative Markings

While the patient is in the upright position, the new nipple position is marked first. For the classic inverted-T inferior pedicle breast reduction, the new nipple position should be set 1 cm below the level of the IMF so that a high-riding nipple position can be avoided. This author's preference is to use a Wise pattern template for all initial marking in a standard fashion. The distance for each vertical length should be less than 6 cm (usually 5 cm), and the inverted-T closure could be approximated without tension. For horizontal marking along the IMF, the medial extent of the incision should be away from the midline of the anterior chest and should not be visible while the patient is standing. The lateral extent of the incision should not go beyond the anterior axillary line of the patient and should not be visible. Attention should be given to symmetric placement of the new nipple position in each breast based on gross inspection and measurements (Fig. 19.5).

Intraoperative Markings

While the patient is in the supine position, commonly under general anesthesia, the nipple–areola complex is marked with either a 38- or 42-mm cookie cutter based on



• **Fig. 19.5** Preoperative marking of the inverted-T inferior pedicle breast reduction. Please note that the new nipple position should be placed 1 cm below the level of the IMF.

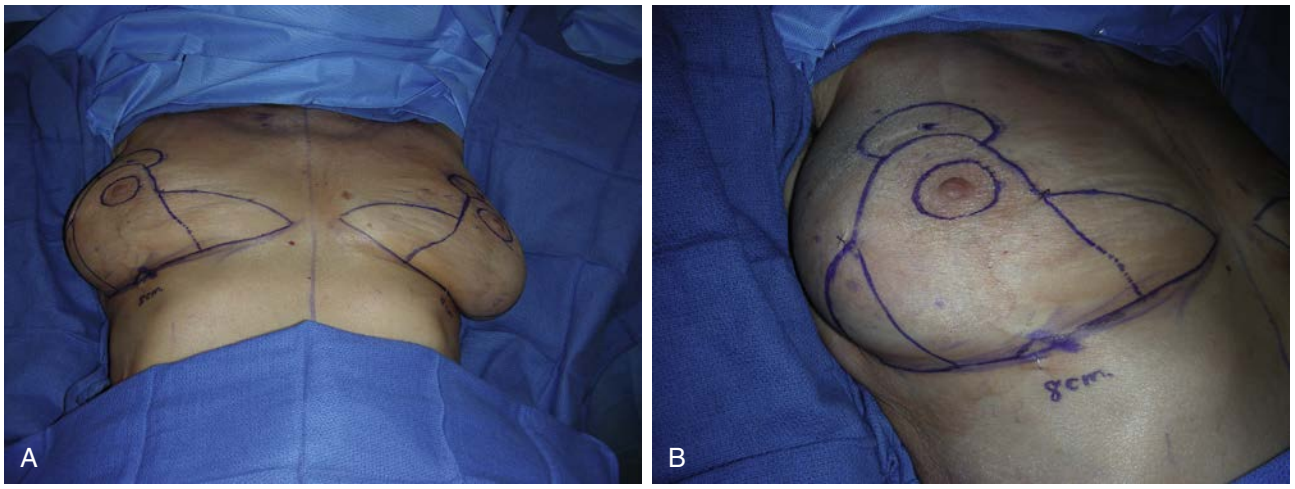
the location of the new nipple position. Once the midline of each breast is determined along the IMF the inferior pedicle can then be designed, with the pedicle width from 7–9 cm depending on the breast size the surgeon wants to achieve after breast reduction. It is important to leave at least a 1-cm-wide section of breast tissue from the proposed upper border of the nipple–areolar complex to avoid cutting into it (Fig. 19.6A). After completion of the pedicle marking, a small triangle is marked in the middle of the horizontal inferior pedicle to serve as a skin bridge to potentially reduce tension on the inverted-T closure (see Fig. 19.6B). Finally, the marked medial and lateral vertical limbs in the breast should be tested for easy approximation in the proposed inverted-T closure without tension.

Details of the Procedure

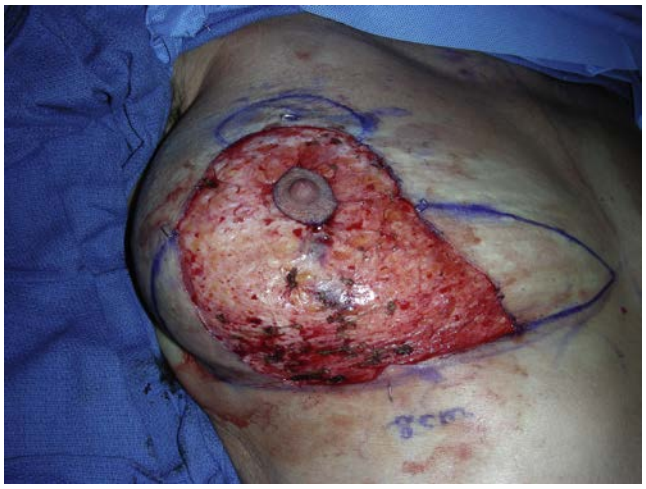
For the inferior pedicle vertical breast reduction, the area of de-epithelialization over the pedicle is de-epithelialized with either a knife or scissors, as preferred by the surgeon. In the lower part of the pedicle, a triangular shape of skin should be preserved (Fig. 19.7). A breast tourniquet can be used to facilitate de-epithelialization.[8]

The medial wedge resection of the breast is performed first. The resection should be performed conservatively to ensure adequate medial fullness after breast reduction. The resection should be done with attention to preserve more tissue in the medial aspect of the breast. The lateral wedge resection of the breast can be done more aggressively, including removal of the tissue from the breast tail. The resection can be quickly performed down to the base of the breast, in close proximity to the pectoral fascia, but should not include the fascia so nipple sensation can be well preserved postoperatively. Attention should be given to beveling the incision away from the inferior pedicle during the resection so adequate pedicle size can be achieved.

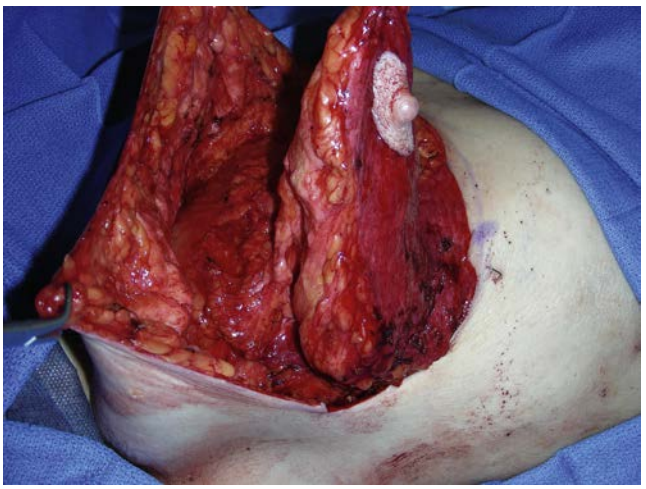
The entire inferior pedicle is then elevated. Attention should be given to beveling the cutting superiorly away



• **Fig. 19.6** (A) Intraoperative marking of the inferior pedicle. The pedicle should be wider and sufficiently thick once it is elevated. (B) Close-up view showing the inferiorly based pedicle and the marking for a small skin triangle.



• **Fig. 19.7** Intraoperative view shows the completion of de-epithelialization over the inferior pedicle of the right breast.

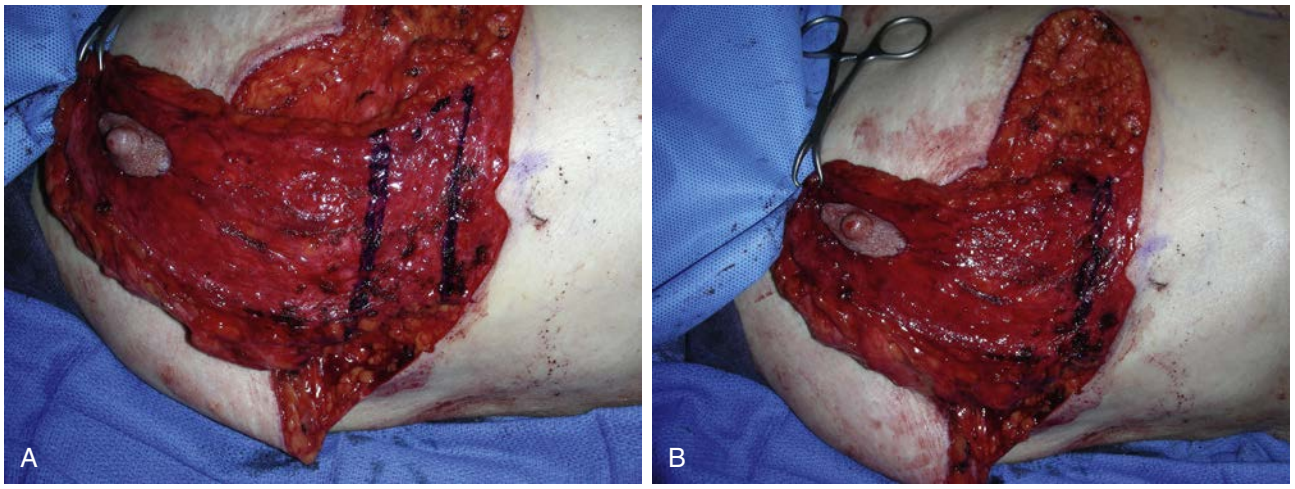


• **Fig. 19.8** Intraoperative view shows the completion of the right breast pedicle elevation. The pedicle is relatively thick and has a wider base. It also receives blood supply from the central part of the breast base.

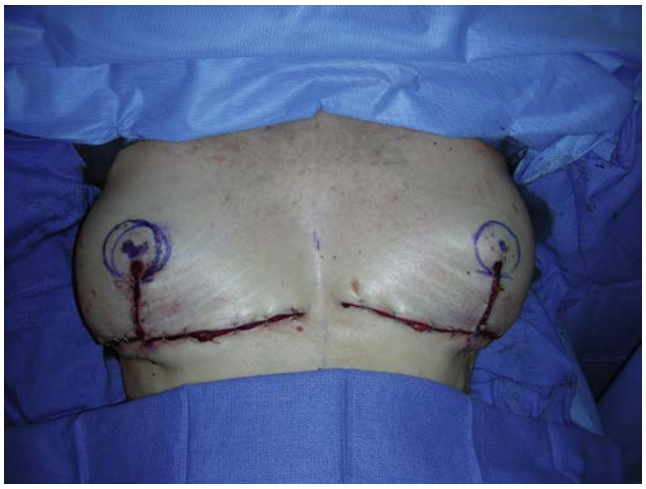
from the pedicle so that a thicker pedicle with more perforators, perhaps from the central portion of the breast, can be preserved (Fig. 19.8). Such a pedicle has a wider base with the blood supply not only from the traditionally inferior portion of the breast but also from the central portion of the breast so that an adequate blood supply can be maintained to the nipple–areolar complex. Once the pedicle is elevated, additional debulking of the pedicle can be performed as long as an adequate blood supply to the nipple can be ensured. The breast skin flap is undermined toward the clavicle and can then be thinned with a direct excision with scissors or a knife. At this point, any excess pedicle tissue can be resected under direct vision. Once adequate resection of the pedicle and breast skin flap are accomplished, the inferior pedicle can be plicated (the total length of the pedicle is shortened to about 5 cm) with interrupted 3-0 Vicryl sutures so breast projection can be improved and in-set of the nipple–areola complex can be more easily performed (Fig. 19.9A, B).[9]

The closure of the breast after in-set of the pedicle is performed with a 2-0 Vicryl suture for the inverted-T closure. Once the new nipple position is confirmed, the area for the nipple–areola complex is de-epithelialized, the final in-set of the nipple is done, and the rest of the incision is approximated temporarily with staples (Fig. 19.10). Both breasts are then judged for symmetry in size, shape, and projection with the patient in the upright position.

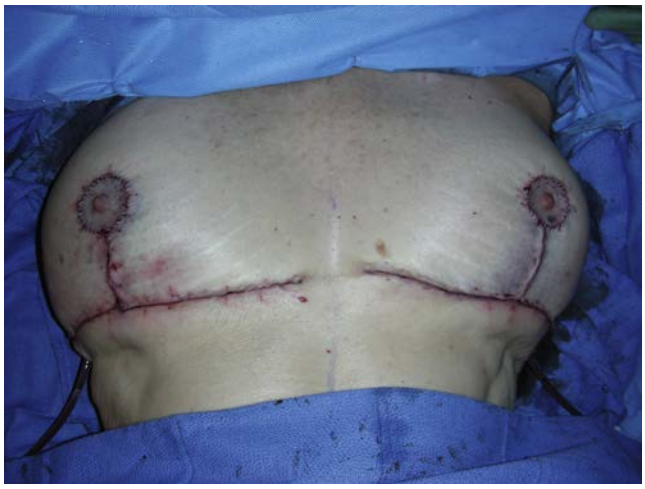
A suction drain is placed laterally in each breast pocket. The vertical and horizontal incisions are closed in two layers. The deep dermal closure is done with 3-0 Monocryl interrupted sutures. The skin closure is performed with the 3-0 V-Loc wound closure device (Medtronic, Minneapolis, MN, United States) for horizontal incision and 4-0 Monocryl for vertical incision in a running intradermal fashion. The new nipple–areola complex is also closed in two layers with interrupted 4-0 Monocryl sutures for deep dermal closure and



• **Fig. 19.9** (A) Intraoperative view shows the extent of the pedicle plication (marked with *blue ink*). (B) Intraoperative view shows the completion of the pedicle plication.



• **Fig. 19.10** Intraoperative view shows the temporary completion of the pedicle in-set and inverted-T closure. The new nipple position then can be reconfirmed or adjusted.



• **Fig. 19.11** Intraoperative view shows the completion of the final closure and the immediate result after bilateral inferior pedicle breast reductions from the same patient.

a simple running 5-0 chromic suture for the skin closure (Fig. 19.11). The average time for bilateral inferior pedicle breast reductions in the author's practice is about 3–4 hours depending on the size and amount of the breast reduction. For a video on this technique, see Video 19.1.

Postoperative Care and Expected Outcomes

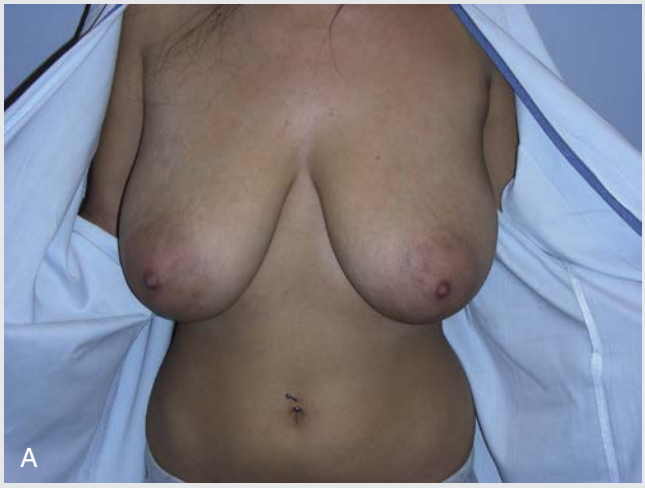
All incisions are covered with Steri-Strips, and a surgical bra is applied after surgery. The patient should wear a surgical bra for 2–3 weeks until the incision has healed and will then convert to a new bra without an underwire. A drain is placed routinely for this type of breast reduction and can be removed after 24 hours in the author's practice. Depending on the amount of the breast reduction, the patient may stay overnight in the hospital for observation. The incision usually heals within 2–3 weeks, and the patient should avoid heavy lifting for 6 weeks.

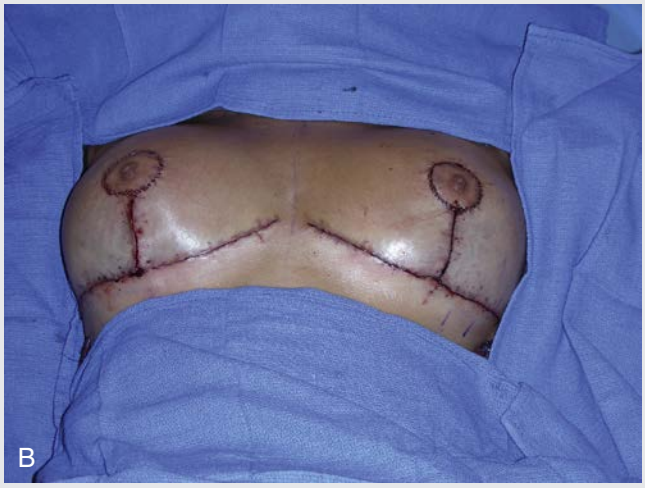
Both functional and cosmetic improvement can be achieved after an inverted-T inferior pedicle breast reduction. The result is usually quite consistent. Problems related to delayed wound healing in the inverted-T area is relatively common but can be treated with local wound care in an outpatient setting. Even for a very large breast reduction, the inferior pedicle breast reduction is still a procedure of choice, and free nipple graft has not been performed in the author's practice. Scars can be prominent initially but are usually well tolerated by most patients once they have matured. Overall patient satisfaction is still quite high, and revision surgery has rarely been performed in the author's practice.

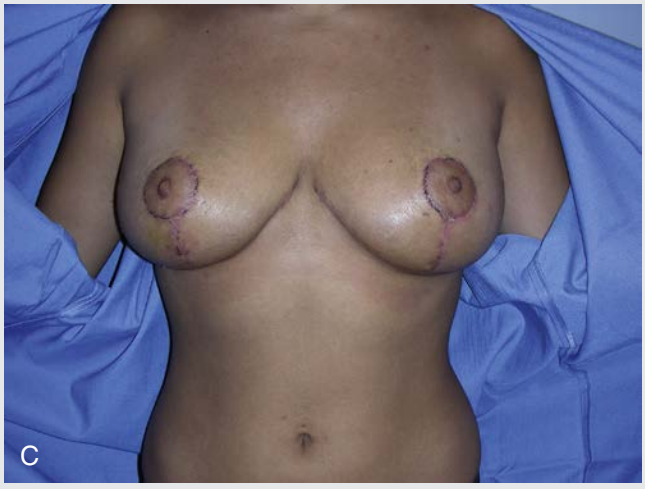
Case Examples

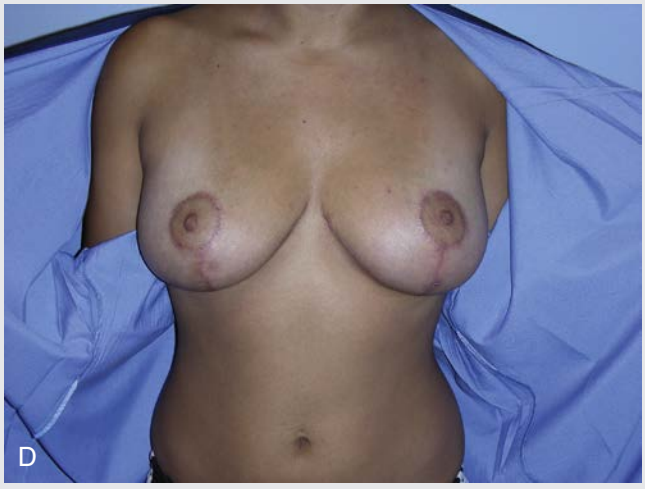
CASE 19.1

A 19-year-old white woman was offered an inverted-T inferior pedicle breast reduction for symptomatic macromastia (Case 19.1A). Her surgery went well, and the total amount of breast tissue removed from her right breast was 335 g and from her left breast 275 g (Case 19.1B). Her postoperative course was uneventful. The patient is quite happy with the overall cosmetic appearance and functional improvement during follow-up. Results are shown at 1 month (Case 19.1C) and 3 months (Case 19.1D) postoperatively.



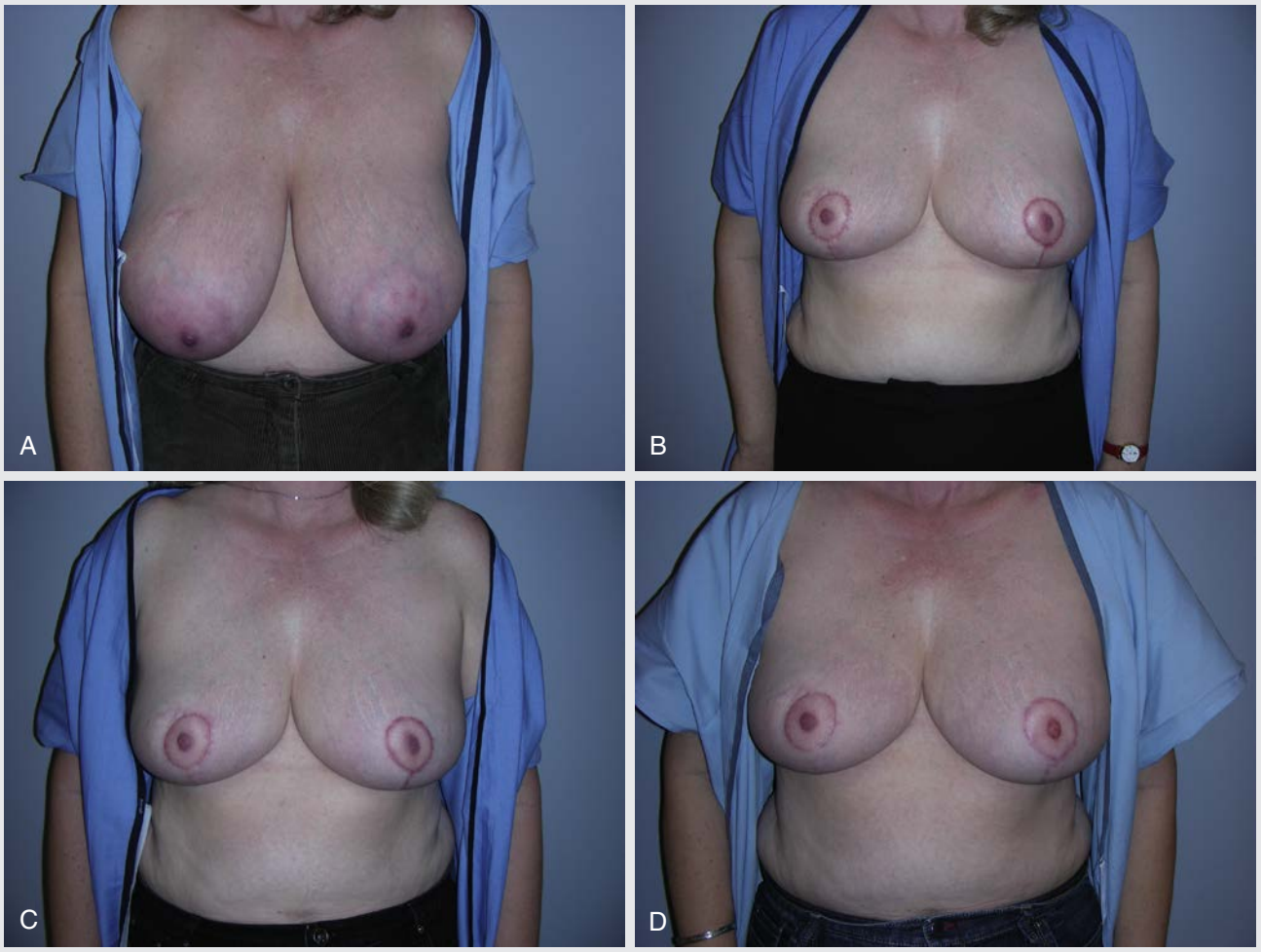






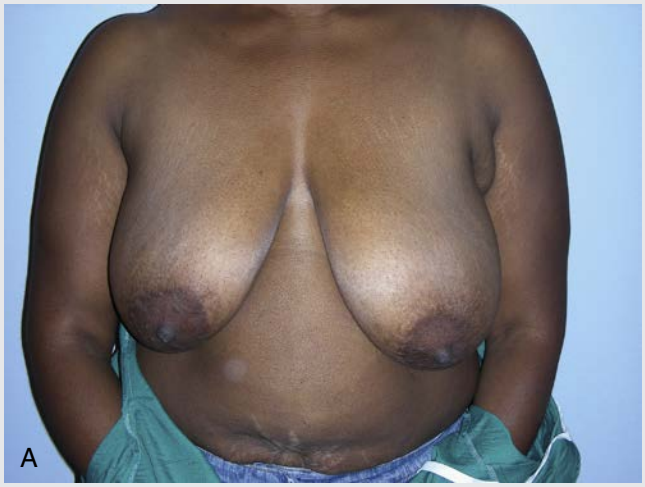
CASE 19.2

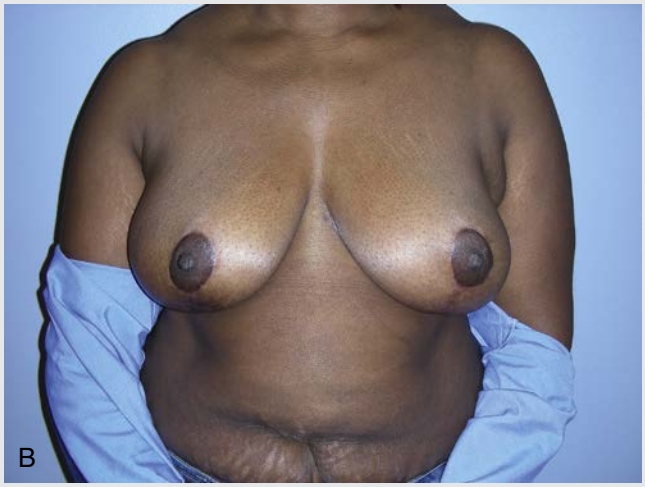
This 48-year-old white woman suffered from symptomatic macromastia and an inverted-T inferior pedicle breast reduction was planned for this patient (Case 19.2A). Her surgery went well, and the amount of breast tissue removed from her right side was 1065 g and from her left side 925 g. Postoperative recovery was uneventful. The patient is quite happy with the overall cosmetic appearance and functional improvement during follow-up. Her results are shown at 1.5 months (Case 19.2B), 4 months (Case 19.2C), and 9 months (Case 19.2D) postoperatively.

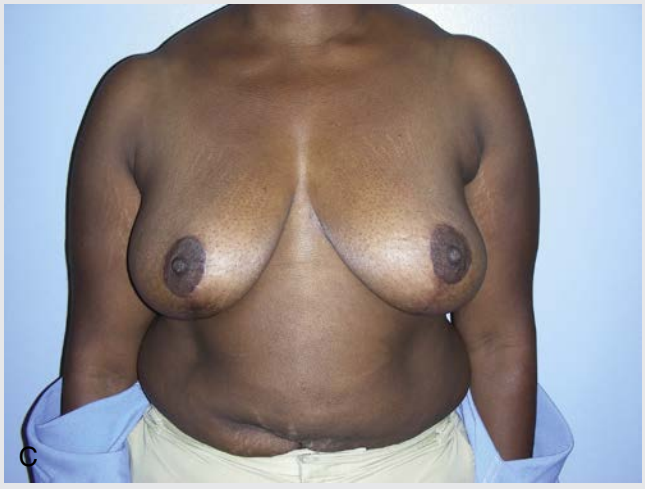


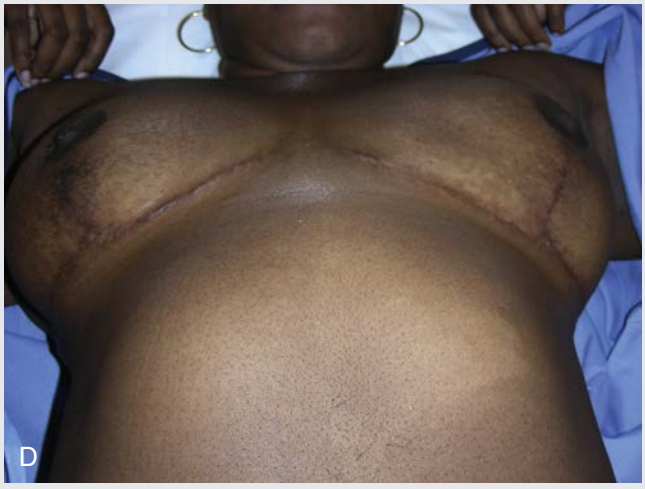
CASE 19.3

A 39-year-old woman of African descent was offered an inverted-T inferior pedicle breast reduction for her symptomatic macromastia (Case 19.3A). Her surgery was performed successfully, and the amount of breast tissues removed from her right side was 225 g and from her left side 445 g. The patient is quite happy with the overall cosmetic appearance and functional improvement during follow-up. The results are shown at 3 months (Case 19.3B) and 9 months (Case 19.3C) postoperatively. Her scar 9 months after breast reduction is shown in Case 19.3D.



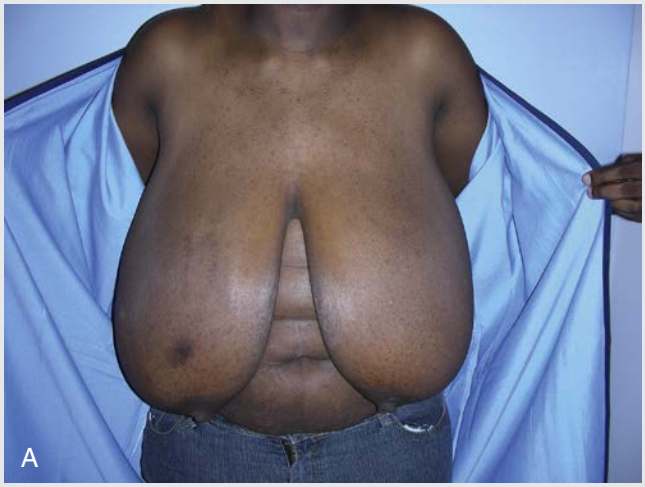


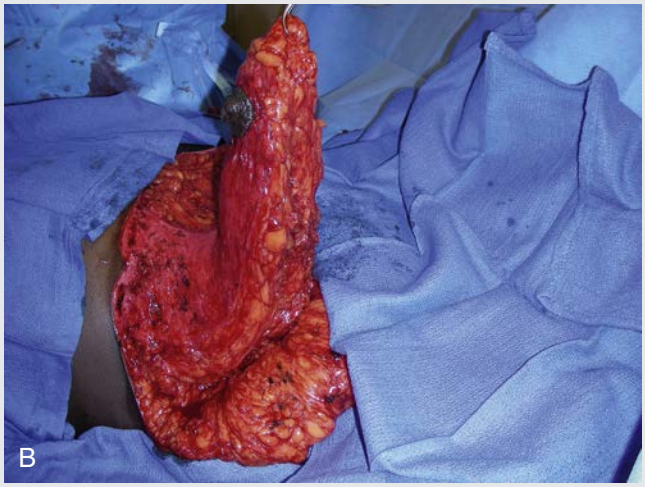


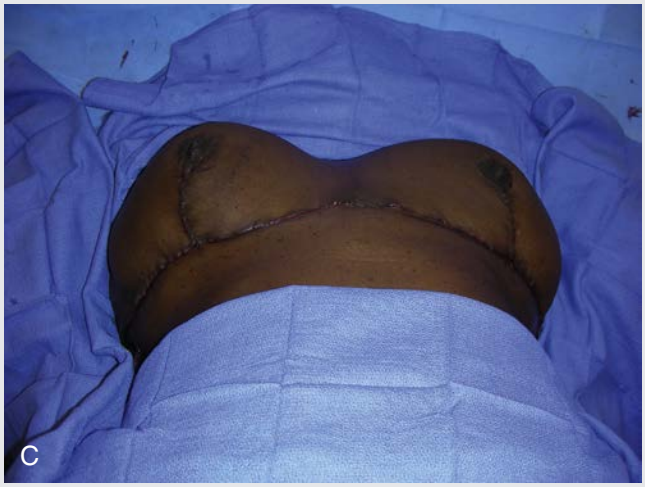


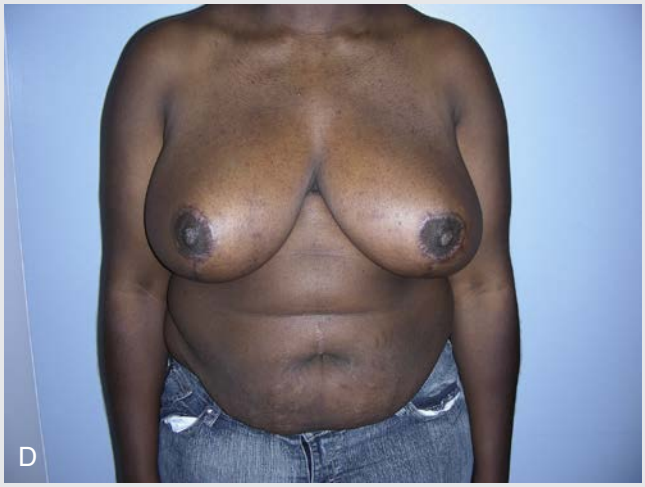
CASE 19.4

This 31-year-old woman of African descent was offered an inverted-T inferior pedicle breast reduction for her symptomatic gigantomastia (Case 19.4A). An inferior pedicle breast reduction was performed. The thicker and wide pedicle was created to ensure adequate blood supply to the distal flap, including the nipple (Case 19.4B). The surgery went well, and the amount of breast tissues removed from her right side was 2290 g and from her left side 1945 g (Case 19.4C). Her postoperative course was uneventful, and she is quite happy with the overall cosmetic appearance and functional improvement during follow-up. The result is shown at 5 months postoperatively (Case 19.4D).









Management of Complications

In general, the complications after the inverted-T inferior pedicle breast reduction in the author's practice are less common. One relatively common complication after the inferior pedicle breast reduction is delayed wound healing in the inverted-T area. The patient may develop skin necrosis in the area that will compromise the proper healing of the incision. Fortunately, this kind of complication usually just requires prolonged local wound care and can be managed in the office setting. No reoperation has ever been required. Occasionally the patient may develop a hematoma or seroma as in any type of breast surgery. These complications can be managed accordingly with evacuation of the hematoma or seroma in the office or in the operating room. Fat necrosis has been seen after this type of breast reduction and can be managed by direct excision if it causes symptoms such as pain. More severe complications such as partial or total loss of the nipple have not been seen in the author's practice.

Secondary Procedures

For the inferior pedicle breast reduction, the breast shape is maintained by the breast skin and therefore the quality of the breast skin for each patient after breast reduction can be critical. A bottoming-out appearance of the breast is relatively common after 1 year because the quality of the breast skin is poor in most of the patients with macromastia. However, this condition can be corrected by additional excision of excess breast skin in the vertical orientation and a more optimal shape of the breast can be restored. Revision surgery to improve the breast shape can be performed as early as 6 months after breast reduction. After revision, the breast shape can be maintained longer. The scarring can be a problem after the inverted-T inferior pedicle breast reduction.[5] A widened scar can be revised after 6–12 months if the patient desires. Scar revision, in general, can be performed in the office setting under local anesthesia.[10]

Conclusion

The inverted-T inferior pedicle breast reduction can be performed safely and effectively with functional improvement and a reasonably good long-term cosmetic result. The overall complications after this type of breast reduction are still less frequent, but, unfortunately, scarring and bottoming-out of the breast can be seen after such a breast reduction.[7,11,12] Nevertheless, the inverted-T inferior pedicle breast reduction is considered a standard technique in the United States for any patient and can be mastered by most plastic surgeons with consistent results.

PEARLS FOR SUCCESS

- Inferior pedicle breast reduction can be performed for almost all patients.
- The procedure has a short learning curve and can be mastered relatively quickly.
- The new nipple position should still be placed 1 cm lower than the actual level of the IMF.
- The pedicle should be kept wider and thicker so adequate blood supply to the distal pedicle and nipple–areolar complex can be ensured.
- The pedicle can be plicated to facilitate the in-set of the nipple–areolar complex and improve the projection of the breast.
- Medial resection should be done conservatively to preserve the medial fullness, but lateral resection can be performed aggressively to include removal of the tissue from the breast tail.
- The horizontal incision should be designed medially away from the midline of the sternum and laterally at the anterior axillary line.
- Pay attention to the closure of the inverted-T junction and measures that can be taken to reduce tension on the closure.
- Prominent scarring in the IMF and breast bottoming-out can be some long-term problems.

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Video 19.1 A well edited operative video (about 10 minutes) is enclosed.

20

Breast Reduction—No Vertical Scar

RICHARD J. GRECO

Introduction

Breast reduction surgery is not only about improving the quality of life of women with the symptoms of macromastia but also improving the patient's perception of her own image. Although it is thought by surgeons that the horizontal scar is the scar that bothers most patients, when 66 prospective patients desiring reduction were asked to rate line drawings and postoperative photographs of all three reduction techniques (Wise pattern, vertical, and no vertical scar), the no-vertical-scar operation was significantly preferred by the prospective patients.[1] In addition to removing the vertical limb of the T scar, this procedure does not result in the disfiguring pull of the vertical limb on the shape of the new areola and significantly reduces the healing complications of the inferior T connection on a standard Wise pattern. The no-vertical-scar technique was brought to our attention by Passot[2] and later re-popularized by Lalonde[3] and Nagy.[4]

The no-vertical-scar breast reduction is an excellent operation for specific groups of patients: (1) women with very pendulous breasts with the present nipple–areola complex at least 7 cm below the proposed new nipple–areola position, (2) patients who do not want a vertical scar, and (3) women with the same nipple position and in whom the risk of trifurcation loss is very high with a standard Wise pattern resection (e.g., obese, diabetic, immune suppressed, smoking history).[5]

Indications and contraindications for the no-vertical-scar technique are as follows:

- *Macromastia:* Patients with large breasts desiring a reduction in size and who meet the criteria of having their present nipple positions at least 7 cm lower than the proposed new nipple position. Patients would prefer this operation if they are at high risk for delayed wound healing or wish to avoid the vertical scar.
- *Breast ptosis:* Patients relatively happy with their breast size but not happy with their shape because of excess skin sag, are a candidate for a mastopexy, would prefer to not have a vertical scar, and meet the criteria for the procedure.

This procedure is available only to patients who have their present nipple–areola complex below the newly proposed horizontal incision (Fig. 20.1A). Dr. Lalonde demonstrates a way to reduce the need by 1–2 cm less,[2] but this is not where you should start your experience. Patients must be healthy enough to undergo surgery and willing to accept the general risks of an inferior pedicle Wise pattern breast reduction.

Preoperative Evaluations and Special Considerations

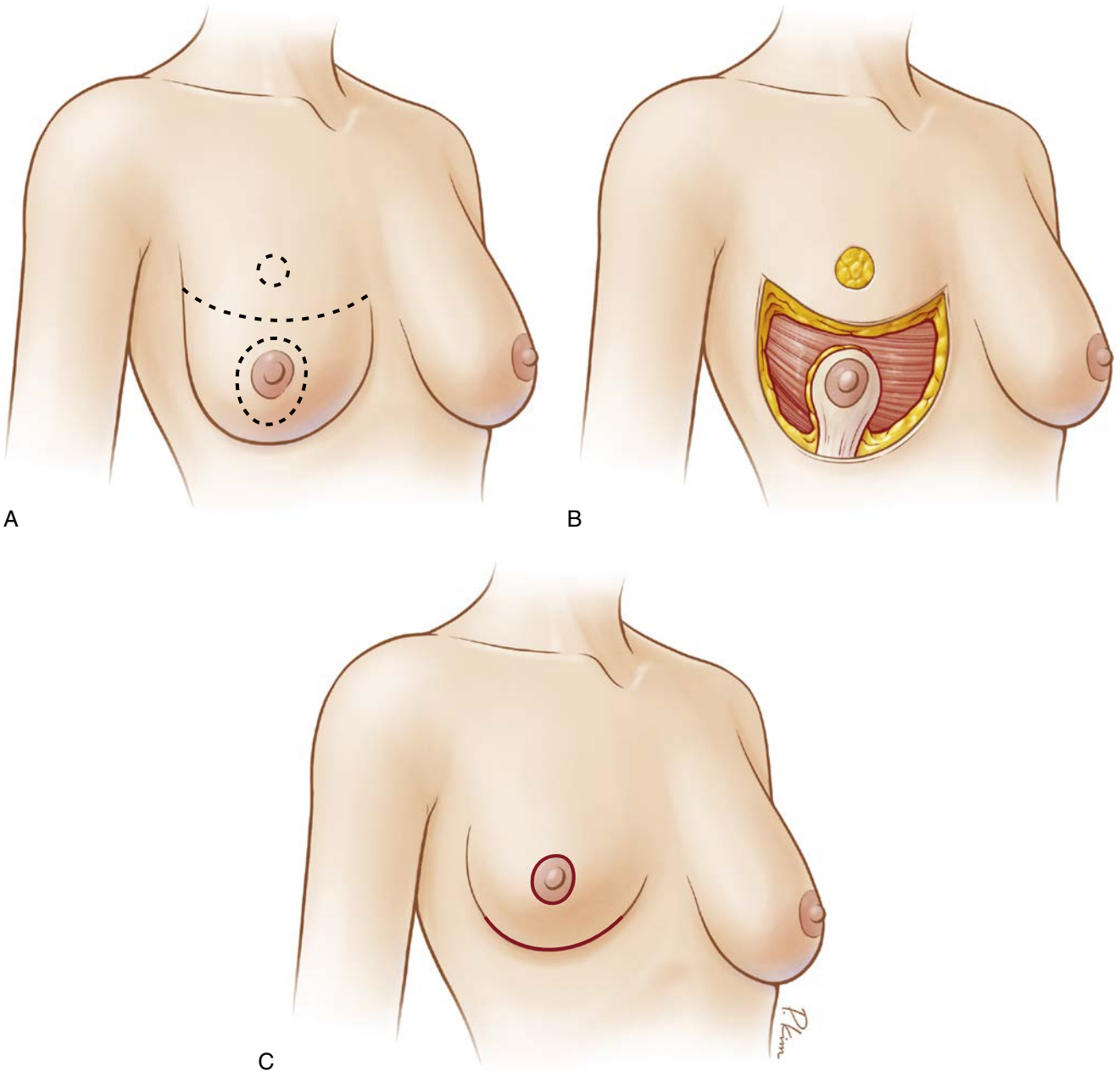
It is important to discuss a woman's family history of breast cancer and her breast health when considering any significant surgery on the breasts. These questions should start with age breast development started, whether the patient has had any pregnancies, age at first pregnancy, bra size before the pregnancy, size of breast during pregnancy and after delivery, present breast size, any breast masses identified and if biopsy was performed or mass removed, plans for more children, if future breastfeeding is important to the patient, and if the patient is at her ideal body weight or is planning weight loss. In addition to breast history, understanding the patient's smoking history, diagnosis of diabetes or autoimmune diseases, present weight and plans for weight change, and any underlying cardiovascular disease; these will be important in your plans for the patient.

On physical examination, determining whether the patient is an appropriate candidate for a lift or reduction procedure, and, if so, how much tissue would be removed to obtain the desired breast volume postoperatively. An examination of where the new nipple position will be (Figs. 20.2 and 20.3) and whether there is an adequate amount of transposition to have 5 cm of intact skin between the new nipple position and the upper limb of the skin incision (Fig. 20.4) will determine if the no-vertical-scar technique can be used.

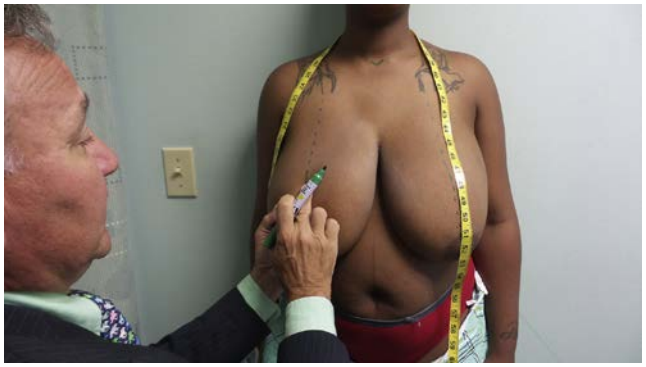
Surgical Technique

Relevant Surgical Anatomy

The most important anatomic aspect of breast reduction surgery is understanding the vascular blood supply of the patient's breast and the planned operative pedicles. Any



• **Fig. 20.1** Illustrations of no-vertical-scar technique. (A) Skin pattern design. (B) Inferior pedicle and superior flap. (C) Final skin closure.



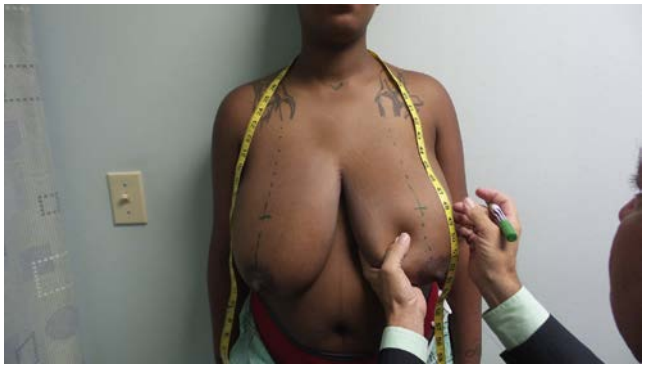
• **Fig. 20.2** Drawing of nipple position: present and proposed.

previous breast surgery could have injured the blood supply to the patient's nipple or pedicle.

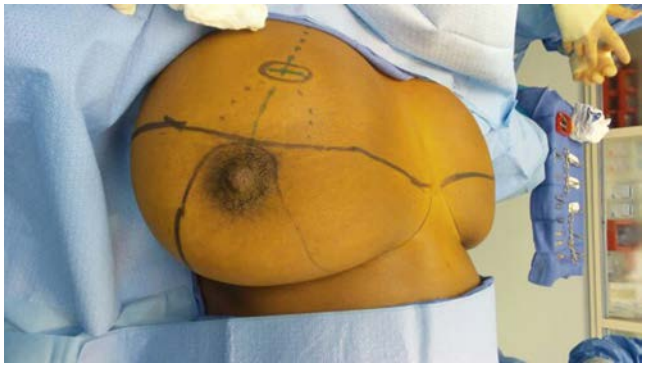
In the no-vertical-scar reduction, I use the inferior pedicle flap. The blood supply to the inferior pedicle comes from the internal mammary artery, the intercostal arteries, and the external branches of the lateral thoracic artery. It is important to not undercut the pedicle to allow the vessels to travel to the breast and the nipple–areola complex.

Markings

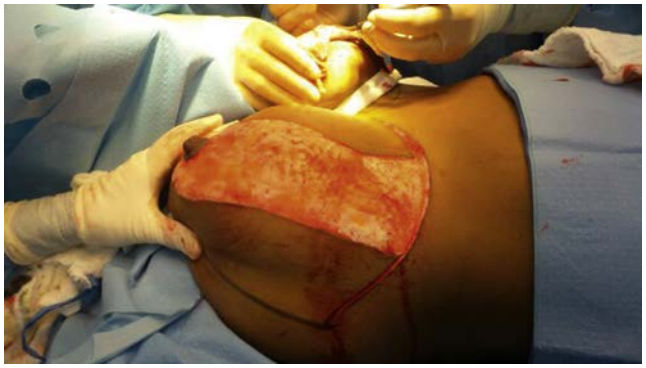
With the patient in the upright position, I first mark in green the suprasternal notch and then the meridian of the



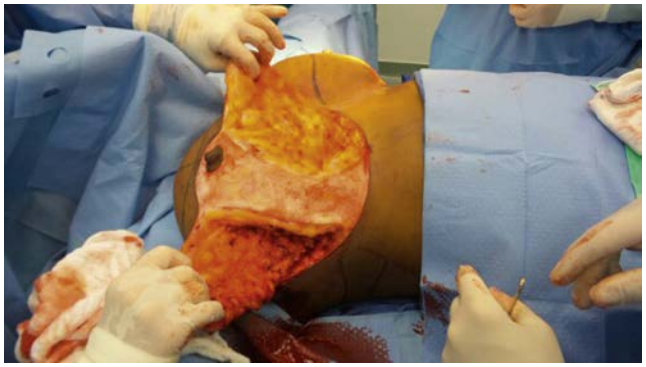
• **Fig. 20.3** New nipple position.



• **Fig. 20.4** New nipple position and the upper limb of the incision, measuring greater than 5 cm.



• **Fig. 20.5** De-epithelialization of the inferior pedicle.



• **Fig. 20.6** Create inferior pedicle.

breast on each side using a long tape measure. I then transpose the inframammary fold (IMF) to the anterior surface of the breast to mark the proposed new nipple position (see Fig. 20.2) and mark with green. A similar procedure is performed on the opposite breast (see Fig. 20.3). A measurement from the suprasternal notch to new nipple position is checked on each side, and a visual check on their position being level is performed.

A Wise pattern tool is used to mark the standard markings for an inferior pedicle technique. This should make you very comfortable with the markings. I then connect the inferior limb of both wings, which will be the upper limb of resection.

Surgical Procedure

Details of the Procedure

Pedicle Elevation

After general induction and intubation, Xylocaine 1% with 1:100,000 epinephrine is injected along the proposed incision lines. I verify the width of the pedicle based on the length of the pedicle and the final size goal after surgery. It is usually 8–12 cm wide. The breast is held in a taut position with a garrote, and the nipple–areola complex is marked with a 38-mm cookie cutter. The inferior pedicle is then de-epithelialized; holding the pedicle steady, it is developed and care is taken not to undermine the blood supply during dissection. Tissue is left medially for final breast shape fullness and the lateral and axillary area is more aggressively resected (Figs. 20.5, 20.6, and 20.7).

Resection

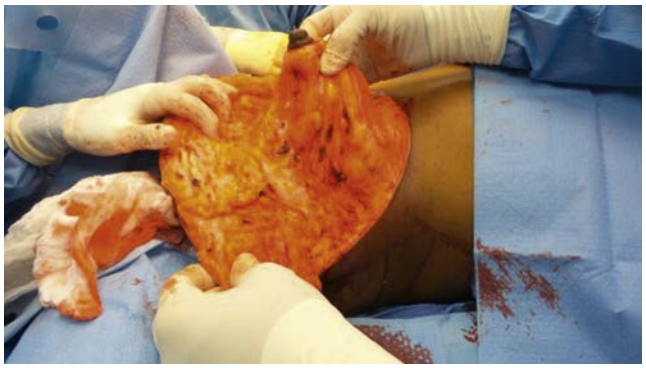
After the creation of the inferior pedicle, the breast that has been elevated and resected from the medial and lateral aspects of the breast are attached to the superior flap. The long upper limb is incised and developed at 1.5–2.0 cm thickness and beveled to eventual full thickness (Figs. 20.8 and 20.9). The entire specimen is removed and hemostasis obtained.

Closure of the Breast Envelope

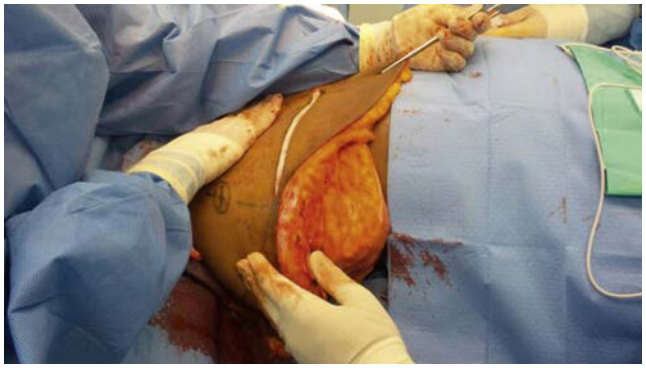
Before closing the breast and in-setting the nipple, the inferior pedicle is secured medially and superiorly with 2-0 PDS (Fig. 20.10). The middle of the superior flap is tacked in position to mitigate the medial dog ear and divide the closure roughly in half. The new nipple position is determined by measuring 5 cm above the suture line on the green nipple meridian line (Fig. 20.11).

Nipple–Areola Complex In-Set

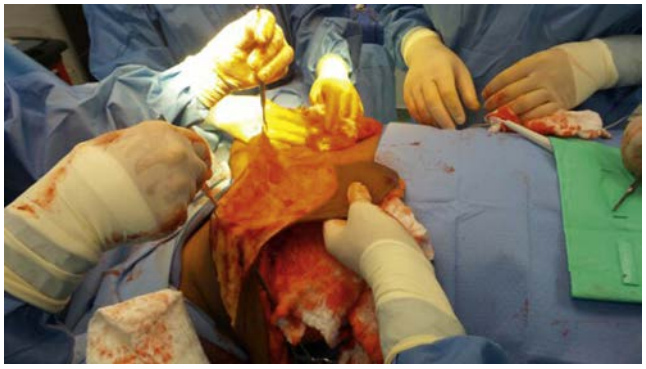
The new nipple is marked with a 34-mm cookie cutter. I place the bottom of the cookie cutter at the 5-cm mark. If the pedicle is 10 cm or greater, I mark it at 6 cm. When the skin is incised, it immediately expands to 36–38 mm (Figs. 20.12 and 20.13). The nipple is brought out through the



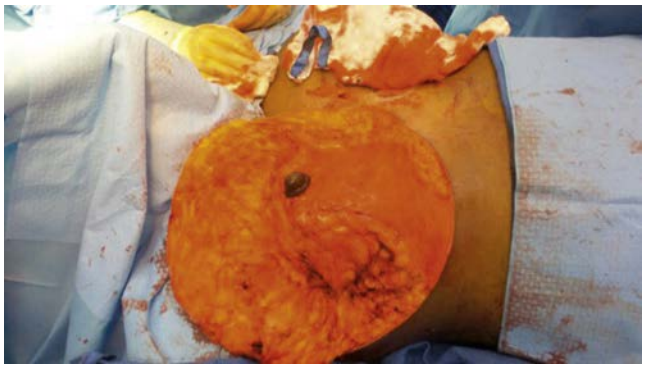
• **Fig. 20.7** Separating inferior pedicle from upper flap.



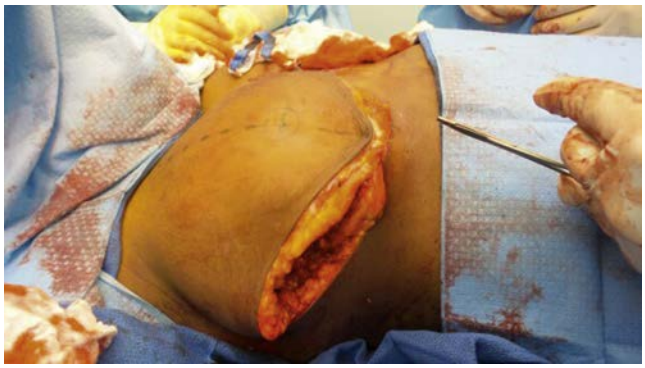
• **Fig. 20.8** Incision along lower end of upper flap.



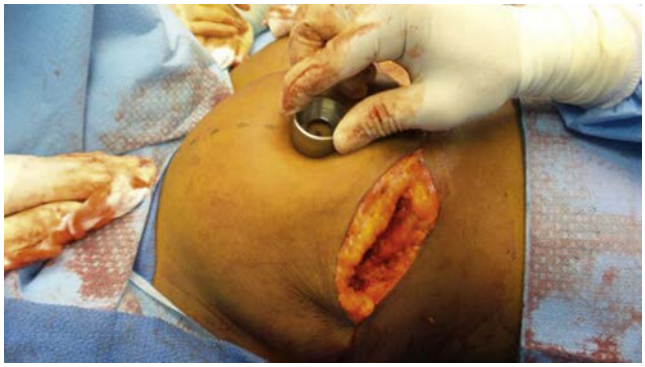
• **Fig. 20.9** Bevel superiorly and resect excess breast tissue.



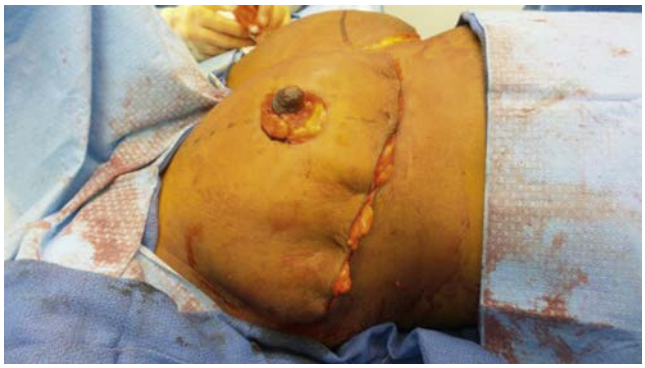
• **Fig. 20.10** Tack pedicle medially.



• **Fig. 20.11** Bring superior flap over pedicle.



• **Fig. 20.12** Mark new nipple position 5–6 cm up from IMF. Use 34-mm cookie cutter.



• **Fig. 20.13** Core out new the nipple location and bring the nipple through.

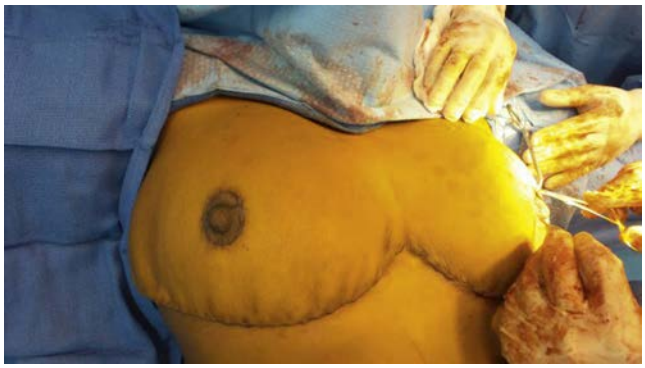
newly marked nipple position. Anchor it with 4-0 PDS at 12 o'clock, 3 o'clock, 6 o'clock, and 9 o'clock, followed by one tacking suture between each location and then a final nipple–areolar closure with a running 5-0 PDS suture.

The horizontal incision is now closed. I continue to divide the incision lengths in half to redistribute the extra length of the upper flap to the shorter inframammary

incision. Closure is performed in a layered fashion. I prefer 2-0 PDS for deep tension approximation, followed by 3-0 PDS for dermal approximation. The skin is then closed with a running 4-0 PDS (Fig. 20.14).

After the breast has been completely closed, a similar procedure is performed on the opposite breast (see Fig. 20.14). The appearance of the final results on this patient is presented in Cases 20.1 and 20.2.

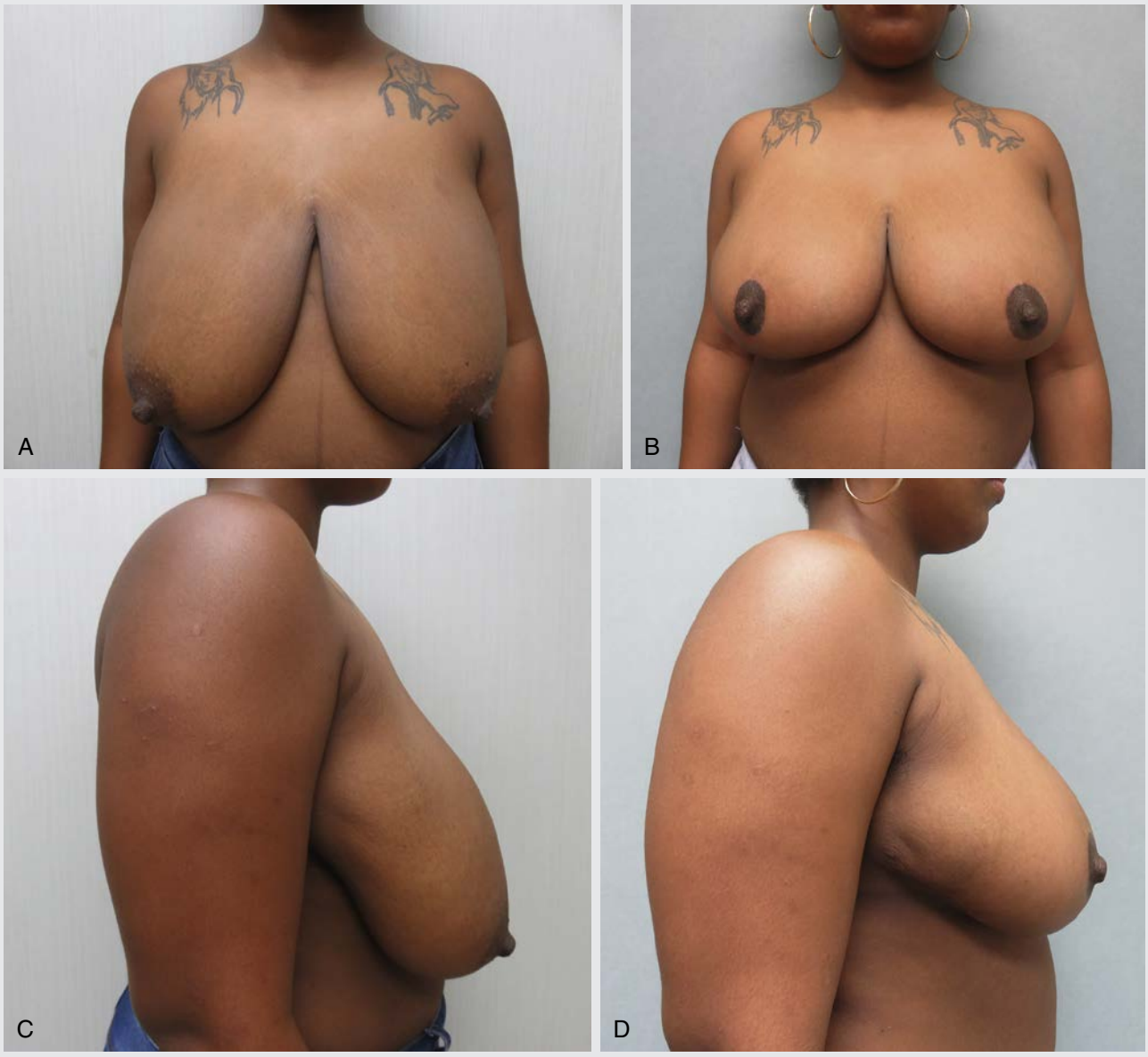
Case Examples



• **Fig. 20.14** Close nipple and close inferior incision.

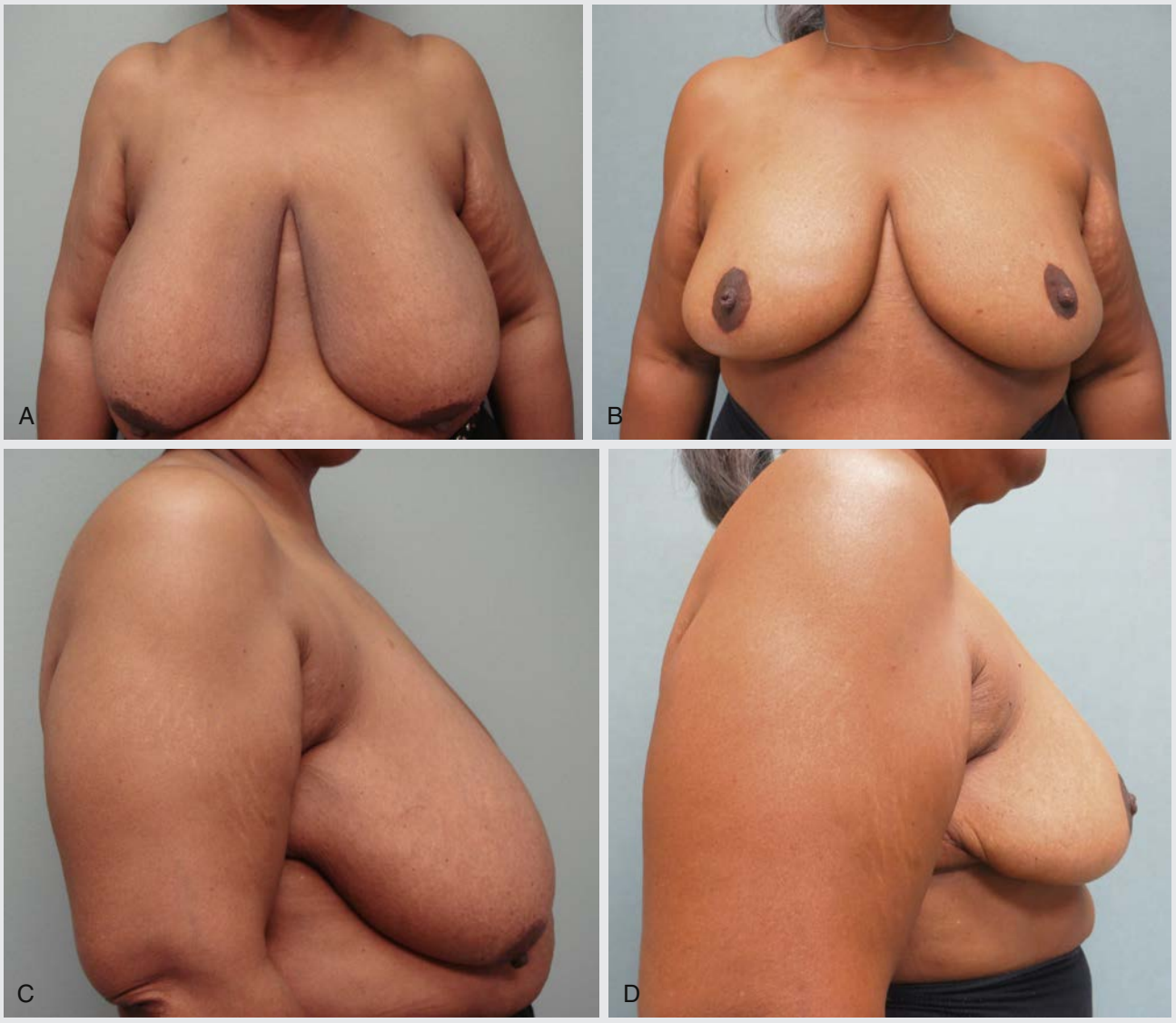
CASE 20.1

This 25-year-old woman (5 ft, 4 inches; 191 lb) with size 36H breasts presented preoperatively with significant symptoms of macromastia (Case 20.1A and C). She had very ptotic breasts and was an excellent candidate for the no-vertical-scar technique. Her sternal notch–to-nipple distances were right 35.5 cm and left 36 cm. We resected 796 g from her right breast and 768 g from her left. She did well and is shown at 12 months postoperatively (Case 20.1D).



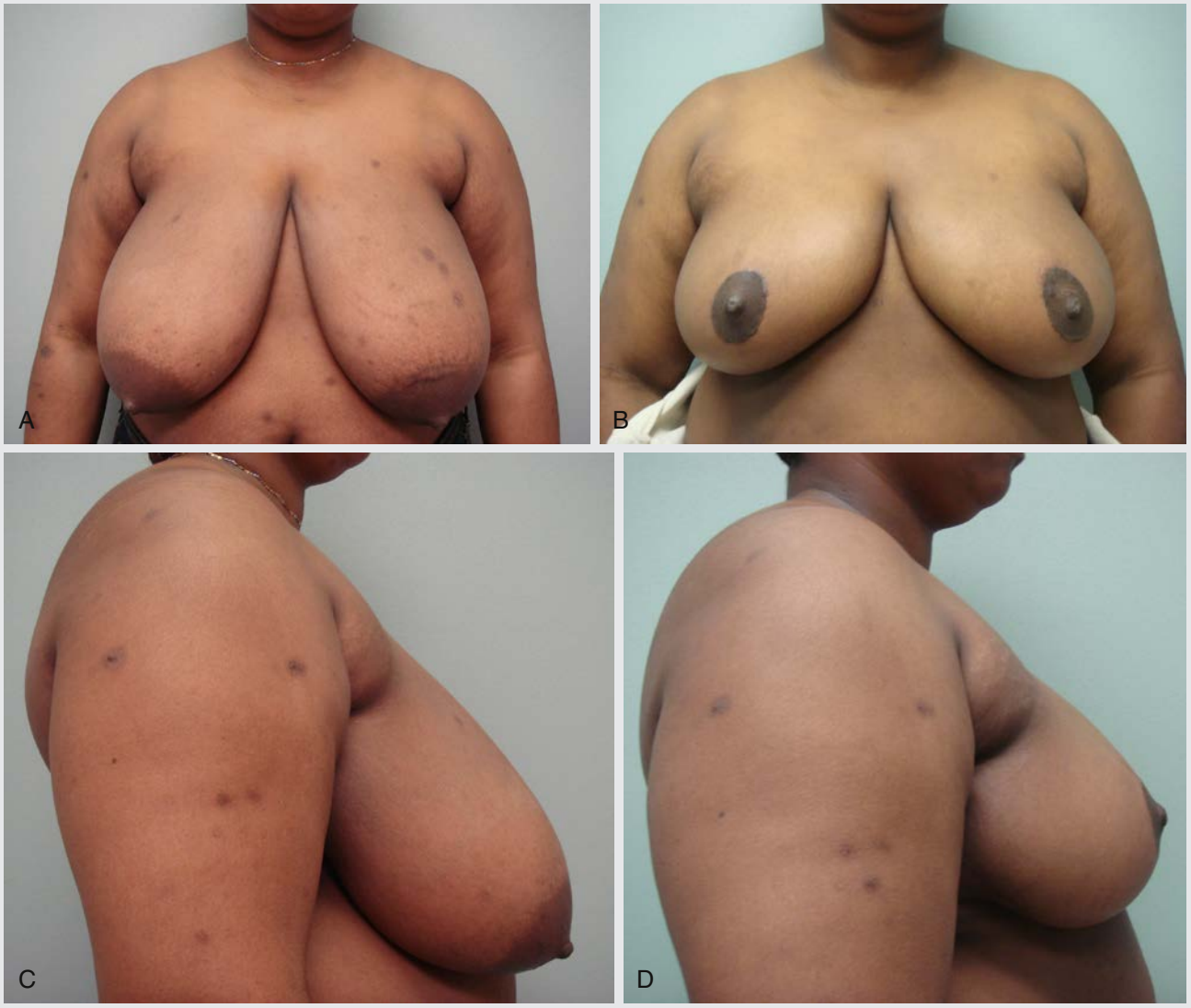
CASE 20.2

This 56-year-old woman (5 ft, 1-inch; 190 lb) with size 44DD breasts preoperatively with significant symptoms of macromastia (Case 20.2A and C). She had very ptotic breasts and was an excellent candidate for the no-vertical-scar technique. Her sternal notch–to-nipple distances were right 38.5 and left 39 cm. We resected 760 g from her right breast and 764 g from her left. She did well and is shown at 4 years postoperatively (Case 20.2D).



CASE 20.3

This 29-year-old woman (5 ft, 7 inches; 220 lb) with size 38DD breasts presented preoperatively with significant symptoms of macromastia (Case 20.3A and C). She had very ptotic but firm breasts and was an excellent candidate for the no-vertical-scar technique. Her sternal notch–to-nipple distances were right 40.5 and left 39.5 cm. We resected 1280 g from her right breast and 1052 g from her left. She did well and is shown at 9 months postoperatively (Case 20.3D).



Postoperative Care and Expected Outcome

The postoperative care is similar to that for all other patients undergoing breast reduction. These patients are treated as outpatients unless there are medical issues. They should be able to take care of themselves as soon as the anesthetics wear off (usually 24 hours). They can return to sedentary jobs or school in 5 days.

Dressings

Antibiotic ointment is placed over the nipples and incisions and a small piece of Adaptec gauze (3M, St. Paul, MN, United States) along the incisions, with fluff gauze and ABD pads in a surgical bra. The patients will wear these for 48 hours and then remove them to shower. They can reapply a similar dressing or use gauze in an old bra if they prefer.

The first postoperative visit is at 5–7 days. I instruct the patient on the need to start massaging the incisions at day 14 for 5–10 minutes at least twice a day with any lubricant they prefer. I also recommend either sheets or liquid silicone on the incisions for at least 4 hours a day. It will take 1–3 months for the breast to have the final shape and for the horizontal incision to smooth out. It is important to emphasize preoperatively that the incision initially will be mismatched and accordion-like, but it will get better.

Activities

Patients can walk as far as they want on postoperative day 1, but they are not allowed to increase their blood pressure or exert themselves for the first 2 weeks. They have a 25-lb weight lifting limitation for 2 weeks. Between the second and fourth week, they can lift up to 50 lb and increase their activities to jogging and light aerobics. At 4 weeks, they can be involved in any desired activity.

Expectations

Patients usually note an immediate relief of back and neck pain. The healing phases are typical of all patients undergoing breast reduction.

Management of Complications

The most dreaded complication in this patient population is an ischemic nipple. The sternal notch–to-nipple distance in these patients is usually greater than 35 and often much longer. One must design a wide enough and large enough inferior pedicle to carry adequate blood supply to the nipple for it to survive. Many inferior pedicles are 9–12 cm wide, and it is important to not undercut the pedicle during dissection.

If the nipple–areola complex appears to have slight venous congestion, topical nitroglycerin paste every 2–3 hours is helpful. If a patient loses a nipple, the patient should be treated and the nipple reconstructed later in a fashion similar to that with any breast reduction technique. It is important to discuss with the patient before surgery that loss of the nipple–areola complex can occur.

Preoperative evaluation of the lateral axilla for excess skin and fat should be noted, documented, and discussed with the patients. The patient population well-suited for this operation often have large axillary rolls that go all the way to the middle of their back. Liposuction and additional skin excision can be discussed and considered. Pointing out before surgery what patients will perceive postoperatively as an extra breast on their sides is important because after surgery when their breasts become much smaller, these areas will become more prominent.

Secondary Procedures

The only secondary procedures in my experience have to do with two things: excess skin and fat in the axilla going to the back and hypertrophic scars along the horizontal scar. The excess skin and fat can be handled with weight loss or a combination of liposuction and skin excision. The hypertrophic scars are rare and are treated in the usual way with massage, topical silicone, corticosteroid tape or long-acting corticosteroid injections, and scar excision as a last resort.

Conclusion

The no-vertical-scar breast reduction can be an excellent operation for specific groups of patients: (1) women with very pendulous breasts with the present nipple–areola complex at least 7 cm below their proposed new nipple–areola complex position, (2) patients who do not want a vertical scar, and (3) women with the same nipple position and in whom the risk of trifurcation loss is very high with a standard Wise pattern resection (e.g., obese, diabetic, immune suppressed, smoking history). The results are excellent, and patients prefer not to have the vertical scar of standard breast reduction techniques.

PEARLS FOR SUCCESS

- Proper patient selection is critical for the no-vertical-scar technique.
- Design the new nipple position at the level of the IMF.
- There must be at least 7 cm between the new nipple position and the top of the present nipple–areola complex.
- The inferior pedicle must be 8–12 cm wide.
- Do not undercut the pedicle.
- Once the superior flap is tacked to the IMF incision, mark the new nipple–areola complex 5–6 cm above the IMF.
- Use a 34-mm cookie cutter to mark new N/A defect; as you incise, the defect will expand to 38-mm.
- Prepare patient for accordion nature of the IMF incision closure, and inform the patient that it will resolve in 2–3 months.

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SECTION 5

Other Procedures

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21

Breast Reshaping After Massive Weight Loss

FRANCESCO M. EGRO AND J. PETER RUBIN

Introduction

With the ongoing rise of obesity in the United States a greater emphasis is placed on the importance of weight loss, diet, and exercise. A weight loss of more than 50 lb is classified as massive weight loss, and it can cause significant disfigurement and irregularities. Breasts are significantly affected by these changes. The loss of parenchymal volume combined with skin redundancy and loss of elasticity leads to a flattened, deflated, and ptotic breast appearance. Furthermore, the skin redundancy produces a roll of skin and fat on the lateral border of the breast that extends onto the chest wall. This lateral roll blurs the lateral curve of the breast and often forms one continuous roll of soft tissue, greatly affecting the aesthetics of the breast.

The Pittsburgh Rating Scale[1] is a validated measure introduced in 2005 by our group to classify contour deformities after massive weight loss. This scale helps especially in the breast where the commonly used breast ptosis scales fall short because they are not sufficiently descriptive of the unique breast changes associated with massive weight loss. The scale ranges from 0 to 3:0 includes normal breasts that do not require operative management; 1 includes grade I or II ptosis, or severe macromastia, and it benefits from traditional mastopexy, reduction, or augmentation techniques; 2 includes grade III ptosis, or moderate volume loss, or constricted breast, and it benefits from traditional mastopexy with or without augmentation; and 3 includes severe lateral roll and/or severe volume depletion with loose skin and flattened breast shape, and it benefits from parenchymal reshaping techniques with dermal suspension and consideration of auto-augmentation. Aside from the breast shape, patients who have had massive weight loss also have the characteristic of nipple medialization. This is important to recognize to ensure the nipple–areola complex (NAC) is moved laterally along a true breast meridian.

This chapter highlights the anatomic changes observed in the breast after massive weight loss and provides an overview of the preoperative evaluation, surgical management, and postoperative care to achieve an aesthetically pleasing result.

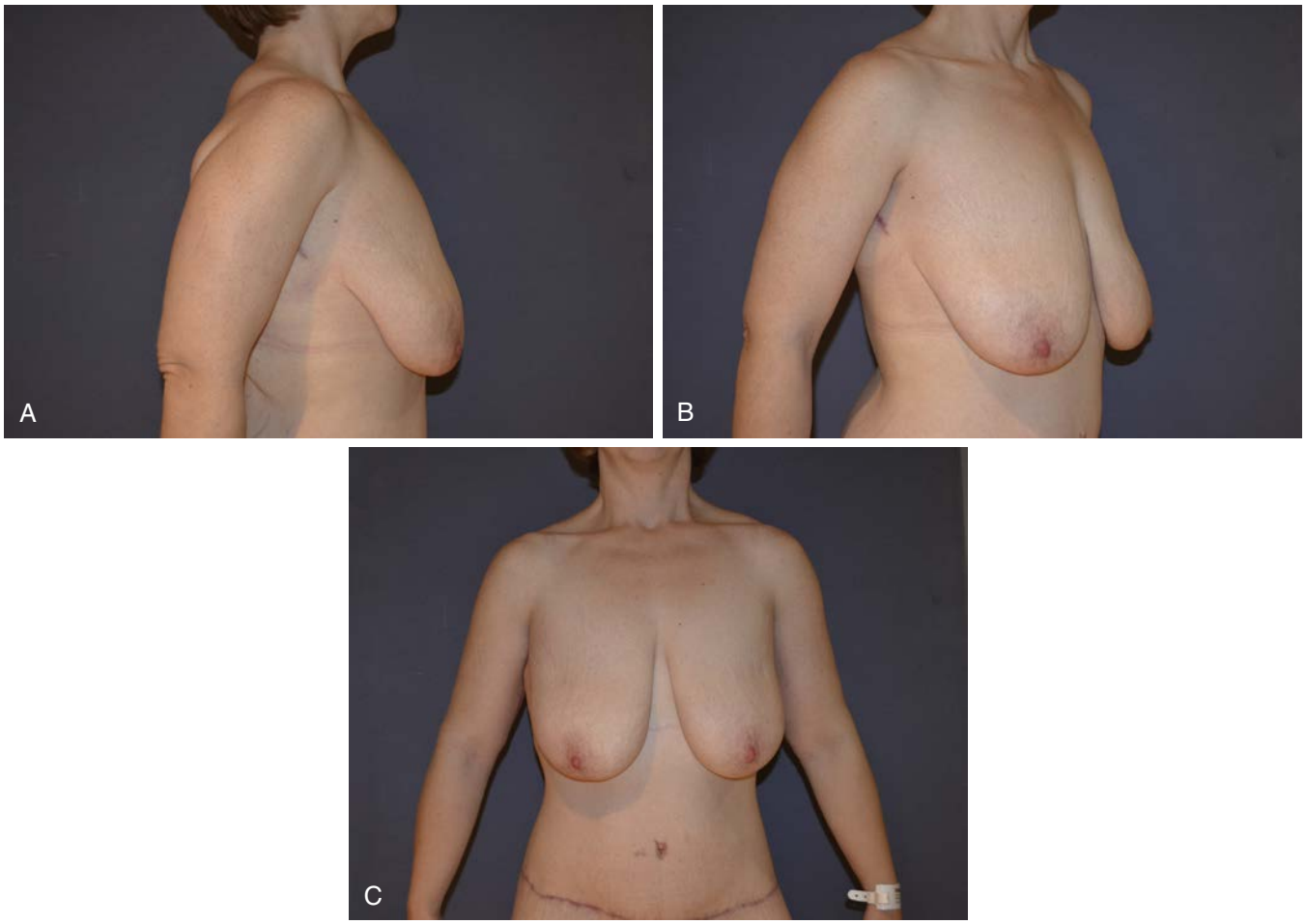
Indications and Contraindications

Breast reshaping with mastopexy or other techniques is indicated in patients who have lost a massive amount of weight with ptosis, loss of upper pole fullness, and medialization of the NAC. The type of breast reshaping procedure depends on the Pittsburgh Rating Scale and certain clinical criteria. Patients with mild breast deformities should be considered for traditional mastopexy techniques, including short scar approaches. However, dermal suspension and parenchymal reshaping with selective auto-augmentation is indicated in patients with the following conditions:

- Grade III breast ptosis
- Parenchymal volume loss with flattening of the breast against the chest wall
- Inelastic and redundant skin envelope
- Medialization of the NAC
- Roll of skin and fat on the lateral border of the breast that extends onto the chest wall (see Fig. 21.1A–C)

The only absolute contraindications for the use of dermal suspension and parenchymal reshaping with selective auto-augmentation includes active tobacco use, because extensive flap dissection is required with this technique and smoking can compromise the blood supply to the flaps. Relative contraindications for the use of dermal suspension and parenchymal reshaping with selective auto-augmentation include the following:

- Prior breast scars located in areas that may compromise perfusion of the undermined tissues.
- Inadequate parenchymal or lateral roll volume to mobilize and build a breast mound. In the case of significant asymmetry, the smaller breast is augmented using lateral chest wall tissue, or, if not possible, a reduction of the larger breast is performed to match the contralateral side.
- Active intertrigo.
- Diffuse fibrocystic disease.
- Body mass index (BMI) over 35.

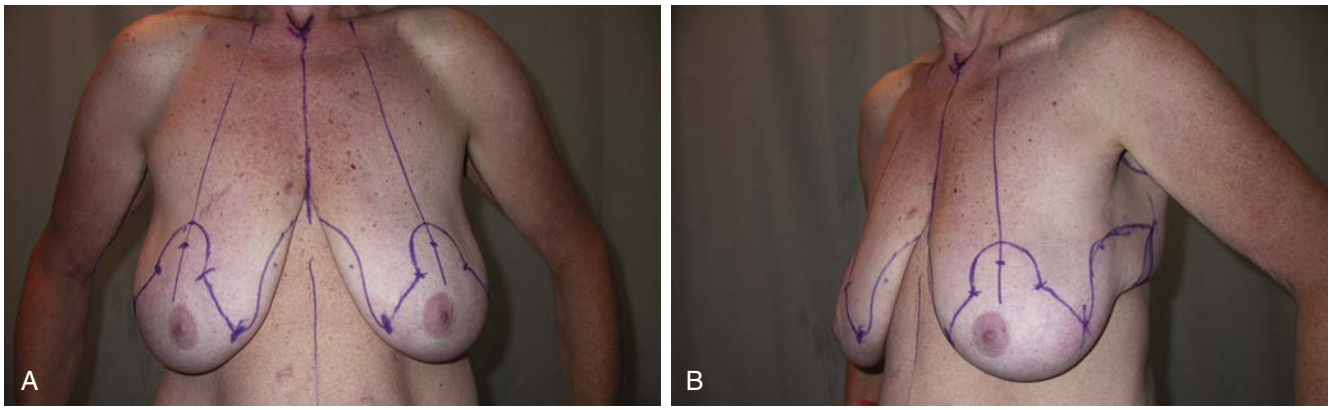


• **Fig. 21.1** (A–C) Typical candidate for dermal suspension and parenchymal reshaping with selective auto-augmentation technique.

Preoperative Evaluations and Special Considerations

Preoperative planning is crucial when performing body contouring in patients who have lost a massive amount of weight. A detailed history should be taken, including the type of bariatric surgery; time elapsed since the bariatric surgery; and the patient's initial and current BMI, nutritional status, diet, medical or family history of venous thromboembolic event, and smoking status. The patient should be at goal weight (preferably with a BMI under 30) with no significant fluctuations (no more than a 5-lb change per month) for the prior 3 months. This weight stabilization usually occurs 12–18 months after bariatric surgery. Patients with a higher BMI should be referred back to the weight loss specialists to provide diet and exercise programs to optimize the patient's BMI before surgery. Patients who are current users of tobacco products should be instructed to stop 1 month before and after surgery. Patients with a positive history of smoking are routinely tested with a cotinine urine test before surgery. A thorough physical examination of the breast should be conducted not only to determine the aesthetics but also to rule out the presence of masses and scars. Surgeons should assess skin quality, parenchymal volume, NAC position, and presence and size of a lateral roll of skin and fat.

The surgeon should determine whether the native breast parenchyma and lateral roll together will provide adequate volume for a breast reshaping procedure. Patients should be adequately assessed and should undergo medical clearance. Appropriate laboratory testing should be performed before surgery. Mammography is requested in accordance with the American Cancer Society guidelines. Patients should be asked to stop all medications that interfere with platelet function 2 weeks before surgery to avoid bleeding complications. Photographs of the breasts and trunk should be taken from a wide variety of angles. Photographs are helpful to plan the markings and the surgery and to critically assess the results postoperatively. Informed consent should be obtained discussing the procedure and complications. The postoperative care should be discussed to prepare the patient on what to expect in the postoperative period. The surgical plan, risks, and benefits are reviewed again on the day of surgery to address any outstanding patient concerns. Throughout the preoperative consultation, the plastic surgeon should gauge patient goals to ensure the expectations are realistic.



• **Fig. 21.2** Wise pattern markings showing correction of medial nipple–areola complex position and the lateral extension to address lateral skin and fat roll to provide additional tissue for auto-augmentation. (Reproduced from Rubin, J.P., Matarasso, A., 2007. Aesthetic Surgery After Massive Weight Loss. Elsevier, Edinburgh.[4])

Several factors should be taken into account when deciding the most appropriate procedure for breast reshaping: severity of the breast deformities, desired breast size, and surgeon's experience and comfort level.

The goals for breast reshaping in patients with massive weight loss are as follows:

- Use all available breast tissue and additional adjacent autologous tissue
- Reshape the breast skin envelope without relying on it for support
- Re-establish an appropriate NAC position
- Restore superior pole projection
- Eliminate the lateral skin and fat roll

The senior author has developed and refined a surgical technique to meet these goals.[2] The principles are based on dermal suspension and parenchymal reshaping with selective auto-augmentation, which as mentioned earlier is used for breasts that score 2 or 3 on the Pittsburgh Rating Scale. In brief, an extended Wise pattern is used to encompass the lateral skin rolls necessary for volume augmentation. The de-epithelialized Wise pattern creates a broad dermal surface area, which is plicated to precisely contour the breast shape and is suspended to the periosteum of the chest wall. This is a safe and reproducible technique that yields a youthful breast shape in a very challenging population.

Surgical Techniques

Relevant Surgical Anatomy

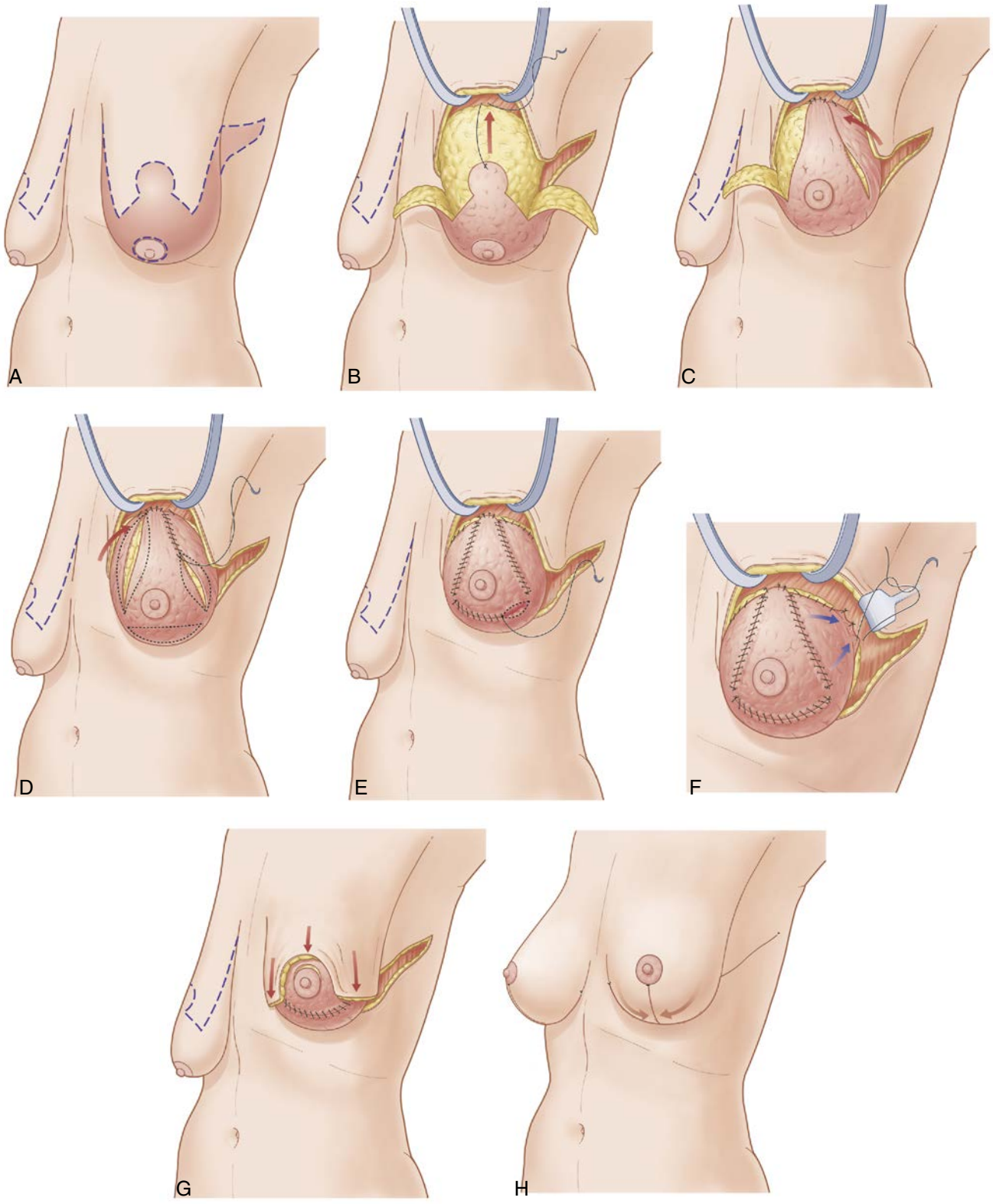
Understanding the normal breast topography and blood supply are key to ensure optimal results and avoid complications. Breast skin receives blood supply from the subdermal plexus, which communicates with underlying deeper vessels supplying breast parenchyma through perforators. For this reason, skin flaps should be thick enough to avoid damaging the subdermal plexus. The breast parenchyma receives a rich blood supply from multiple arterial sources: internal mammary artery, lateral thoracic artery, intercostal perforators, thoracodorsal artery, and thoracoacromial artery. The central pedicle used in the technique described later relies on perforators of the internal mammary artery from the fifth or sixth intercostal space that comes through the pectoralis muscle into the parenchyma just medial to the breast meridian. The venous system accompanies the perforator. For this reason, the pedicle should be well designed and not undermined to prevent NAC and parenchymal necrosis.

Preoperative Markings

An extended Wise pattern is drawn with a lateral extension to address lateral skin and fat roll to provide additional tissue for auto-augmentation (Fig. 21.2). A new breast meridian is drawn in the center of the breast mound. This line will often not cross the medialized nipple position. The new position of the nipple is transposed over the meridian breast line using the inframammary fold (IMF) as the reference point. The superior border of the NAC is then marked 2 cm above the new nipple position. This is used as the reference point to draw a keyhole pattern with 5-cm vertical limbs. A lateral extension is then drawn from the Wise pattern to include the lateral skin and fat roll often to the posterior axillary line and beyond depending on the amount of tissue that needs to be recruited for auto-augmentation. This tissue is supplied by the lateral thoracic perforators and is rotated into the breast for auto-augmentation. The amount of lateral extension used depends entirely on the desired size and degree of asymmetry.

Surgical Technique

The areola is marked with a 42-mm cookie cutter and is based on a central pedicle. The entire area within the marked Wise pattern is de-epithelialized (Fig. 21.3A). Skin flaps of 1 cm in thickness are elevated overlying the breast capsule down to the chest wall. Superiorly, the undermining continues along the chest wall overlying the pectoralis major fascia all the way to the level of the clavicle. Medial and lateral



• **Fig. 21.3** Illustrative description of the senior author's dermal suspension and parenchymal reshaping technique with selective auto-augmentation. (A) Markings with a Wise pattern and lateral extension. (B) Breast parenchyma degloving and medial and lateral flaps mobilization. The central dermal extension is secured to the rib periosteum. (C) The lateral breast flap is secured to the chest wall near the previous suspension point. (D) The medial breast flap is suspended to rib periosteum; the parenchyma is shaped using dermal plication. (E) The inferior pole of the breast parenchyma is plicated. (F) The lateral dermal flap may need to be secured to the lateral chest wall fascia. (G) Breast parenchyma redraping with the skin flaps. (H) Closure is performed in layers. (Reproduced from Rubin, J.P., Matarasso, A., 2007. Aesthetic Surgery After Massive Weight Loss. Elsevier, Edinburgh.[4])

flaps of breast tissue are then mobilized by undermining at the level of chest wall fascia. These flaps represent the medial and lateral triangles that are normally excised during a Wise pattern breast reduction. The lateral flap is shaped to the desired size. Perforators that enter these flaps should be preserved (see Fig. 21.3B). The central dermal breast extension is then suspended with size 0 braided permanent mattress suture to the periosteum of a selected rib along the breast meridian (often the second rib). The decision of the rib level is made based on where you want the nipple positioned—the higher the rib level, the higher is the final position of the nipple. Next the lateral dermal flap is suspended to rib periosteum in a manner similar to that used for the central dermal breast extension, usually next to the central suspension suture, but it also can be placed at a different level to ensure an optimal shape and lateral curvature (see Fig. 21.3C). Next the medial dermal flap is also suspended to rib periosteum in a similar fashion to ensure optimal medial breast shape. With the suspension points secured, the parenchyma is shaped using dermal plication with a running 2-0 braided absorbable suture. The plication process starts by suturing the lateral flap to the central dermal breast extension, followed by suturing the medial dermal flap to the central dermal breast extension (see Fig. 21.3D). Finally, the inferior pole of the breast parenchyma is plicated to shorten the nipple-to-IMF distance and increase projection (see Fig. 21.3E). The lateral dermal flap may need to be secured to the lateral chest wall fascia (Fig. 21.3F). The suspension and plication process should be undertaken simultaneously on both breasts rather than completing one breast and moving to the other. A final fine-tuning process is undertaken by additional plication sutures to optimize breast symmetry. The breast parenchyma can be redraped with the skin flaps throughout the whole plication process to help guide the need of major and minor adjustments (Fig. 21.3G). If the abdominal wall tissues are very loose, a decision may be made to secure the superficial fascial system layer of the dissected edge of the abdominal wall to the periosteum of the fifth rib to restore the IMF position. Closure is performed in layers. A half-buried mattress suture is used to secure the dermal edges at the "triple point" along the IMF. The dermis around the nipple may be incised part of the way around the circumference to release any tethering as needed. Suction drains are placed in each lateral breast. The skin is then closed using intradermal sutures (Fig. 21.3H). The dressing includes gauze fluffs over all incision lines, and the chest is wrapped with a lightly elastic compressive wrap.

Combined Procedures

Often, patients with massive weight loss present with multiple deformities that require more than one body contouring procedure to address them. Breast reshaping can be combined with other body contouring procedures in select patients, but careful planning is needed to ensure adequate results. A combined breast and abdominal contouring procedure would require the abdominal portion to be performed before the breast reshaping because the IMF is usually lowered with an abdominoplasty/panniculectomy. Furthermore, if a fleur-de-lis abdominoplasty is performed, the IMF not only is moved inferiorly but also is rotated medially. Therefore, the mastopexy markings may need to be adjusted and moved superiorly and/or laterally after the abdominal procedure**.** However, patients with loose IMF may benefit from a second-stage mastopexy to achieve a good aesthetic outcome. A combined breast reshaping procedure and upper body lift can be safely performed. The markings of the mastopexy lateral skin and fat roll should be drawn in continuation with the upper back lift markings, which will leave a single incision line. Our preference is to first work on the upper body lift in the prone position and close the back incisions. The patient is then turned and placed in the supine position for the mastopexy portion of the surgery. The lateral incisions of the mastopexy will be closed without dog-ears or irregularities by merging it into the upper body lift incision. A combined breast reshaping procedure and brachioplasty also can be safely performed. The brachioplasty caudal incision is merged with the lateral incision of the mastopexy to improve the lateral chest/axillary contour. However, patients should be warned that some redundancy at the posterior axillary line may persist, which can be corrected with an upper body lift during a second stage.

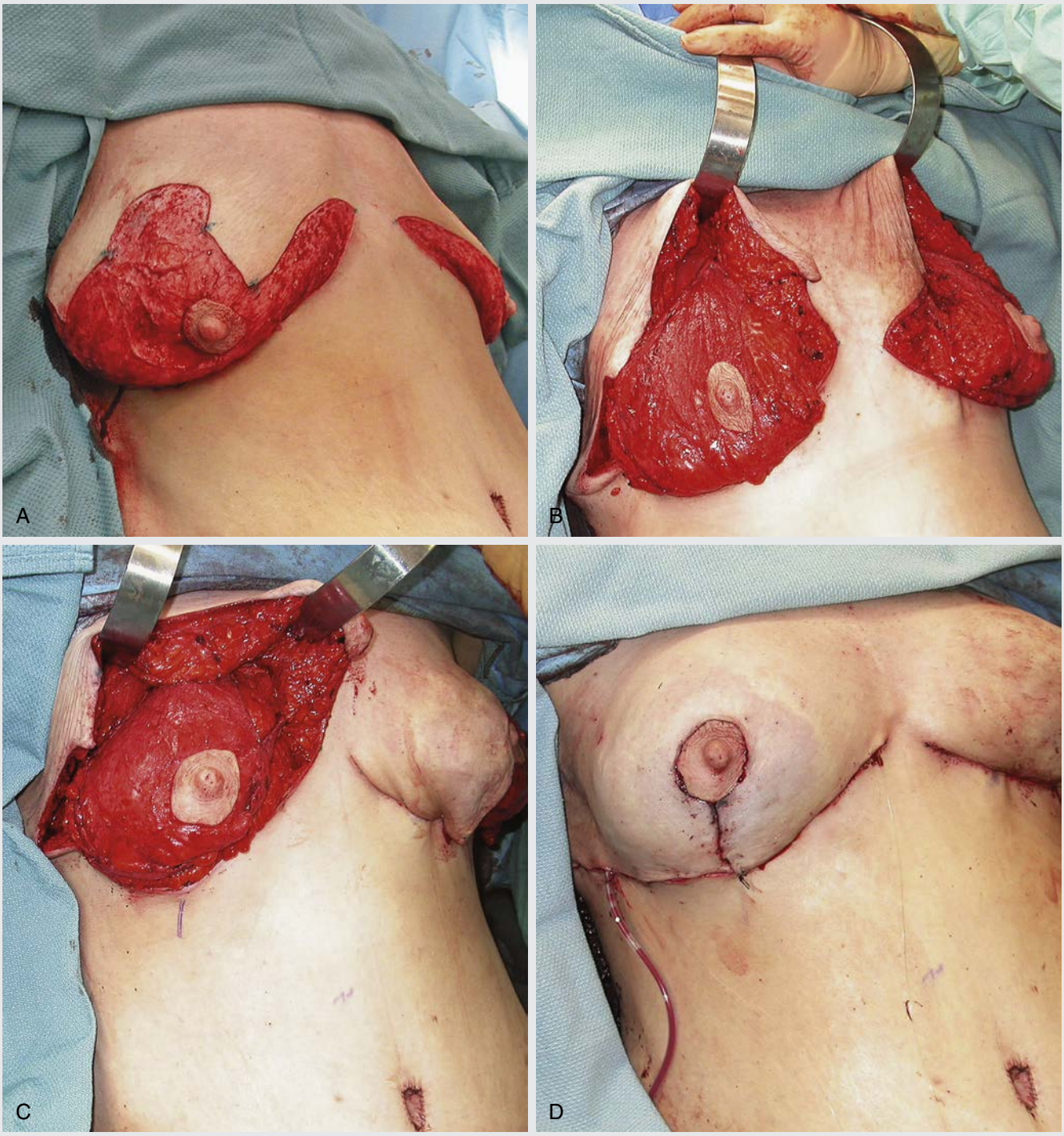
Outcome Optimization

There are certain tricks that the authors want to highlight that can help optimize aesthetic outcomes. First, complete elimination of the lateral skin and fat rolls can be achieved by extending the Wise pattern as far lateral as needed. Second, the entire lateral flap of the Wise pattern may be deepithelialized and used to add as much volume to the breast as needed. Third, the breast flaps should be approximately 1 cm thick (or greater) to minimize tissue loss at the inverted-T point. Fourth, plication is most impactful on the inferior and lateral aspects of the breast, because it helps increase breast projection and create a well-defined lateral breast contour. Fifth, nipple tethering can be improved by incising and partially releasing the surrounding dermis. Finally, breast reshaping should not be performed in patients who have lost a massive amount of weight or who are active smokers.

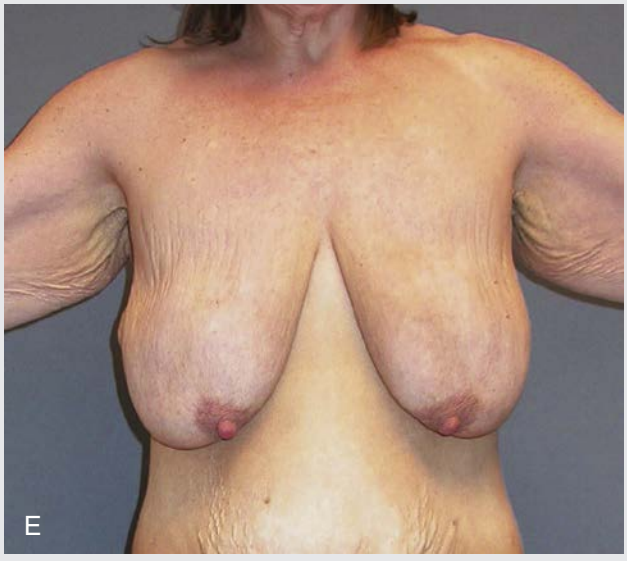
Case Examples

CASE 21.1

A 46-year-old patient who underwent 160-lb (73 kg) weight loss presented with Pittsburgh Rating Scale 3, grade III ptosis, parenchymal volume loss with flattening of the breast, inelastic and redundant skin envelope, NAC medialization, and rolls of skin and fat on the lateral border of the breast. The patient elected to undergo mastopexy with dermal suspension and parenchymal reshaping technique with selective auto-augmentation (Case 21.1A–D). Preoperative and postoperative photographs are shown in Case 21.1E–J.



• **Case 21.1** A 46-year-old patient after 160-lb (73 kg) weight loss who underwent mastopexy with dermal suspension and parenchymal reshaping technique with selective auto-augmentation. (A) Intraoperative photographs showing extensive de-epithelialization. (B) Suspension of the central dermal extension. (C) Plication sutures in place. (D) Redraping of skin flap. (E, G, I) Preoperative and (F, H, J) Six-month postoperative photographs. (Reproduced from Rubin, J.P., Matarasso, A., 2007. Aesthetic Surgery After Massive Weight Loss. Elsevier, Edinburgh.[4])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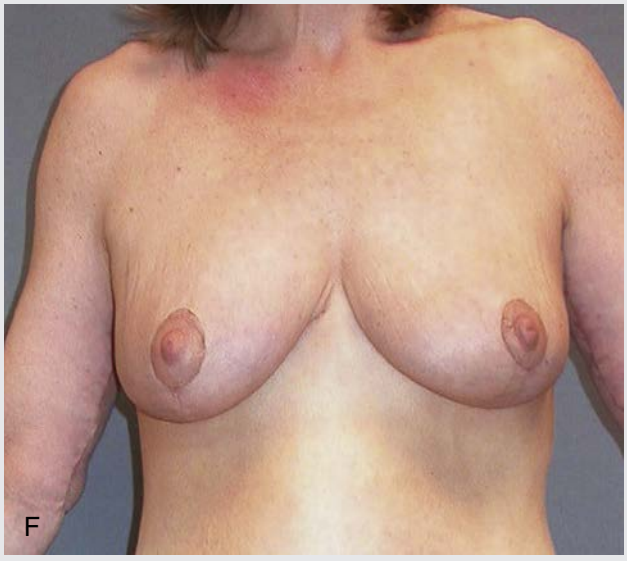
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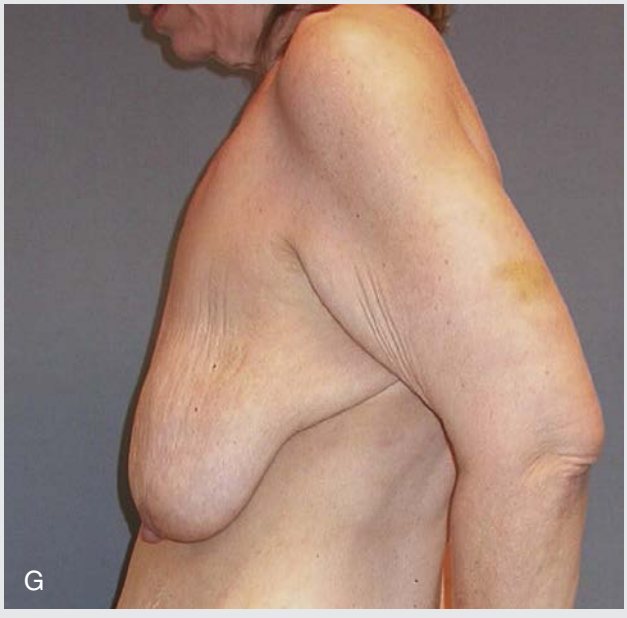
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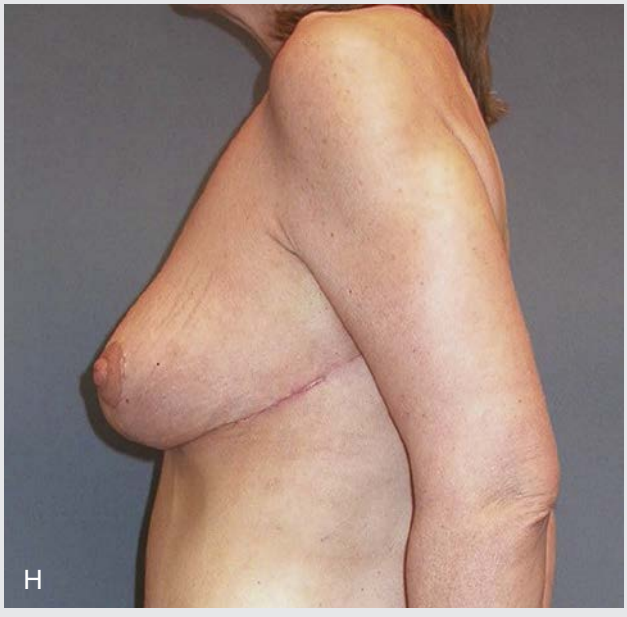
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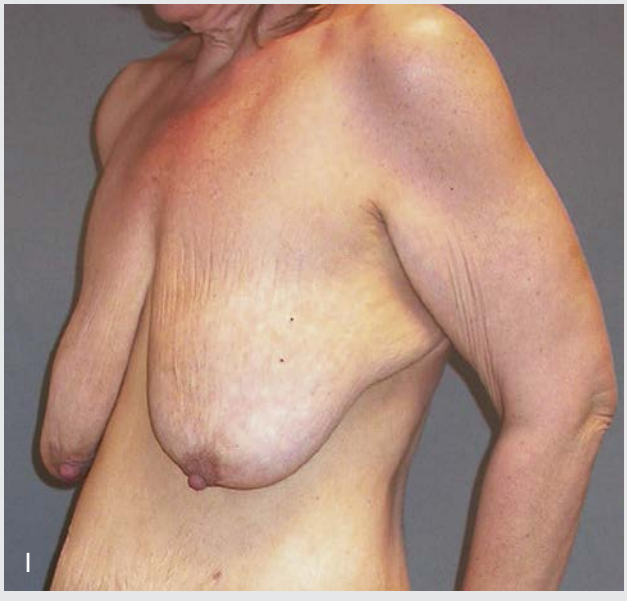
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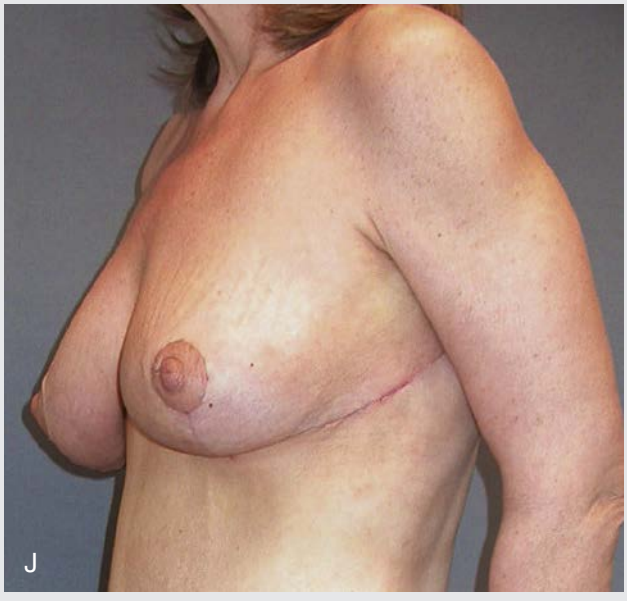
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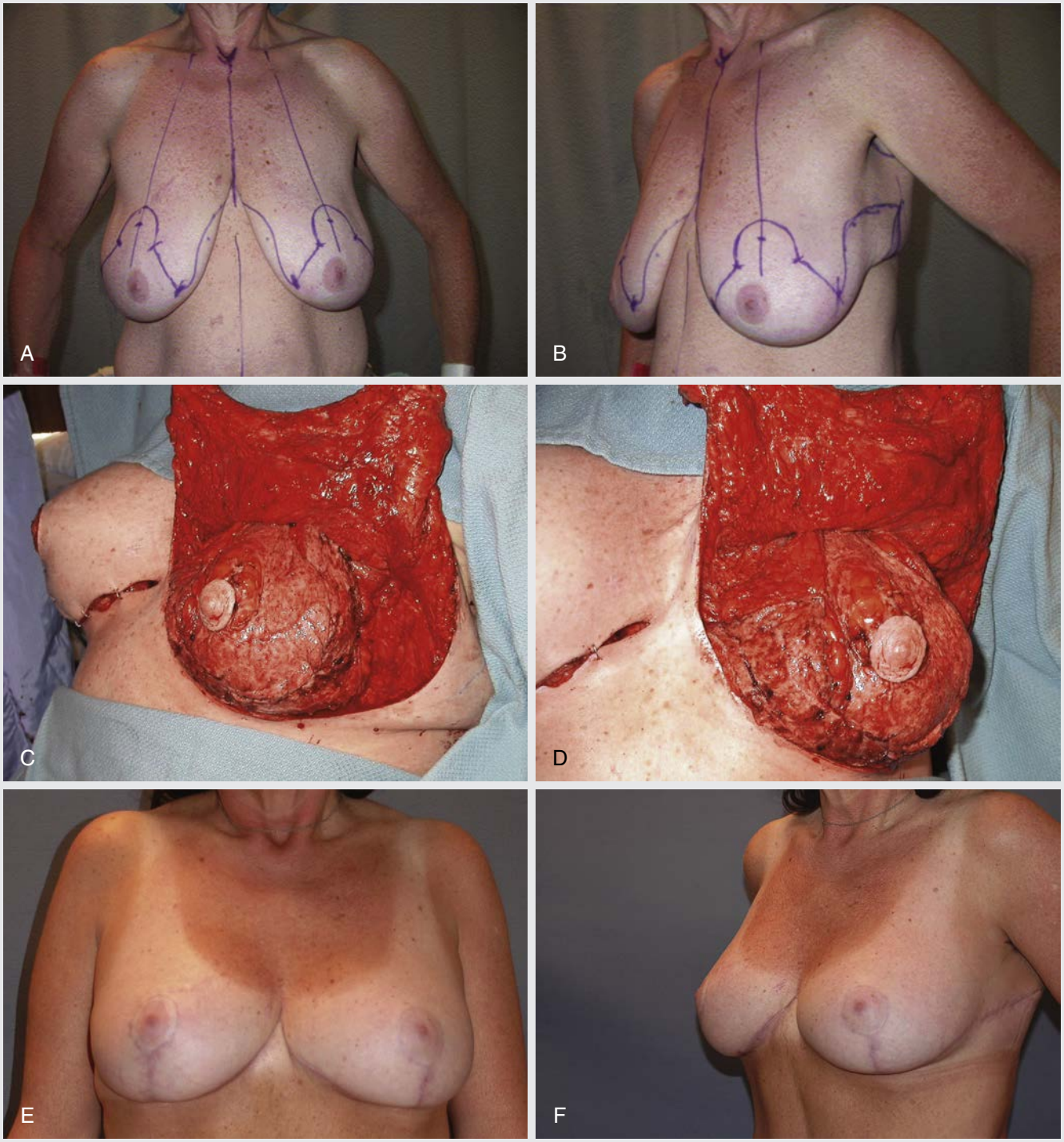
CASE 21.2



• **Case 21.2** A 57-year-old patient after 130-lb (60 kg) weight loss who underwent mastopexy with dermal suspension and parenchymal reshaping technique with selective auto-augmentation. (A, B) Preoperative photographs. (C, D) Intraoperative photographs demonstrate plicated parenchymal shape with this technique. (E, F) Six-month postoperative photographs. (Reproduced from Rubin, J.P., Matarasso, A., 2007. Aesthetic Surgery After Massive Weight Loss. Elsevier, Edinburgh.[4])

Postoperative Care and Expected Outcomes

The lightly compressive breast dressing is kept in place for the first 5 days and then is replaced by a sports bra with no wires for 4–6 weeks. The bolster stitch is removed at 1 week. Drains are kept in place for the first 48 hours and then discontinued if the daily output is less than 30 cc. The patient is instructed to avoid lifting anything heavier than 10 lb for 3 weeks, followed by a gradual increase in activity. Patients are usually safe to be discharged on the same day if mastopexy alone is performed. If combined with another body contouring procedure, the patient would benefit from overnight monitoring.

Patients undergoing breast reshaping can expect mild pain, edema, and ecchymosis. However, major complications are extremely rare. An analysis of our prospectively maintained registry[3] demonstrated that breast reshaping after weight loss is a very safe and reliable technique performed alone or in combination with another body contouring procedures. Of 108 consecutive patients with massive weight loss requiring breast reshaping, 91 patients (182 breasts) underwent a dermal suspension, parenchymal reshaping mastopexy with auto-augmentation, alone or in combination with other procedures. Breast complications were rare with mostly dehiscence (n = 3), seroma (n = 3), or skin flap necrosis (n = 2). Only 3 patients required a revision (3.3%), but none were related to the breast reshaping procedure.

Management of Complications

Any delayed wound healing can be treated with local wound care. Seromas were observed in the lateral aspect of the breast after drain removal, but all resolved with needle aspiration. No cases of nipple loss, breast flap loss, or fat necrosis were found. We think that nipple loss can be prevented by the generous blood supply from the central pedicle, along with the increased vascular network within the pedicle that is commonly observed in patients who have had weight loss. Although fat necrosis was not found to be an issue, surgeons should be wary of the risk for fat necrosis, especially at the distal tip of the transposed lateral chest wall flap used for autologous augmentation. Several measures can be adopted to minimize this risk. First, the lateral extent of the flap should not extend beyond the posterior axillary line. Second, the flap should be assessed for adequate perfusion and evidence of arterial bleeding. Third, active tobacco users should not undergo surgery.

Secondary Procedures

Patients who have undergone massive weight loss present a significant challenge for the plastic surgeon because regular mastopexy techniques often fail. The implementation of the dermal suspension and parenchymal reshaping technique with selective auto-augmentation has provided reliable and long-lasting aesthetic outcomes. Our study has shown that no reoperations were required, but potentially patients might require further secondary adjustments. Dog-ear irregularities can form if not completely chased laterally; secondary skin/fat excision can be easily performed in the office under local anesthesia. Given the extent of the incisions, unsightly scars may occur, which would require excision and closure. Augmentation or minor refinements in contour could be obtained using fat grafting, but surgeons should be aware of the reduced quantity of lipoaspirate in patients who have lost a massive amount of weight.

Pearls for Success

- Patient selection and planning are key for successful outcomes.
- Several factors should be taken into account when deciding the most appropriate procedure for breast reshaping: severity of the breast deformities, desired breast size, and surgeon experience and comfort level.
- Dermal suspension, parenchymal reshaping, and selective auto-augmentation technique has proved to be a safe and reliable breast reshaping technique in patients who have lost a massive amount of weight.
- Skin flaps should be approximately 1 cm thick (or greater) to minimize tissue loss at the inverted-T point.
- The entire lateral flap of the Wise pattern may be de-epithelialized and used to add as much volume to the breast as needed.
- Plication is a very impactful tool to improve the appearance of the breast shape and projection. Shaping of the breast is performed on both sides contemporarily to optimize symmetry and aesthetic outcomes.
- Nipple tethering can be improved by incising and partially releasing the surrounding dermis.
- Breast reshaping can be safely performed in combination with other body contouring procedures patients with massive weight loss, but the order should be considered carefully to avoid distortion of the intramammary fold and breast.

Conclusion

Obesity is an increasing problem in the United States, with a rising number of patients who have achieved massive weight loss and require body contouring procedures. Breasts are significantly affected by these weight changes, and breast reshaping has proved to be especially challenging because of the loss of parenchymal volume, skin redundancy, and elasticity; ptosis; and rolls of skin and fat on the lateral border of the breast. To overcome these challenges, the breast often requires significant skin resection coupled with dermal suspension, parenchymal reshaping, selective auto-augmentation, and suture plication. This technique has proved to be safe and reliable, allowing excellent aesthetic outcomes. A sound strategy combined with knowledge will allow surgeons to obtain optimal and reproducible outcomes for even the most challenging breast deformities.

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22

Breast Reshaping With an Inferior Parenchymal Flap

RENATO SALTZ AND FERNANDA D. SCALA

Introduction

Breast reduction and breast lift are widely performed procedures, with over 100,969 surgeries reported by American Society of Plastic Surgeons members in 2016.[1] Patients seek surgery not only for the improvement of symptoms associated with macromastia but also because of concerns over the role of the breasts in body harmony and overall aesthetics. After surgery, patients report an improvement in the quality of their life, as the symptoms are resolved. It is also expected to enhance the patient's self-esteem and well-being overall.

A variety of techniques have been described, with different types of pedicles supplying the nipple–areola complex (NAC), and different results concerning to shape, upper pole projection and resulting scars. The skin excision pattern may start in a simple periareolar design and progress to a circumvertical arrangement or be tailored as an inverted-T, using different templates. The main goal would be to restore a pleasant configuration to the breast mound, making it functionally adequate by reducing its weight and symptoms generated by the ptosis. Results also must be aesthetically compatible to the patient's body shape and desire, providing long-lasting breast lifts. Lack of longevity of the results and complexity of the techniques have been the main reasons that many autologous techniques for breast reshaping have not become very popular compared to a much easier excision of greater amounts of tissue and placement of breast implants, despite the many complications and revisions that may result from this techniques.

The senior author's preferred technique for breast reshaping combines a superiorly based NAC pedicle with an inferior parenchymal flap, rearranging the breast tissue and providing an aesthetically improved breast mound shape, with an inverted-T scar pattern. A modified Wise pattern, designed by Rezende[2] (Fig. 22.1), is used for the initial markings and the inferior parenchymal flap is marked as the dermo-lipoglandular flap described by Liacyr Ribeiro in 1971.[3] Ribeiro's flap was initially described as a "safety flap," maintaining the inferior breast tissue attached, instead of proceeding with the usual resection of this region in all superior pedicle techniques.[4] In the technique here described, the flap is used mainly as an "autoprosthesis", for the projection of the breast mound in a conical and aesthetic shape.[5]

Indications and Contraindications

Breast reshaping combined with a breast lift is indicated for treatment of symptoms related to macromastia, such as mitigating back, neck, and shoulder pain; intertriginous skin irritation; or infection resulting from contact and friction to the abdominal skin. By reducing the breast volume and reshaping it, a better proportion between the patient's breast and body size can be achieved, improving the patient's body image and also allowing physical activities that could have been limited by breast redundancy and weight.[6]

This technique can be performed primarily in any patient desiring breast reshaping. It is especially important for patients with ptosis as the sole chief complaint, instead of those who need to reduce a great amount of volume besides reshaping the breast mound. Remodeling the mammary tissue with an inferior flap will enhance the breast upper pole fullness and its projection overall in a long-lasting manner, in contrast to traditional mammaplasties that can result in early ptosis recurrence or the feared "bottoming-out" deformity. The redistribution of breast parenchyma in a conical and firmer shape resembles more of a natural implant.[3]

Tobacco/nicotine use is an absolute contraindication to any reduction mammaplasty or mastopexy. The risk of skin loss and fat necrosis is reduced if patients cease smoking for a minimum of 6 weeks.[6]

Preoperative Evaluation

The patient's personal data, such as age, height, weight, number of pregnancies, and the desire for new pregnancies must be observed and documented. The main patient complaints (as to size, shape, base width, and ptosis degree) and visual asymmetries are fundamental aspects to consider.

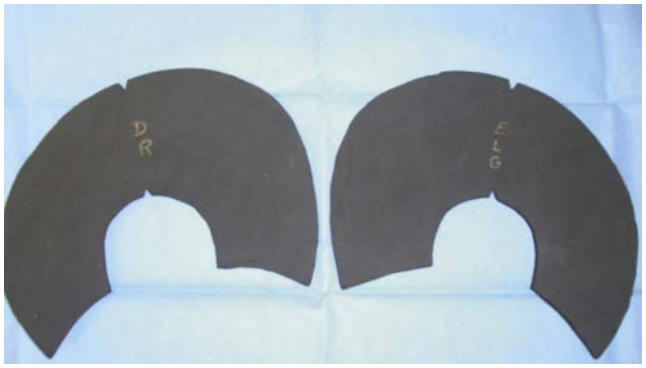
Unrealistic expectations must be promptly detected and evaluated before any procedure. If patients cannot have realistic expectations, do not operate.

Preanesthetic assessment involves regular blood tests (complete blood count) and preoperative mammogram for patients over 40 years of age. Systemic illnesses such as hypertension and diabetes are commonly associated with increased incidence of wound healing problems. Cardiopulmonary insufficiency and collagen diseases also may disrupt wound healing and the viability of flaps and must be identified before surgery. Note that any previous breast surgery or breast biopsies must be investigated because it can affect the vascularity to the NAC.

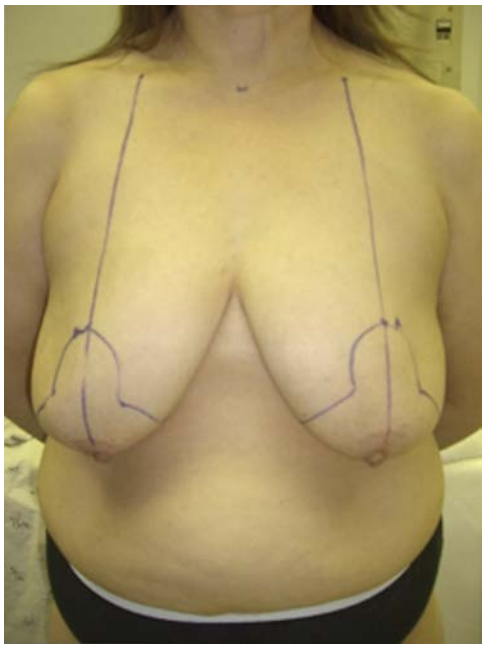
Surgical Technique

Preoperative markings are done using the Rezende template[2] (Fig. 22.2) with the patient standing in front of the surgeon, having the arms down and relaxed. The surgical steps that follow in this text are also described in Video 22.1.

Surgery starts with de-epithelialization of the areas previously marked: the NAC pedicle and the inferior parenchymal flap. Parenchymal detachment from the pectoralis major muscle follows, being performed before the superior NAC pedicle undermining and sparing the de-epithelialized inferior flap, as described by Ribeiro et al.[3] Care must be taken in the progression of parenchymal release from the pectoralis fascia, preserving the most superior segment, since it will be source of the NAC supply.



• **Fig. 22.1** Rezende template for preoperative markings.



• **Fig. 22.2** Preoperative markings, with a meridian line drawn from the midclavicular line to the nipple serving as a reference to position the Rezende template.

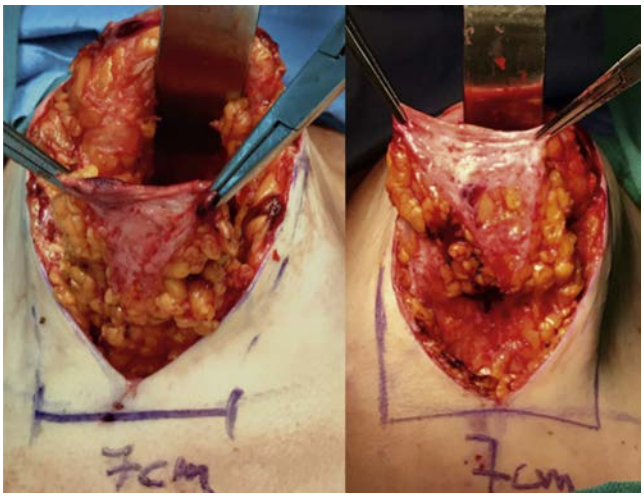
The dermo-lipoglandular inferior flap is designed with a 6- to 8-cm-wide base, and its width will depend on the width of the final breast mound, always taking into consideration the chest wall diameter. The flap's blood supply is delivered by the fourth, fifth, and sixth intercostal perforating vessels of the internal mammary arteries. Its axial vascularization allows easy mobilization to a superior area of the chest wall, and surgical fixation with sutures. To allow a safe and maximum elevation, the flap can be completely released from the inframammary fold (IMF) without compromising its vascularity and contributing to a tension-free movement. The dermal release is done internally with the cautery. The heat stimulation also helps tighten the skin at the level of the IMF (Figs. 22.3 and 22.4).

We have modified the original technique by placing permanent sutures around the entire inferior flap (medially, laterally, and superiorly) and not only at its superior aspect. For a reliable fixation, sutures must embrace the dermis of the flap, attaching it to the underlying muscular fascia. The dermal layer of the flap provides a strong structure for anchoring the repositioning sutures and allows long-term breast lift.[7]

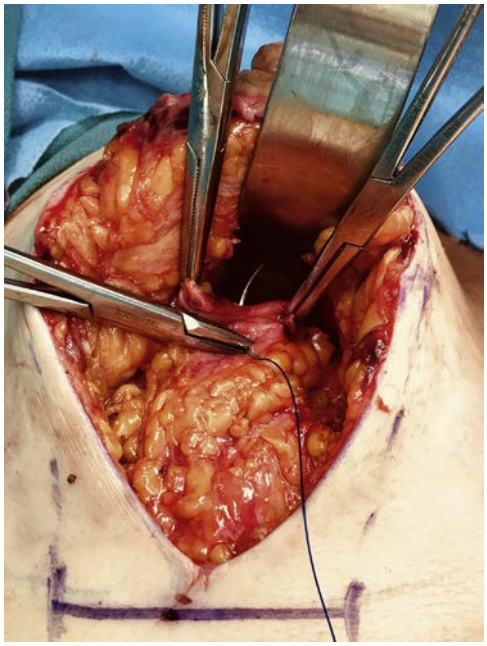
Sutures from the superior NAC pedicle are extended to the top of the inferiorly based flap, bringing the two together and avoiding early descent of the breast tissue, sliding over the inferiorly based flap. The combination of this simple maneuver with placement of drains around the top of the inferiorly based flap eliminates any dead space and creates early adhesion and healing, preventing any movement of the upper breast over the inferiorly based parenchymal flap. Perhaps this is the main reason we do not see major changes in the overall shape and upper pole projection in the long-term follow-up.

For allowing an adequate blood supply and free mobilization of the NAC pedicle, it must have a base of about 2 cm width. The supply for the NAC is usually superior or superomedial, based on the length of the pedicle, the amount of tissue to be resected, and the distance from the sternal notch to the nipple.

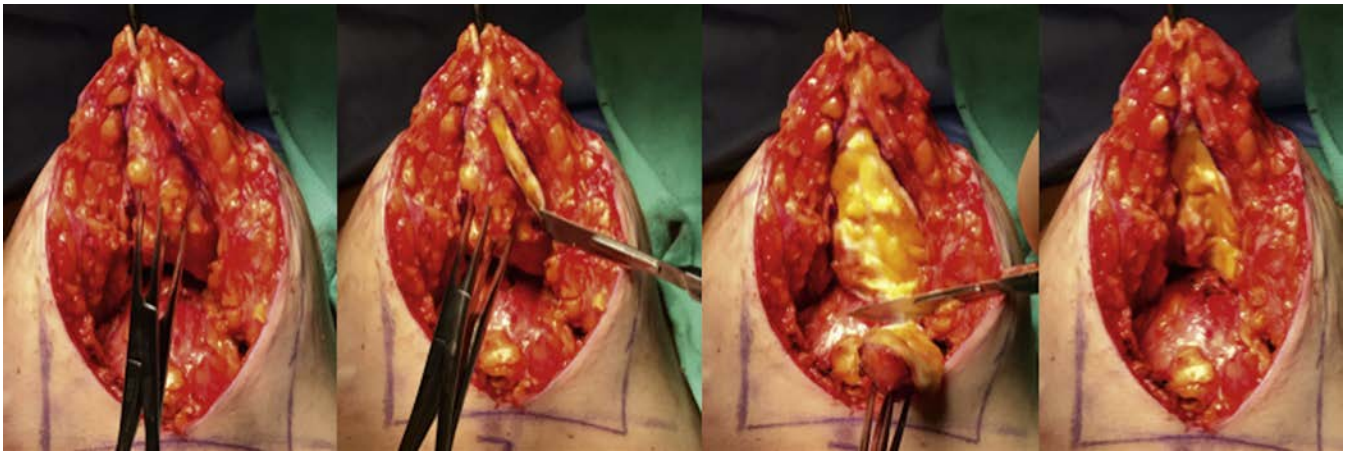
Once the NAC pedicle and the inferior flap are delineated, tissue excision can take place (Fig. 22.5). The location from which to remove breast tissue can be tailored for each patient, depending on what breast quadrant has greater volume and aiming the desired final shape for the mound.[7] The greatest amount of volume is generally excised at the lateral pillars created after isolating the central flap. Those pillars will be sutured together centrally, over the inferior pedicle. Care must be taken not to excise excessive amounts of the breast envelope skin and not resect too little of the parenchyma, leaving excessive tension on skin closure. The greater amount of projection will be provided by the inferiorly based flap. Bringing the medial and lateral pillars together is paramount to the technique success. The skin closure should be completely tension-free, which will avoid stretching of the scars.



• **Fig. 22.3** Inferiorly based dermo-lipoglandular flap isolated and released at the IMF with dermal incision.



• **Fig. 22.4** Mobilization and suturing of the flap to a superior position of the chest wall.



• **Fig. 22.5** Excision of the exceeding tissue to accommodate the flap and NAC pedicle.

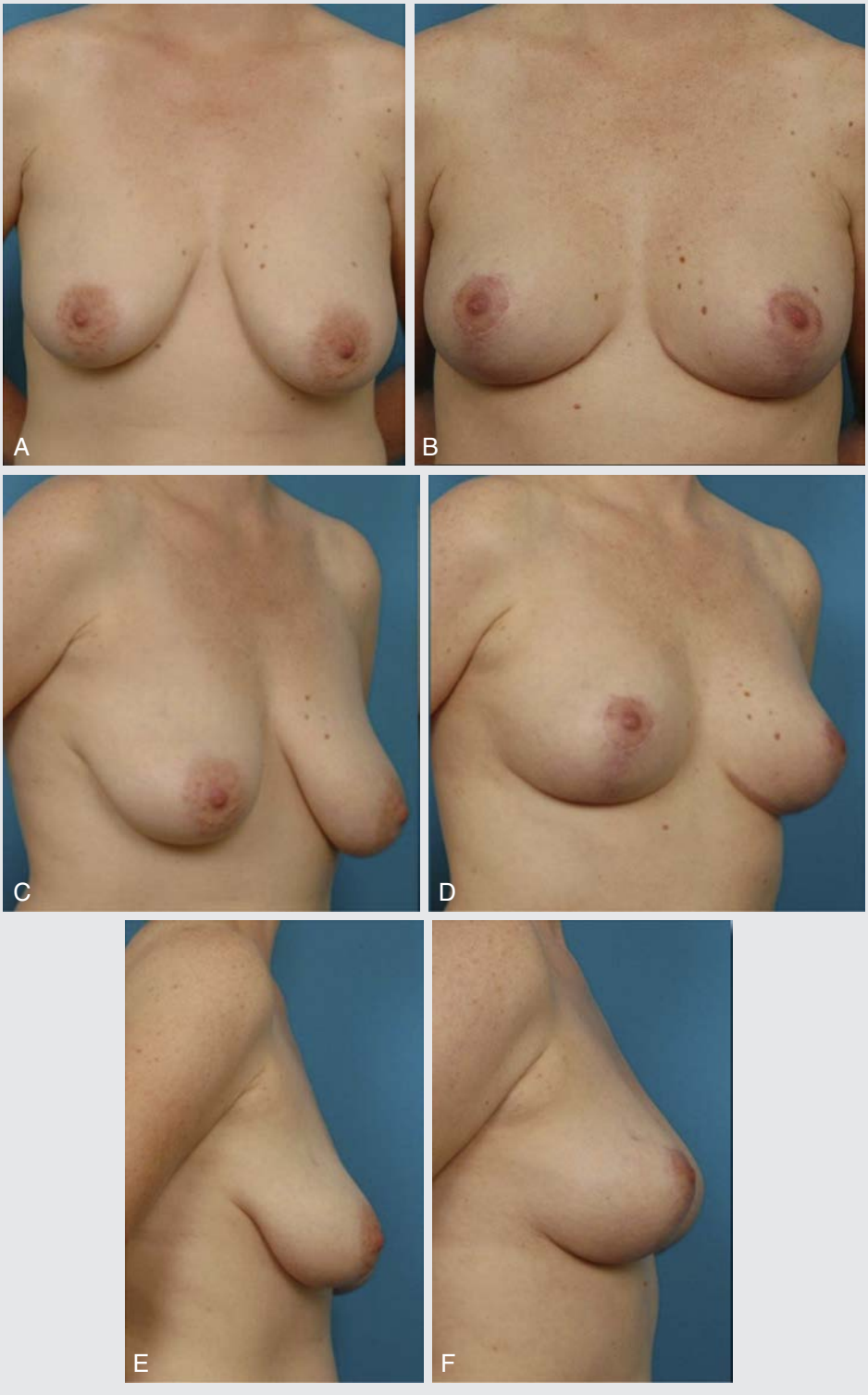
Traditional breast reduction and mastopexy techniques that rely only on skin closure, with no internal parenchymal support, will require early revisions for lack of proper shape, symmetry, and upper pole fullness and patient dissatisfaction. Anchoring the breast parenchyma with this suturing technique secures the long-lasting results observed.

Case Examples

Patients submitted to this technique have been followed up for over 10 years of practice with satisfying and long-lasting results.

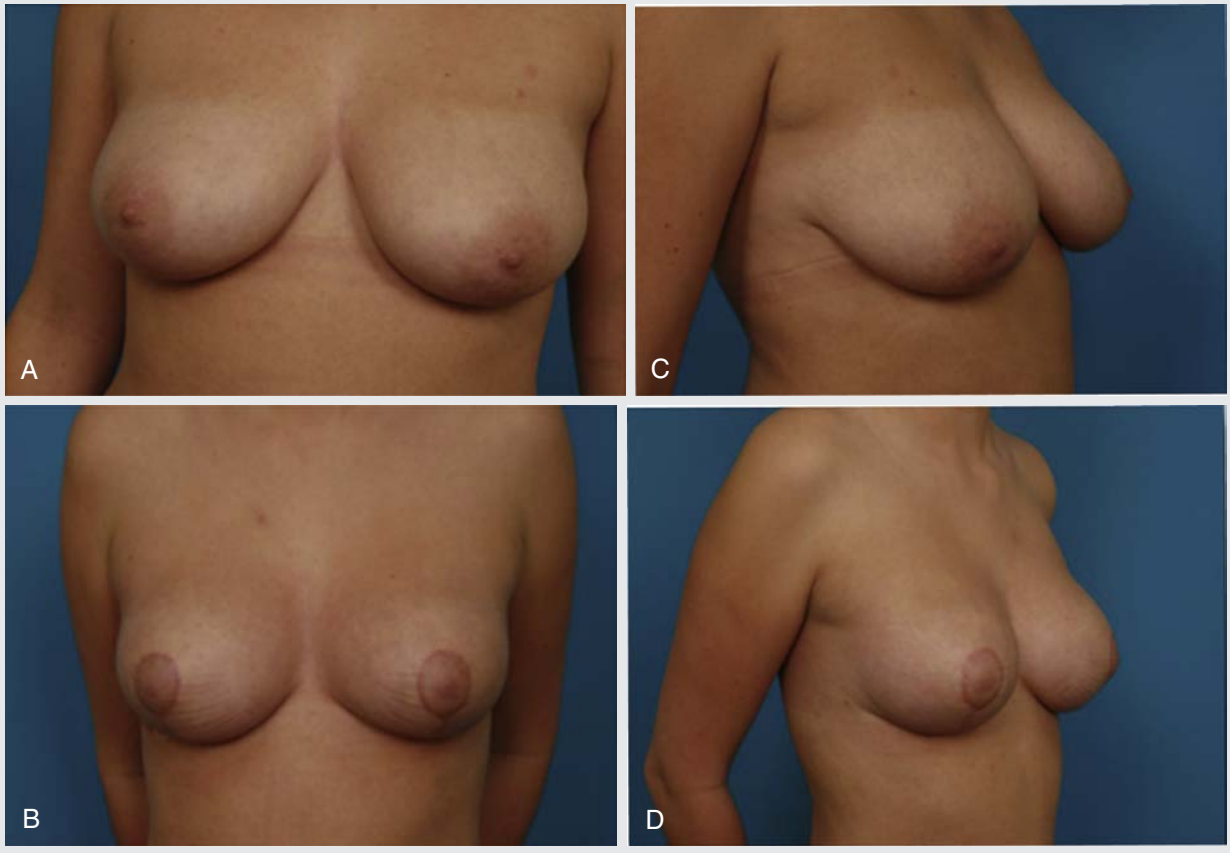
CASE 22.1

Preoperative and postoperative views of patient submitted to vertical mastopexy with autologous augmentation in a one-year followup.



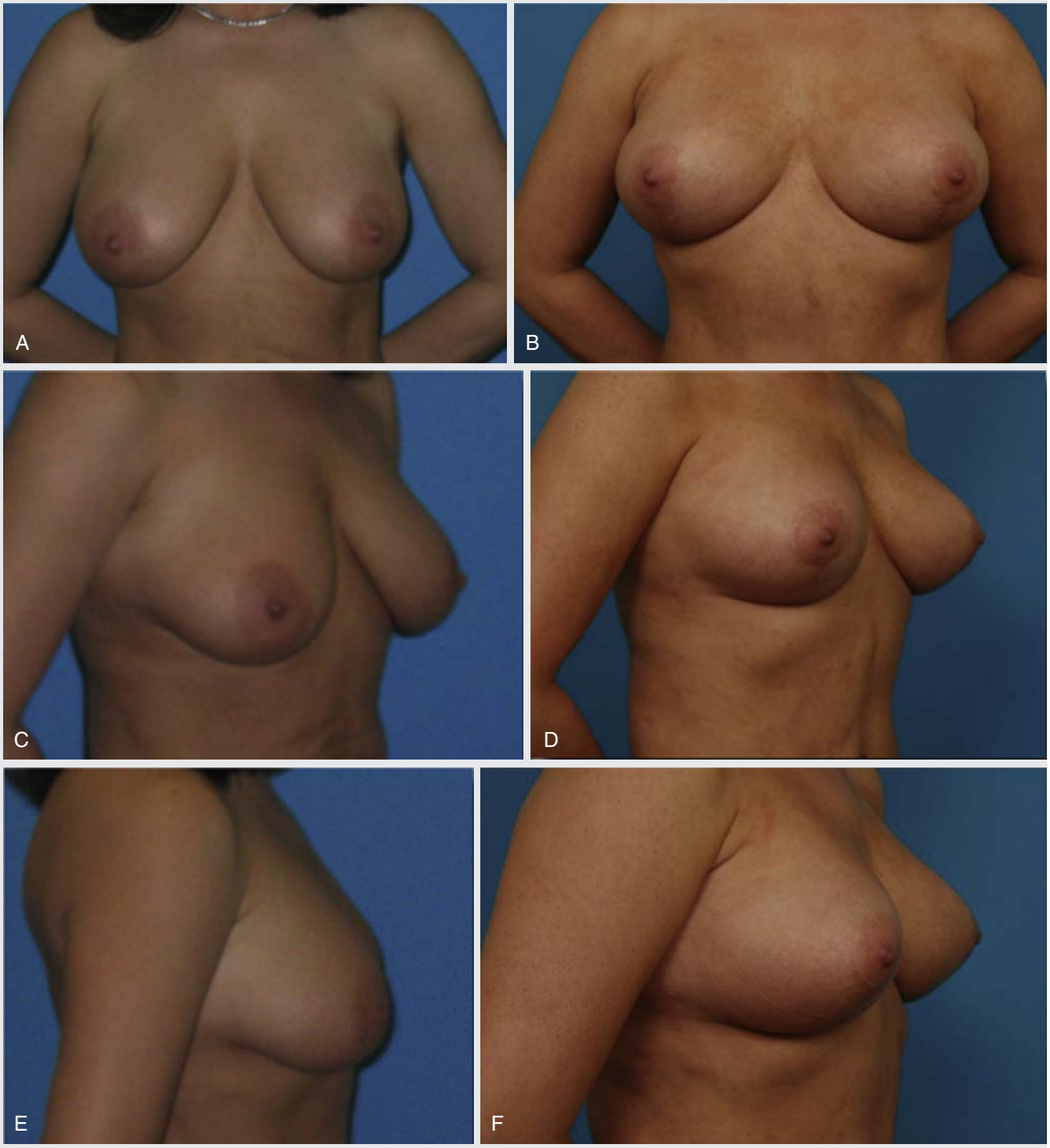
CASE 22.2

Preoperative and postoperative views of patient submitted to vertical mastopexy with autologous augmentation in a three-year followup.



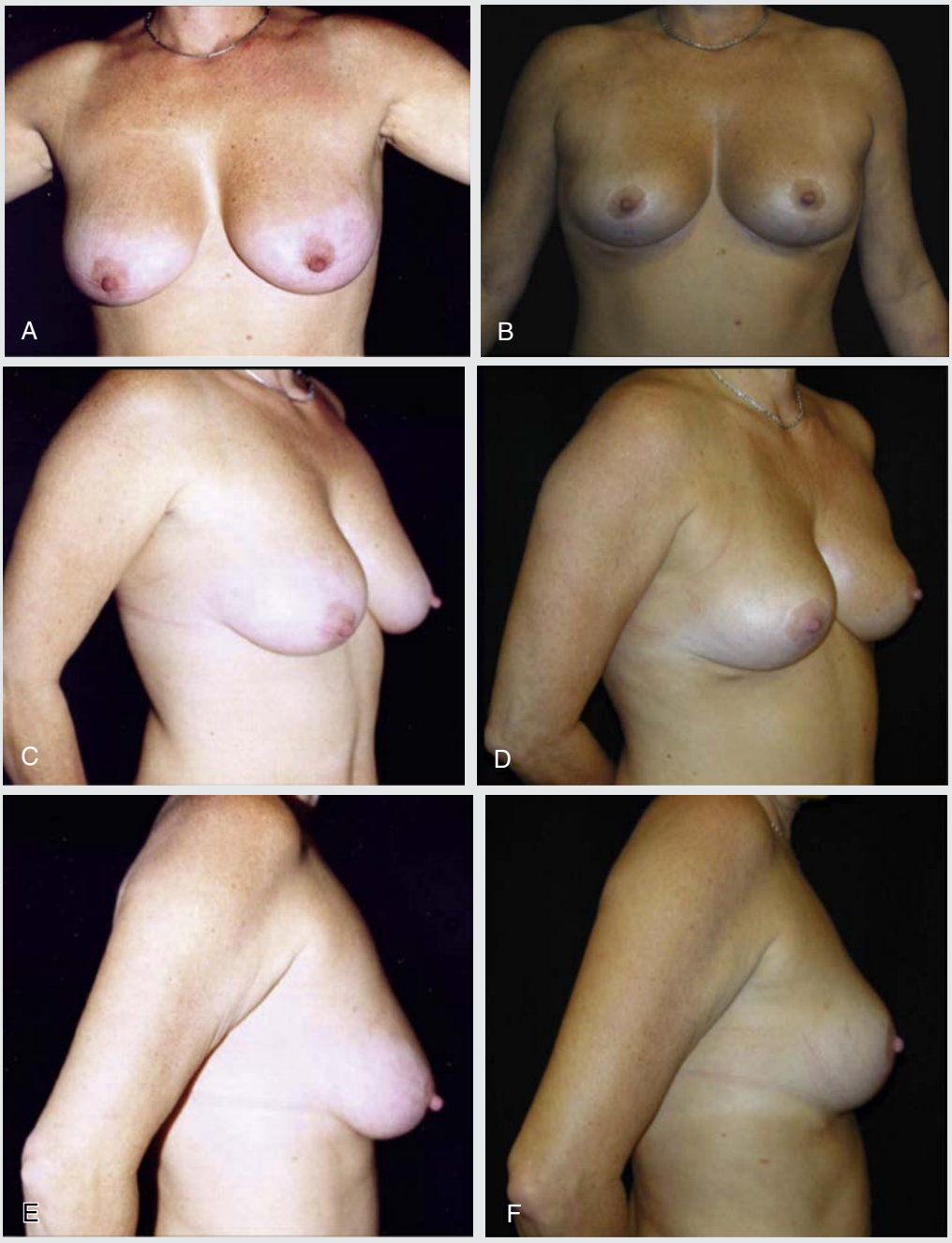
CASE 22.3

Preoperative and postoperative views of patient submitted to vertical mastopexy with autologous augmentation in a ten-year followup.



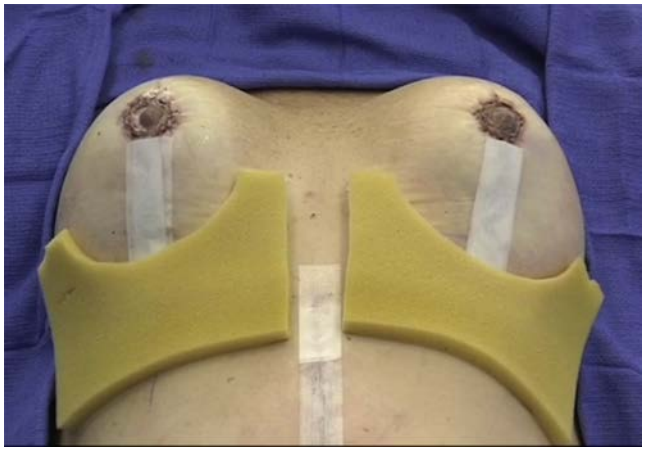
CASE 22.4

Preoperative and postoperative views of patient submitted to vertical mastopexy with autologous augmentation in an eight-year followup.



Postoperative Care and Expected Outcomes

We use absorbable sutures internally and topical skin adhesive (Dermabond, Ethicon, Johnson & Johnson, Somerville, NJ, United States) for the final layer of closure. Patients wear a soft surgical bra and refrain from upper body exercises for the first 6 weeks. In addition to the surgical bra, during the first 2 weeks, a foam molding is kept over the IMF, reinforcing the skin adhesion in this area (Fig. 22.6). Drains are removed within 5–7 days and lymphatic drainage massage is initiated as early as postoperative day 4. Patients can resume exercises and all activities within 6 weeks with the use of a support bra. Scar management starts at 3 weeks.



• **Fig. 22.6** Postoperative dressing with inframammary foam molding, positioned as a reinforcement for tissue healing and adherence in this area.

It is expected that the inferior flap projects the central aspect of the breast, creating a conical form while correcting the ptosis and also filling the upper pole. The nipple is repositioned at the level of maximum breast projection, with the underlying flap fixed in the pectoralis major muscle,[8] providing good long-term results and not being affected by bottoming out.[5] Bottoming out is the term commonly used for pseudoptosis: a lengthening of the distance between the nipple and IMF that develops as a result of gravity effects on the mammary tissue and is facilitated by a poor parenchymal fixation to the chest wall.

Management of Complications

The robust vascular supply for both the NAC and the inferior flap provide safety for this procedure, but complications such as ischemia or necrosis may occur. The surgeon must be careful when deciding the size of the central flap to avoid excessive pressure on the overlying NAC or over the vertical skin flaps when sutured. The most common complication is early compression of the NAC using superior pedicle techniques or when rotating the pedicle on a superomedially or superolaterally based pedicle. When diagnosed intraoperatively and the NAC is based on both pedicles (superomedial and superolateral), it should be converted to one pedicle.

The senior author's preference is the superomedial pedicle for its richer blood supply. If the problem persists, sutures should be removed and tissue excised from the surrounding areas to avoid pedicle compression impairing venous outflow. When venous congestion ensues, the entire vascularity of the pedicle can be in imminent compromise, ultimately causing necrosis. When venous congestion is observed in the recovery room (early postoperative period), the cause is often related to tight dressings and/or postoperative bra, which usually responds well by opening the bra and eliminating the tourniquet effect around the superiorly based pedicle.

The inferiorly based flap must be thoroughly observed during the procedure, and any sign of vascular insufficiency should indicate flap revision by removing the most distal portion of the flap (at the top) until bright red bleeding is observed. Hematoma, impaired blood supply, or constriction at the base of the flap must be ruled out before final skin closure.

Even with good perioperative observance and safe closure, late fat necrosis can be observed, especially at the terminal end of the pedicle that is most distal from the blood supply, forming a small consistent mass.[9] Absorption of the necrotic fat is possible as the edema resolves. If a mass persists up to a year postoperatively, biopsy and removal are recommended, avoiding any potential delay in diagnosis should an actual tumor develop.[9]

Postoperative dehiscence can develop where highest tension is put to the skin closure, for example in the vertical component of the scar or in the T junction. Treatment can be conservative, with secondary healing after only local wound care. Debriment and closure should only be attempted if significant dehiscence.[9] Other complications such as infection, hematoma, and seroma can occur, as with any other breast reduction technique and are treated in the traditional manner.

Ribeiro[4] in 2012 stated that there was no absorption or atrophy of the mammary tissue after his long series of cases. We have observed similar results with our approach.

Secondary Procedures

Patients undergoing very large reductions can experience tissue redundancies, or dog ears, which can be treated with minor secondary procedures under local anesthesia in the office. Patients who have already undergone breast reduction and mastopexy procedures might seek repeated breast reductions and lifts because of recurrent glandular hypertrophy, ptosis, or personal discontentment. It is crucial for the surgeon to review previous operative records and keep in mind the dominant blood supply that was built for the NAC in the preceding procedures.[6]

Conclusion

Reduction mammaplasty and breast lift are important procedures for women who suffer the consequences of macromastia and breast ptosis. Many of those patients come to the surgeon's office desiring a firmer breast mound, as seen in women with breast implants. Using the existing parenchyma for fullness of the upper pole of the breast and the projection of the central mound, as in autologous augmentation mastopexy, is a well-known technique that can bring benefits to the patient and the surgeon, with decreased costs and avoidance of complications often associated with the use of breast implants.[10] Proper fixation of the flap to the chest wall prevents its descent and the bottoming-out deformity, providing long-term patient satisfaction.

PEARLS FOR SUCCESS

- Determine who is a candidate for autologous augmentation during a breast reduction or mastopexy. Patients with a large amount of parenchymal tissue may not need breast implants and can benefit from autologous augmentation.
- Marking by using Rezende templates saves time and improves the final NAC symmetry.
- The inferior parenchymal pedicle is versatile, and each breast can be shaped individually for the patient to achieve maximal symmetry.
- Fixation of the entire inferior dermoglandular flap to the pectoralis major fascia is key for the excellent long-term results.
- Full release of the inferiorly based flap from the IMF allows easier mobilization and more cephalic repositioning of the flap without any compromise to its blood supply.
- The superior pedicle technique provides excellent blood supply for the NAC, allows free repositioning of the inferior pedicle, and contributes to the projection of the breast upper pole, resulting in a firm aspect of the region, similar to a breast implant.

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23

Correction of Gynecomastia

NIRAV B. PATEL AND LEE L.Q. PU

Introduction

Gynecomastia is defined as benign glandular enlargement of the male breast, its hallmark location being a concentric mass directly beneath the nipple.[1,2] It can consist of various proportions of excess subareolar fibrous breast and adipose tissue peripherally, and its extent depends on the individual's body habitus. By contrast, pseudogynecomastia is enlargement of adipose tissue of the male breast.[3] Gynecomastia is by far the most common breast problem in men, with an overall incidence of 32%–36% with up to 75% of cases being bilateral.[4]

Physiologic temporary overgrowth of the adolescent breast also can be responsible for gynecomastia. With onset at approximately age 14 in more than 65% of healthy boys, gynecomastia typically resolves within 2 years. Persistent adolescent-onset gynecomastia beyond age 21 is unlikely to resolve with conservative management.

Gynecomastia also can manifest in men of advanced years. In middle-aged and older men, it is most commonly due to the excessive aromatization of androgens to estrogens, resulting in a decreased overall level of circulating testosterone. It may manifest in 40%–50% of men over 40 years of age.

Although most patients with gynecomastia present with cosmetic concerns, symptomatic gynecomastia can be characterized by breast pain and tenderness. In this chapter, the authors describe their preferred techniques for surgical treatment of gynecomastia to ensure an optimal outcome but with minimal scarring. In addition, patient selection and preoperative evaluation are also described.

Indications and Contraindications

Most patients present with cosmetic concerns about their breast appearance or chest contour. Some patients may complain about breast pain and tenderness. Therefore, surgery is usually indicated to correct gynecomastia related to a breast or chest contour problem.

Contraindications for surgical correction of gynecomastia include any medical conditions that cause such a condition. Therefore, a complete endocrine workup and certain imaging studies are required for all patients to identify endocrine disorders or tumors related to the testicles, adrenal gland, or pituitary gland. In addition, thyroid, renal, or liver function and medications taken by patients should be evaluated.

Preoperative Evaluations and Special Considerations

Initial evaluation requires a detailed history and physical examination to differentiate among fatty tissue, parenchymal enlargement, and a tumor. Age of onset, duration, symptoms, medications, recreational drug use, and medical history are key components to the initial evaluation. The breast examination assesses for fatty versus glandular predominance, excess breast skin, breast ptosis, and palpable masses. In addition, male breast cancer also should be ruled out.

Classification schemes exist to better define the extent of gynecomastia and dictate surgical treatment. The **Simon classification** has traditionally been employed (types I–III), as follows[4]:

I. Small but visible breast development, without skin redundancy
   a. Moderate breast development without skin redundancy
   b. Moderate breast development, with skin redundancy
II. Severe breast development with large skin redundancy

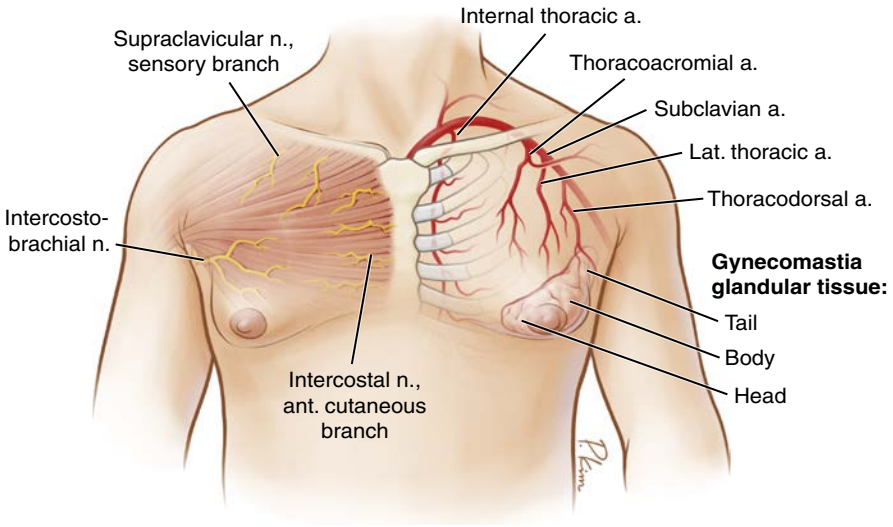
Pearls for Success

The senior author acknowledges this classification with the following modification, which more directly correlates subtype with surgical strategy:

- Core breast tissue only: Direct excision
- Primarily fatty chest tissue: Ultrasound-assisted liposuction (UAL)
- Both core breast tissue and fatty chest tissue: First stage—UAL; second stage—direct excision in 6 months
- Fatty chest tissue and excess breast skin: First stage—UAL; second stage—periareolar mastopexy in 6 months

Nipple position, size, and sensation also must be assessed.

The normal average areolar diameter in the male nipple–areola complex is 25–30 mm, and these dimensions may be affected in cases of gynecomastia. The areola circle must also be addressed and may require a reduction in size or correction



• **Fig. 23.1** Illustration showing blood supply and nerve innervation of the chest and nipple and the composition of gynecomastia glandular tissue, including head, body, and tail. *Ant.,* Anterior; *a.,* artery; *Lat.,* lateral; *n.,* nerve.

in the case of nipple herniation. Finally, mammography or even biopsy may be indicated in certain patients.[3]

Complications are generally rare and well tolerated, but risks of overresection or underresection should be disclosed to patients preoperatively to manage expectations, facilitate informed consent, and provide anticipatory guidance for secondary revisions.

Surgical Techniques

Relevant Surgical Anatomy

The blood supply of the male breast is the same as that in the female breast. The nipple is primarily innervated by the medial and lateral branches of the fourth intercostal nerve. However, the third and fifth intercostal nerves also may contribute. Gynecomastia in males is composed of the core, body, and even tail of glandular breast tissue (Fig. 23.1). Each part of breast tissue can be quite different in terms of its characteristics. For example, the core breast tissue is usually directly under the nipple–areola complex and can be hard and difficult to remove even by UAL. In addition, patients may have excess breast skin and even natural breast ptosis similar to those in the female breast.

The goal of surgical correction for gynecomastia is to restore normal male chest contour but not eliminate all breast tissues. A wide variety of surgical treatment options for removing redundant male breast tissue have been described in the literature, including direct excision, traditional or ultrasound-assisted liposuction, combination of liposuction and direct excision, and use of an arthroscopic shaver.[5–8]

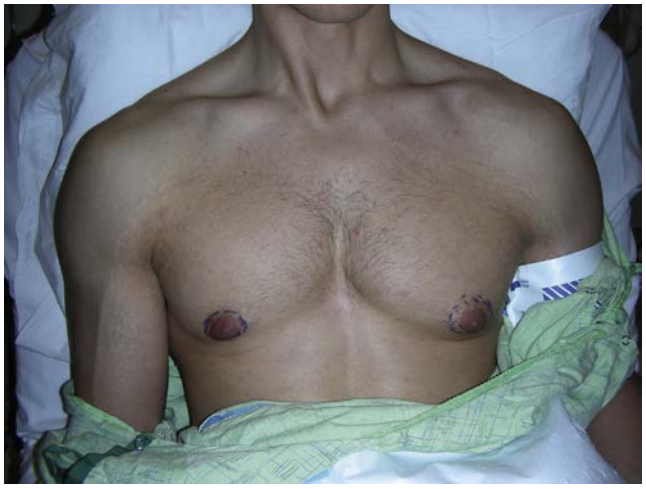
Direct Excision

For patients with enlarged core breast tissue only, a direct excision of subareolar core breast tissue through a limited areolar incision combined with a pull-through technique can be a reasonable approach. Periareolar incision can offer a direct access for tissue resection (Fig. 23.2). After the exposure of subareolar core breast tissue, it can be removed via a pull-through technique (Fig. 23.3). Attention should be given to preserve adequate core breast tissue (approximately 0.5 cm in thickness) under the nipple so blood supply to the nipple is not compromised and noticeable nipple depression can be prevented.

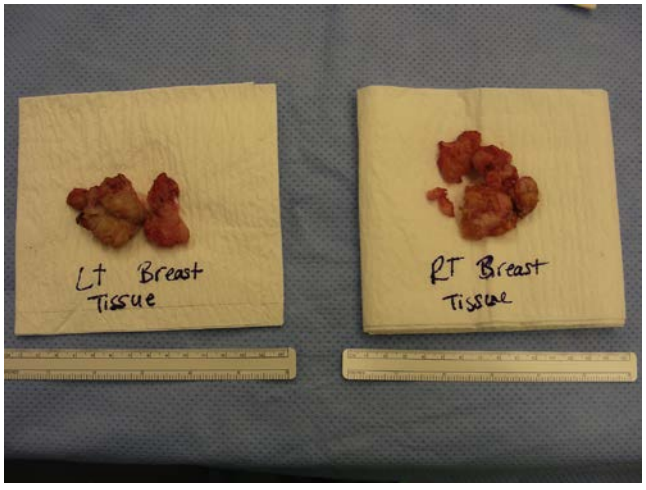
Ultrasonic-Assisted Liposuction

Most gynecomastia tissue is glandular; therefore, traditional liposuction is less effective used as a primary option for treating gynecomastia. Therefore, UAL is a valuable tool in the plastic surgeon's armamentarium in treating gynecomastia. The basic tenets of UAL include infiltration of a super-wet solution, a stab incision at the inferolateral aspect of the chest, employing a radial pattern of suctioning across the entire chest (Fig. 23.4), and disrupting fibroglandular tissue through cavitation of cells in tumesced fields. In addition, UAL may have an advantage in promoting skin retraction, so for cases with mild to moderate ptosis an external scar can be eliminated or minimized for correction of gynecomastia.[4]

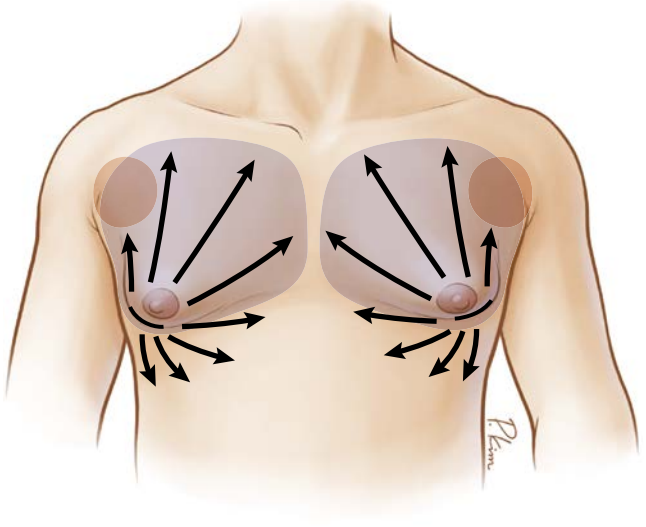
Once the patient is marked in an upper right position and excess breast tissue is outlined (Fig. 23.5), a super-wet solution is infiltrated into the breast; the amount of infiltration is recommended by the manufacturer according to the proposed ultrasonic time (1.5 minutes per 100 cc solution) if UAL is performed (Fig. 23.6). If the new-generation Vaser system (Sound Surgical Technologies, Louisville, CO, United States) is used, a five-ring probe with 90% continuous mode should be used (Fig. 23.7). The probe should be moved slowly and consistently without pause, and adequate ultrasonic time is needed to maximize the destruction of fibroglandular breast tissue (Fig. 23.8). After adequate ultrasonic cavitation on the tissue, conventional liposuction is performed vigorously to move all lipoaspirates (Fig. 23.9). Once liposuction is completed, all remaining fluid should



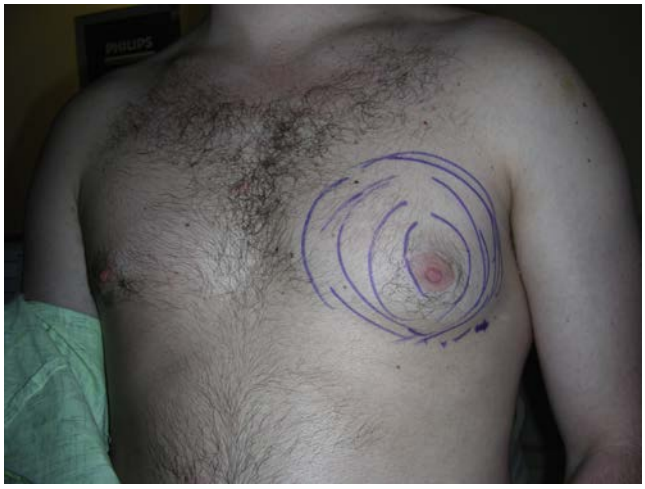
• **Fig. 23.2** Outline of the core breast tissue and the inferior periareolar incision used for direct excision.



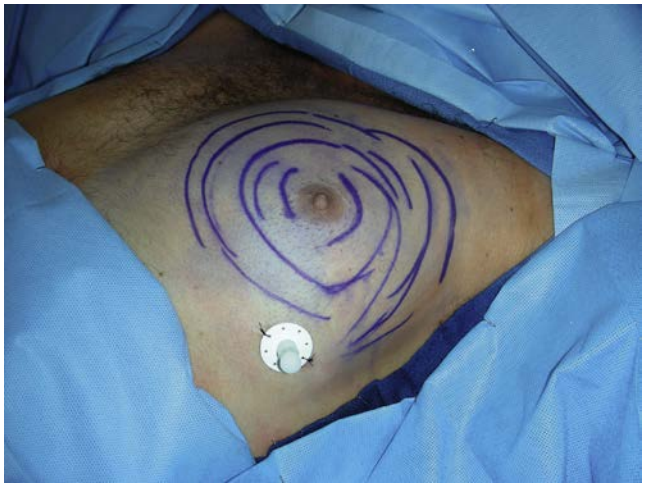
• **Fig. 23.3** Cross view of the excised core tissue from each breast.



• **Fig. 23.4** Illustration showing the planned incision and fan-shape suction by ultrasound-assisted liposuction.

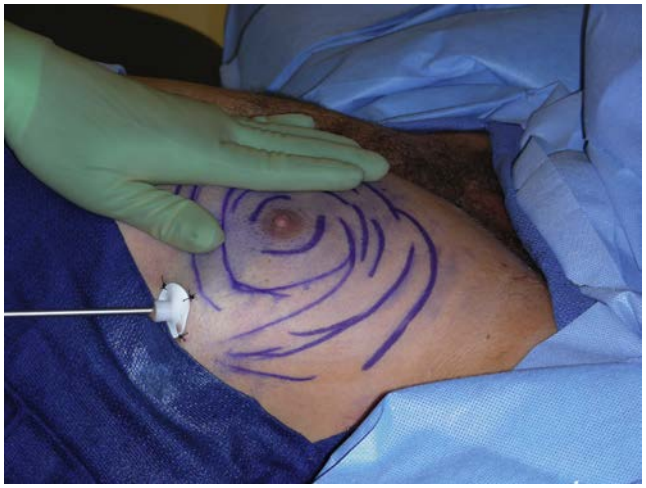


• **Fig. 23.5** Example of preoperative marking for a patient with gynecomastia. The extent of ultrasound-assisted liposuction and the incision are shown.

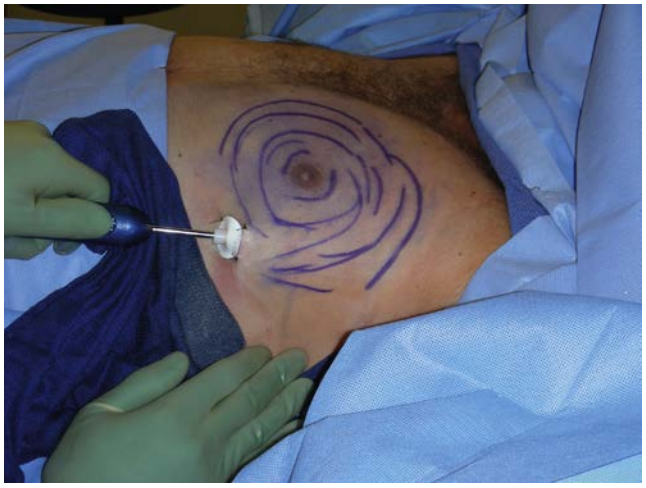


• **Fig. 23.6** Intraoperative view showing the appearance after super-wet solution infiltration to the left gynecomastia breast. A protected port is placed according to manufacturer recommendation.

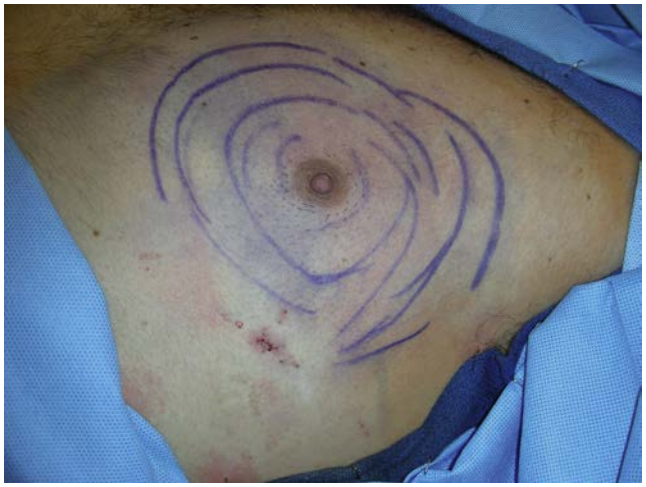
• **Fig. 23.7** New-generation ultrasound-assisted liposuction device (Vaser) that is commonly used for correction of gynecomastia.



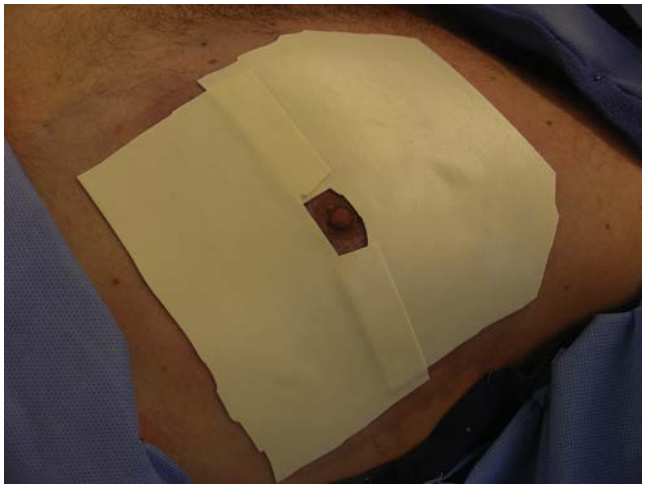
• **Fig. 23.8** Intraoperative view showing the way to perform ultrasonic liposuction according to manufacturer recommendation.



• **Fig. 23.9** Intraoperative view showing the way to perform conventional liposuction after ultrasonic cavitation according to manufacturer recommendation.



• **Fig. 23.10** Intraoperative view showing the immediate result after completion of ultrasound-assisted liposuction.



• **Fig. 23.11** Intraoperative view showing proper taping of the breast immediately after ultrasound-assisted liposuction.

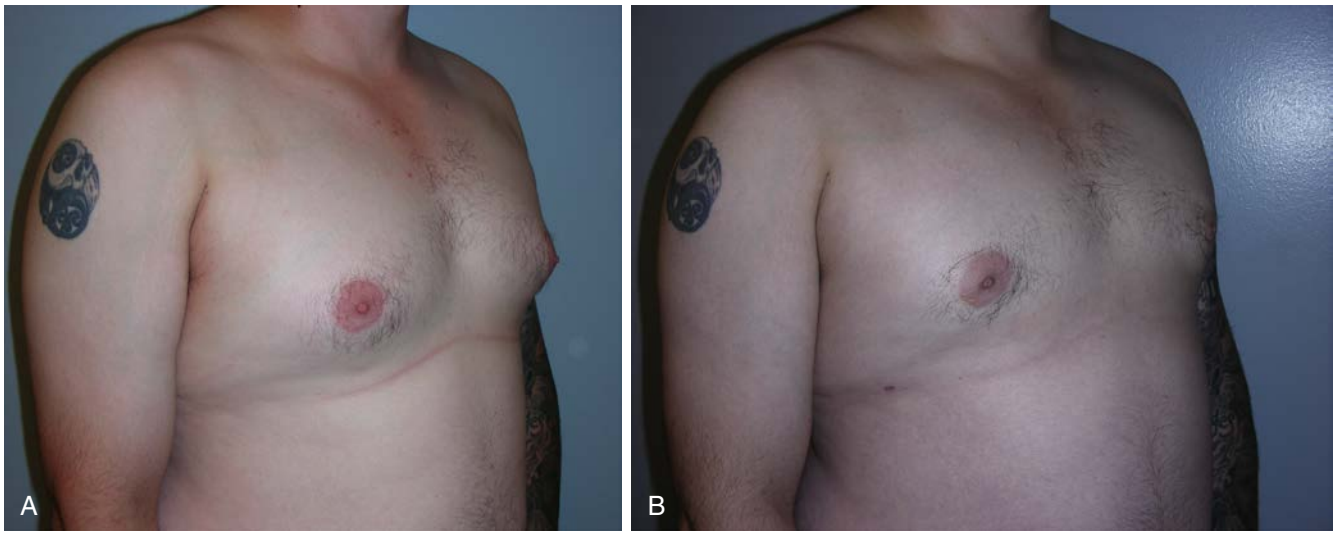
be milked out and the incision is closed (Fig. 23.10). The chest is then covered with heavy tape for compression and contouring (Fig. 23.11). A pressure garment should be used routinely for all patients after UAL.

Combined Ultrasound-Assisted Liposuction and Direct Excision

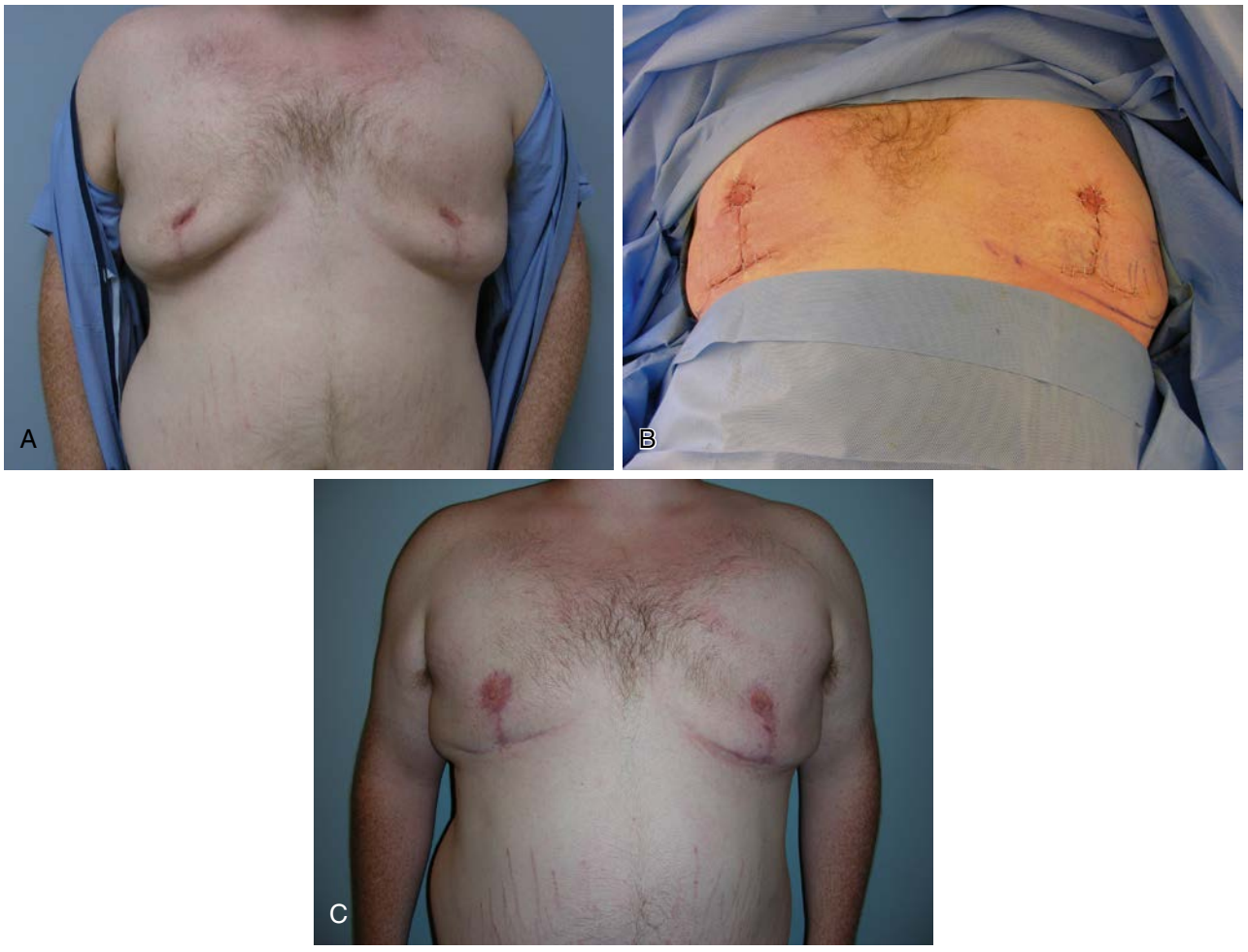
UAL and direct excision can be either a standalone procedure or combined in a single- or two-stage approach. The choice of techniques depends on skin and tissue quality of the breast and the likelihood of skin redundancy postoperatively. Both procedures have been described previously. The senior author prefers a two-stage procedure with UAL as a first procedure. This would allow skin retraction for 6–9 months before determining whether it is even necessary to undergo additional direct incision after UAL if the patient is satisfied with the outcome (Fig. 23.12A, B). In addition, more aggressive ultrasonic and conventional liposuction can be performed during that procedure with less concern about trauma to the nipple.

Combined Ultrasound-Assisted Liposuction, Direct Excision, and Mastopexy

If the patient has a large gynecomastia breast with excess skin, UAL can still serve as an initial procedure. Aggressive ultrasonic liposuction can be performed first, and maximal skin retraction can be observed. During the second-stage procedure, direct excision to remove core breast tissue and the amount of skin resection can be minimized with less resultant scar. Thus, periareolar mastopexy can be performed to adequately remove the excess breast skin so the chest contour can be improved after that procedure. Occasionally, an inverted-T mastopexy may be needed to adequately remove the excess breast skin and correct breast ptosis. Both periareolar and inverted-T mastopexies are performed in the same way as in women (Fig. 23.13A–C).



• **Fig. 23.12** A typical patient before (A) and 5 months after (B) ultrasound-assisted liposuction procedure for correction of his gynecomastia.



• **Fig. 23.13** Before (A) intraoperative planning for skin resection and nipple reposition (B) and 9 months after conventional liposuction and an inverted-T mastopexy for a patient who had significant recurrent gynecomastia (C).

Postoperative Care and Expected Outcomes

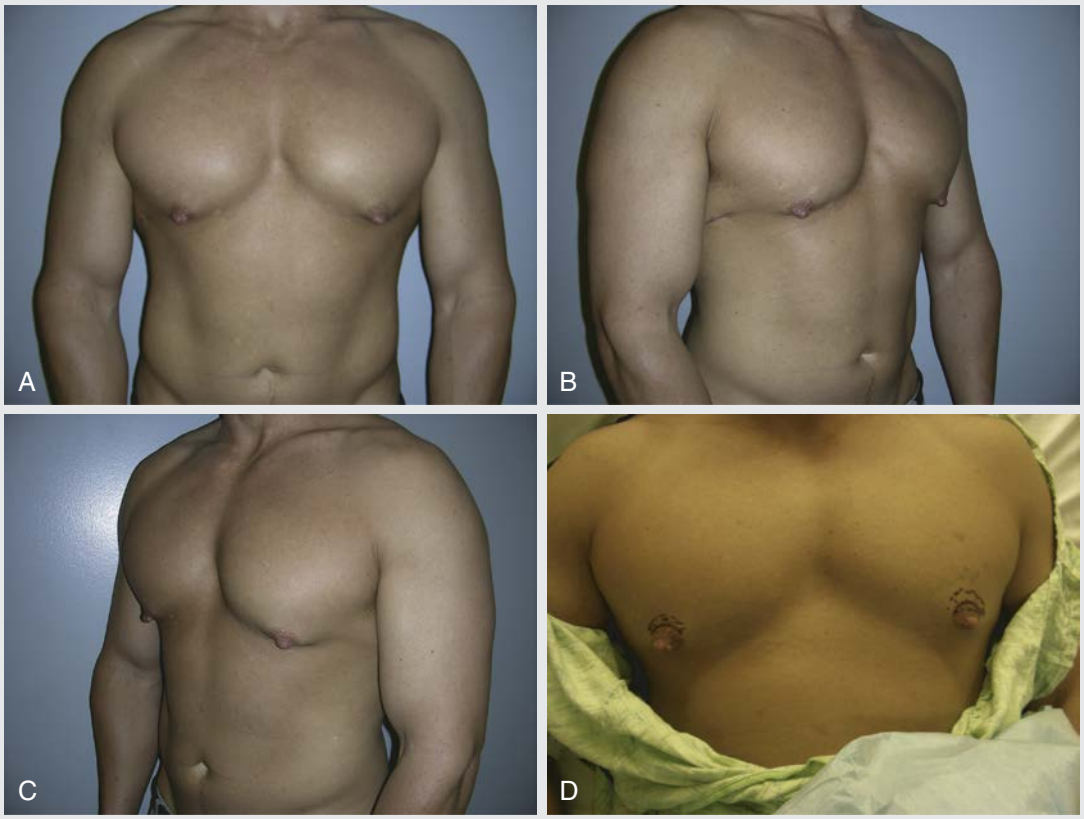
The postoperative care and expected outcomes in gynecomastia procedures are the same as in female breast reduction surgery and trunk liposuction cases. Patients are counseled on postoperative swelling and edema that may persist through the first few months of recovery. To facilitate resolution, minimize fluid reaccumulation, and maintain better chest contour, many surgeons use a layered self-adhering conforming dressing. A pressure garment such as a compression vest is worn continuously for 4–6 weeks, followed by an additional 4 weeks of nighttime use.

Outcomes are generally good, with patients satisfied with their improved chest contour. Possible problems after direct excision include overresection, underresection, or poor scarring. Possible problems after UAL include undercorrection, contour irregularity, or decreased nipple sensation.[4–6]

Case Examples

CASE 23.1

A 35-year-old man with bilateral gynecomastia desired surgical correction. He was found to have only enlarged but tender core breast tissue under the nipple–areola complex on both sides (Case 23.1A–C). His nipple was also pointing down on both sides. A superior periareolar incision was planned for him so that his nipple position might be corrected after direct excision of the core breast tissue (Case 23.1D). His postoperative course was uneventful, and early results are shown at 6 weeks postoperatively (Case 23.1E–G).



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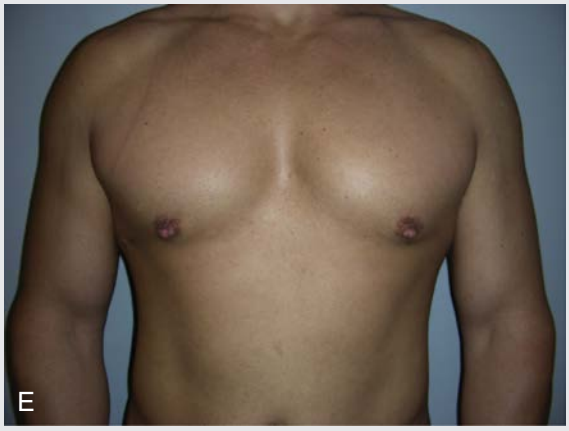
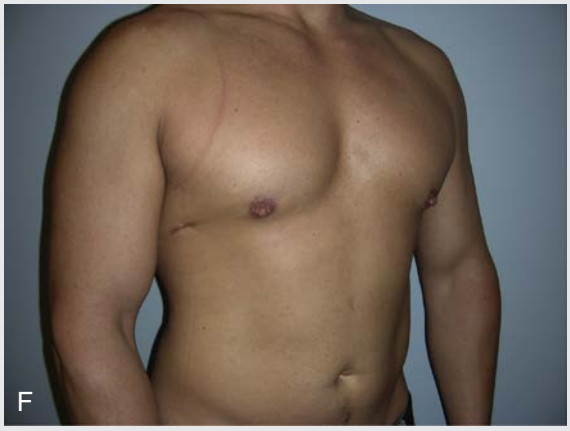
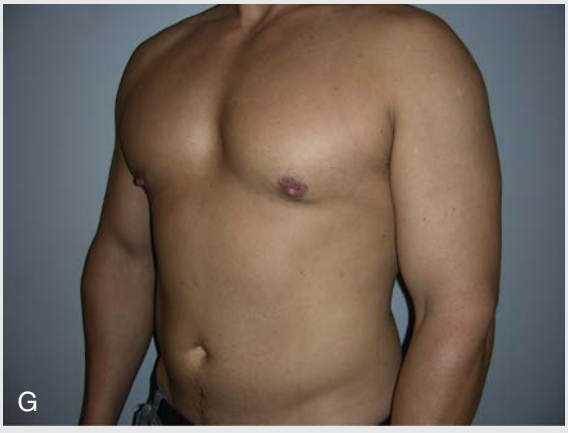
CASE 23.1—cont'd

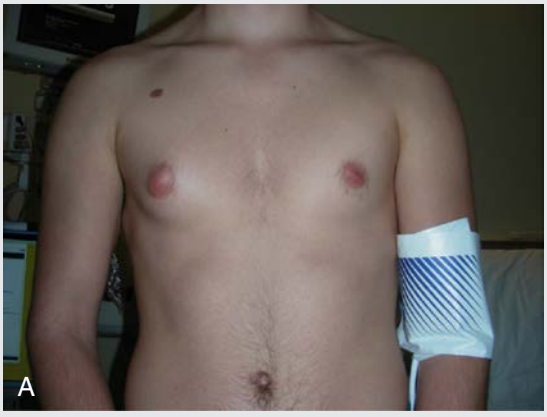


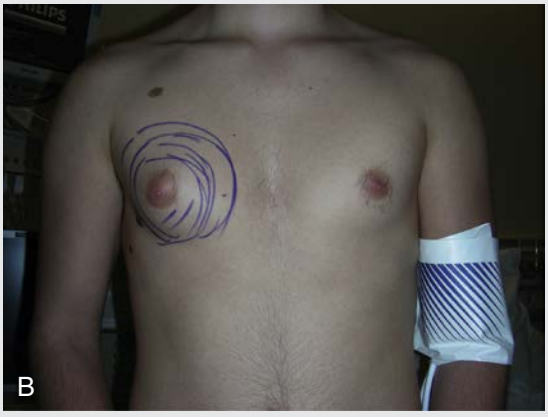


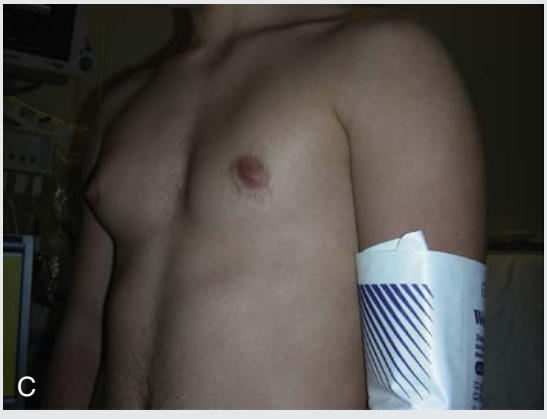


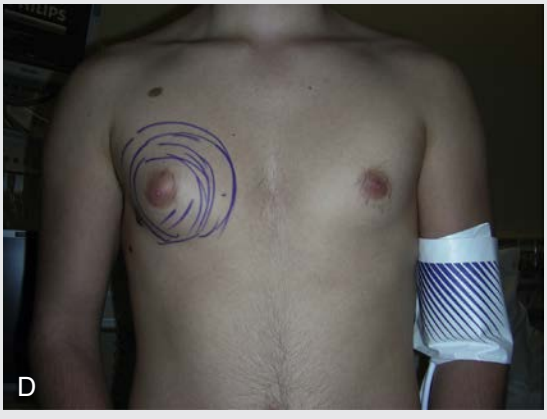
CASE 23.2

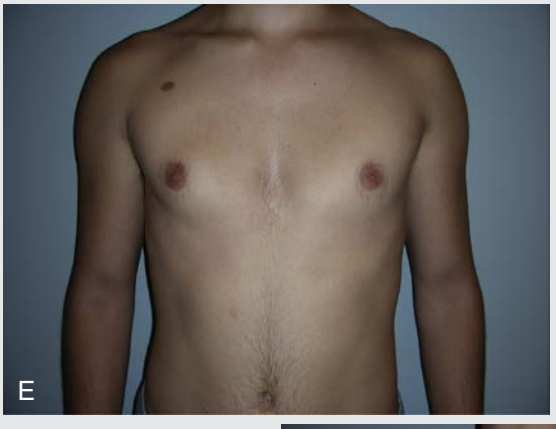
A 20-year-old man with right gynecomastia desired surgical correction. He was found to have a diffusely enlarged right breast, slightly enlarged nipple–areola complex, but no excess breast skin (Case 23.2A–C). Ultrasound-assisted liposuction was performed in the hope that this procedure would be sufficient to improve his right breast contour (Case 23.2D). The Vaser system was used for the procedure, and a total of 150 cc of lipoaspirate was removed from his right breast. His postoperative course was uneventful. Results are shown at 3 months postoperatively (Case 23.2E–G).

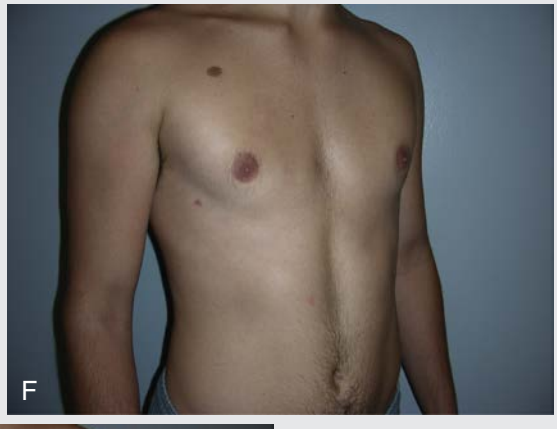


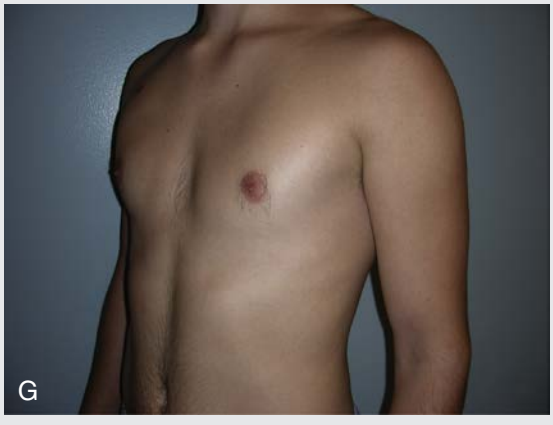






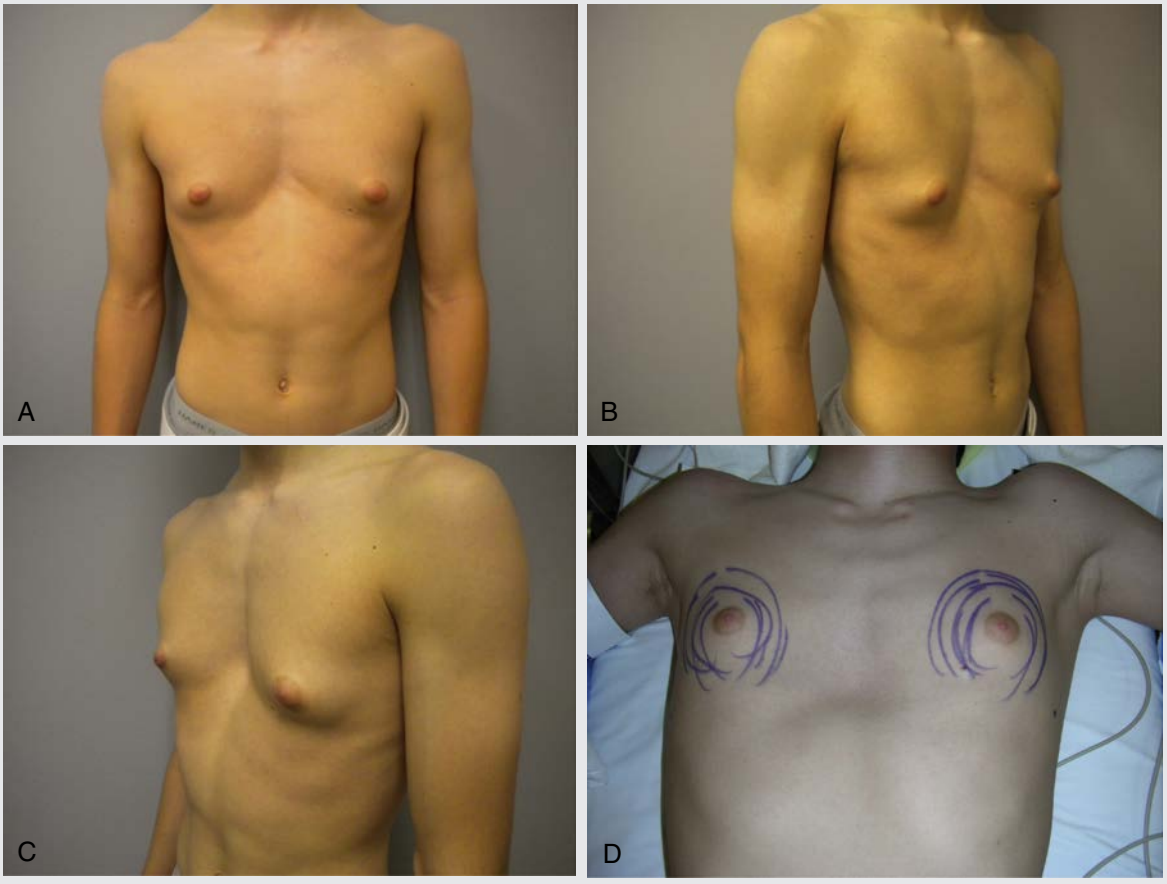






CASE 23.3

A 16-year-old patient with bilateral gynecomastia desired surgical correction. He was found to have enlarged core breast tissue, diffusely enlarged fibrotic breast, and some excess breast skin on both sides (Case 23.3A–C). Ultrasound-assisted liposuction was performed first in hope that he would not need breast skin resection after direct excision of the core breast tissue as a second-stage procedure to improve his chest contour (Case 23.3D) The Vaser system was used for his procedure. A total of 40 cc of lipoaspirate was removed from the right breast and 60 cc from the left breast. About 8 months later, he underwent direct excision of the enlarged core breast tissue through inferior periareolar incision (Case 23.3D, E) and minor conventional liposuction for contouring (10 cc of lipoaspirate from the right breast and 5 cc from the left breast). His postoperative course for both procedures was uneventful. Final results are shown at 11 months after the first procedure (Case 23.3F) and 6 weeks after the second procedure (Case 23.3G).



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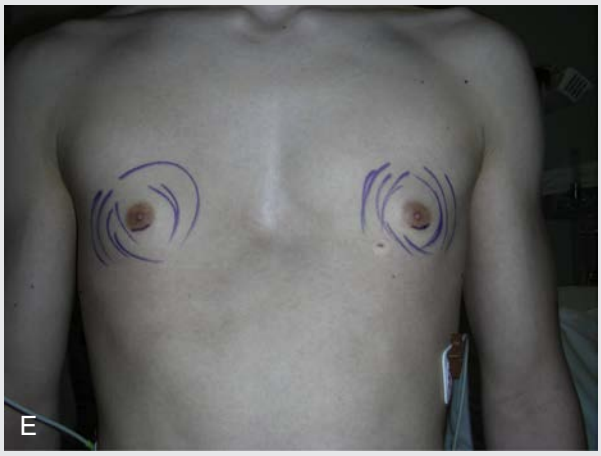
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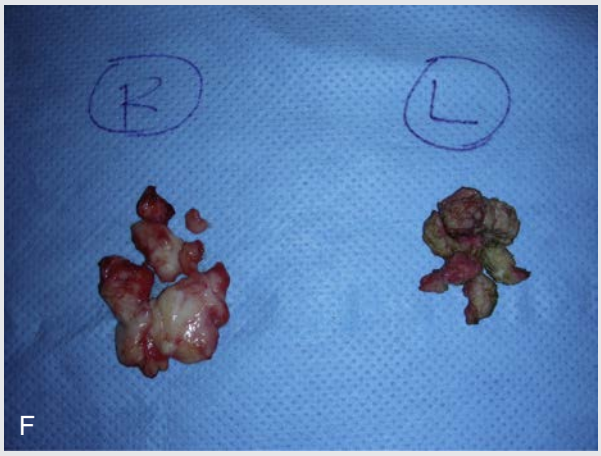

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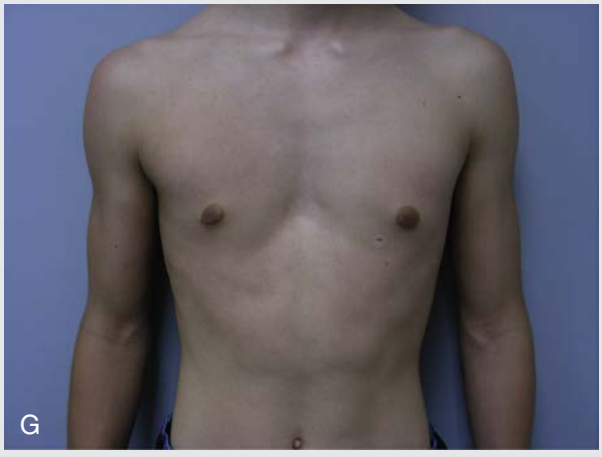
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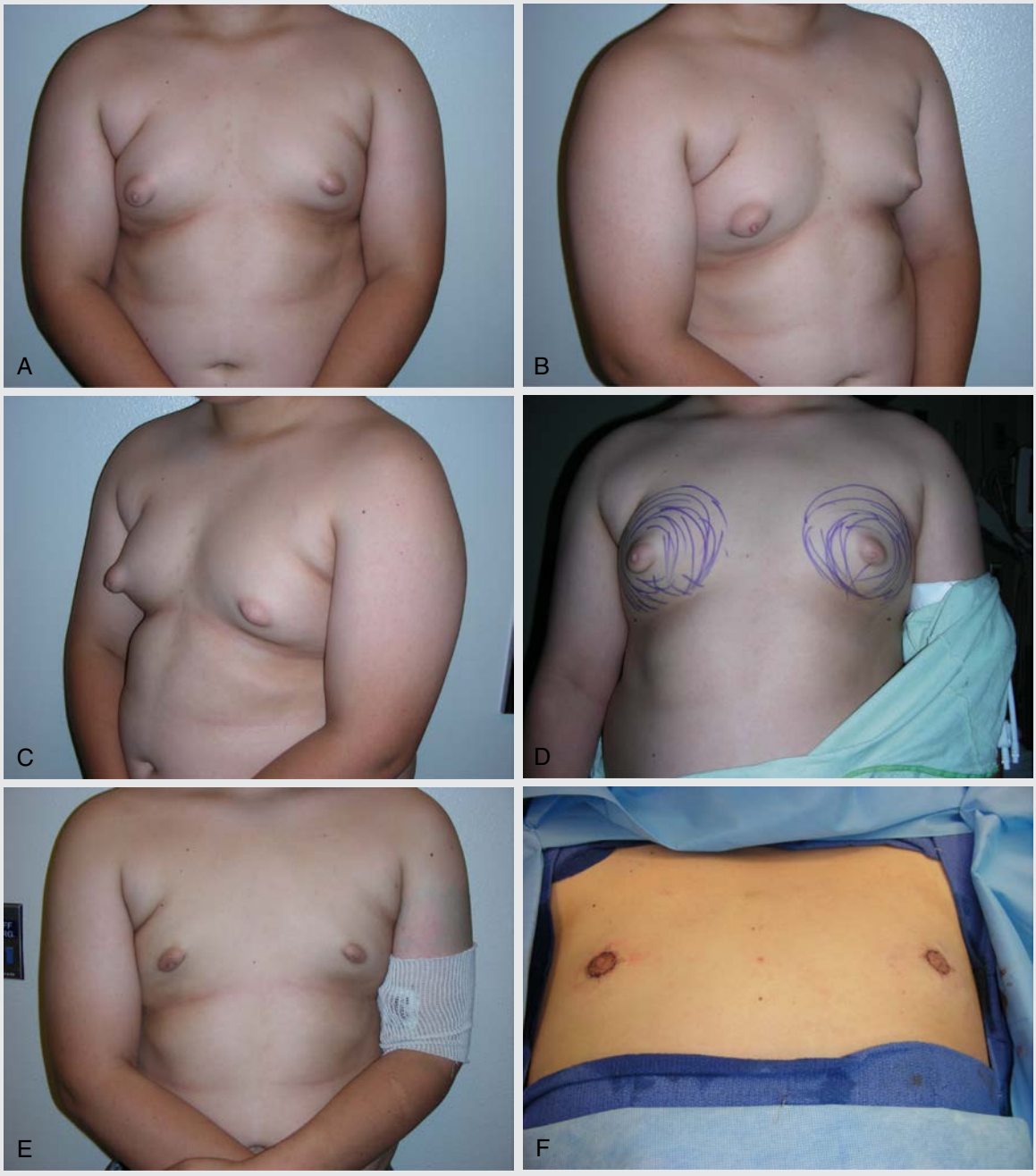
CASE 23.4

A 15-year-old male patient with bilateral gynecomastia desired surgical correction. He was found to have diffusely enlarged fibrotic breast, some excess breast skin, and an enlarged nipple–areola complex bilaterally (Case 23.4A–C). Ultrasound-assisted liposuction was performed first in hope that he would not need significant breast skin resection during the second-stage procedure to improve his breast contour (Case 23.4D). The Vaser system was used for his procedure. A total of 300 cc of lipoaspirate was removed from the right breast and 215 cc from the left breast. The result 2 months after the procedure with significant breast contour improvement and skin retraction is shown in Case 23.4E. About 6 months later, he underwent bilateral periareolar mastopexy to remove excess breast and areolar skin. Intraoperative views show the planned amount of excess skin to be removed (Case 23.4F) and immediate results after periareolar mastopexy (Case 23.4G). Both his postoperative courses were uneventful. Final results are shown at 11 months after the first procedure and 5 months after the second procedure (Case 23.4H–J).



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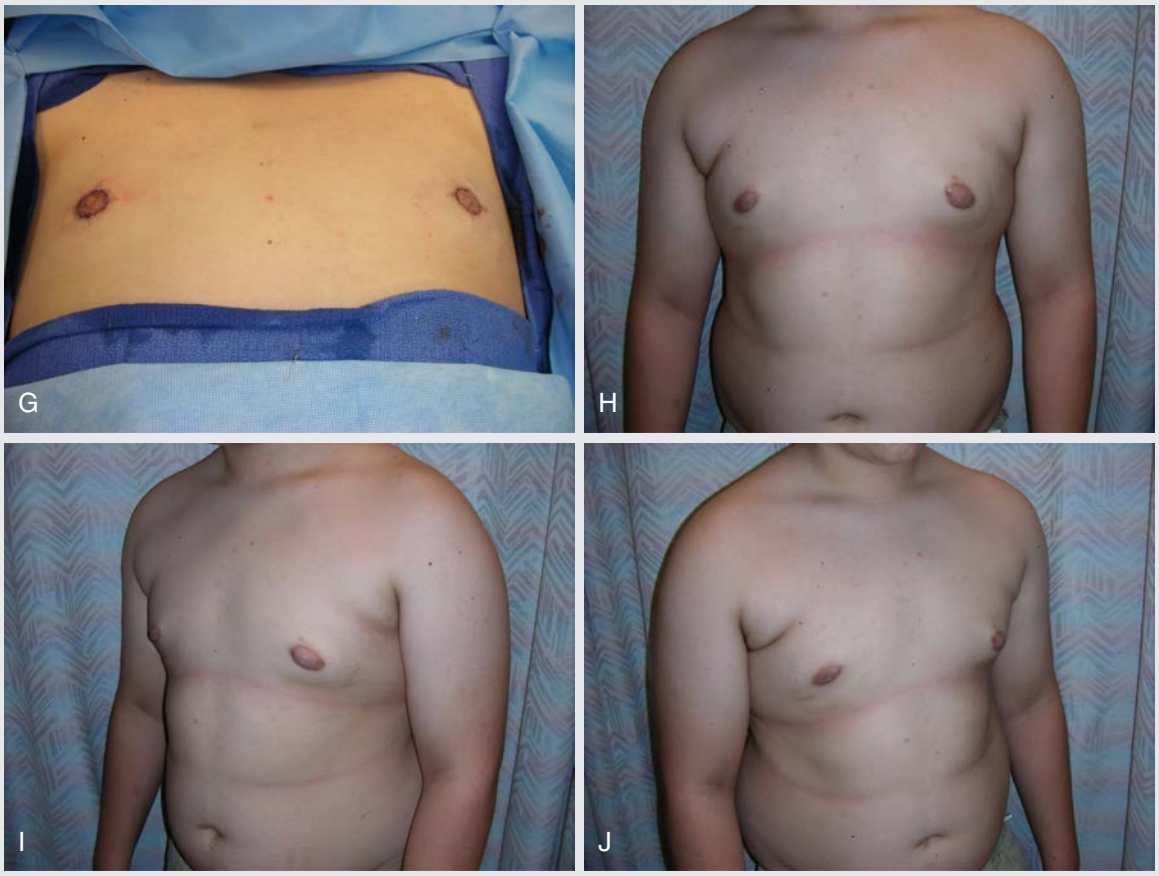
CASE 23.4—cont'd



Management of Complications

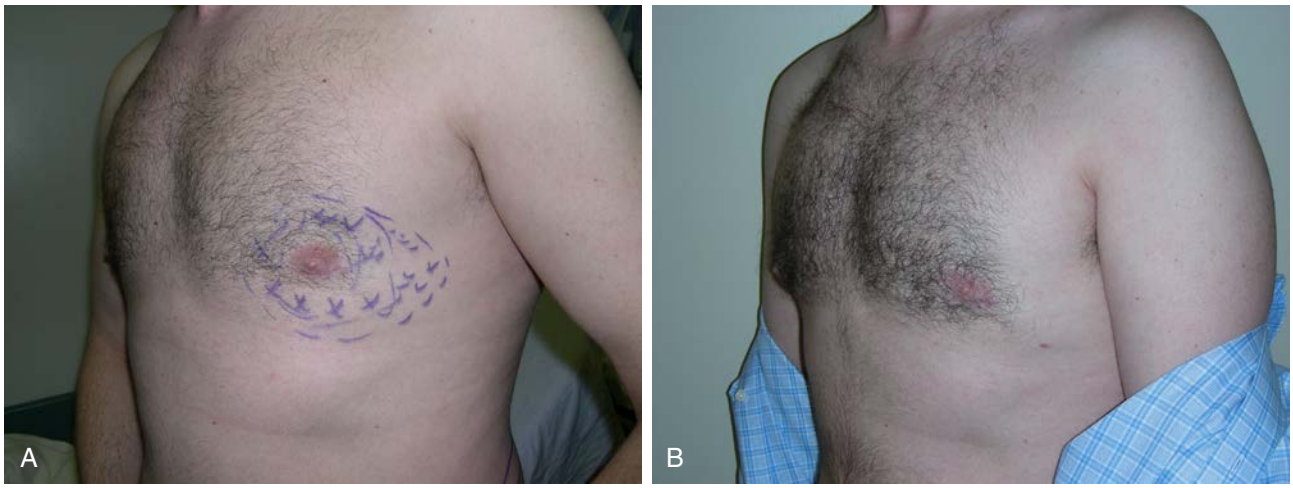
Postoperative complications such as nipple necrosis or wound dehiscence are possible after mastopexy. In general, complications after UAL are rare, and minor complications such as epidermolysis, undesired or hypertrophic scarring, and port skin burns are generally managed with local wound care or scar revisions.

Secondary Procedures

Patients who have already undergone a primary treatment for gynecomastia may seek secondary revision for an improved result. A repeat excision may be required in the event of less complete resection of the core breast tissue. Repeat UAL similarly may be required for less complete removal of the fatty chest tissue. For residual excess breast skin not apparent on primary gynecomastia treatment, a periareolar mastopexy can be performed secondarily. Overresection is arguably a more challenging problem to correct, but strategies may include revision resections on the contralateral side for symmetry or autologous fat grafting in appropriate patients (Fig. 23.14A, B).

Conclusion

Surgical treatment of gynecomastia can be effective with high patient satisfaction and minimal complications. Classification is a vital step in characterizing each patient's degree of glandular versus skin excess of the breast, for which direct excisional techniques alone or in combination with liposuction are effective at adequately contouring the male chest. UAL is a particularly useful technology in initially treating gynecomastia by disrupting fibrous breast tissue while facilitating skin retraction with minimal scarring or a lesser degree skin resection during the second-stage procedure. A periareolar approach for direct skin resection can minimize scarring in select patients and achieve the goal of a flat, masculine chest contour.



• **Fig. 23.14** This patient unfortunately had an overresection of his left breast via direct excision by another surgeon. (A) He was then treated by the senior author with a total of 8-cc of fat grafts. The result is shown at 4 months postoperatively (B).

Pearls for Success

- By assessing tissue characteristics and severity of gynecomastia, classification and staging are invaluable in guiding choice of surgical correction.
- Ultrasound-assisted liposuction (UAL) is an important first-line mainstay of treatment in most cases.
- Combined approaches of direct excision with liposuction such as UAL are common and can be performed simultaneously or staged.
- Secondary procedures are not infrequent and include repeat UAL and/or periareolar mastopexy.
- Complication rates are low with most minor complications well-managed with expectant management or staged secondary revision. Risks of contour irregularities such as overresection or underresection should be disclosed to patients preoperatively to maximize satisfaction and enable optimal outcomes.

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24

Correction of Congenital Breast Asymmetry

MICHAEL D. MIRMANESH SR AND LEE L.Q. PU

Introduction

Congenital breast asymmetry can be relatively common among young women.[1,2] Although tuberous breast deformity, Poland syndrome, and structural chest wall deformities can be considered reconstructive, less extensive congenital breast asymmetry is typically corrected as a cosmetic breast procedure. This chapter will focus only on correction of congenital breast asymmetry for young women who are seeking correction of their breast asymmetry for aesthetic reasons. Often, patients will present for improvement of breast size, shape, and projection without fully realizing their current breast asymmetry, which is sometimes quite significant.

To achieve optimal symmetry and the aesthetic desires of the patient, the specifics of the asymmetry based on preoperative analysis must be identified clearly before any intervention. It cannot be understated how important it is for the plastic surgeon to fully analyze, identify, and show the patient the asymmetry and potential plans for correction. Complete correction may require a more invasive procedure with a greater scar component than the patient desires. An informed discussion with the patient will direct the procedure implemented by the plastic surgeon and the ultimate amount of needed correction.

In this chapter, the authors describe their systematic approach to address several types of congenital breast asymmetry, emphasizing preoperative evaluation, operative approaches, refinements, and secondary procedures. Correction of breast asymmetry is truly an artistic endeavor in aesthetic plastic surgery not defined by a single procedure but by using all available procedures in our armamentarium to obtain a symmetric and satisfying result for the patient.

Indications and Contraindications

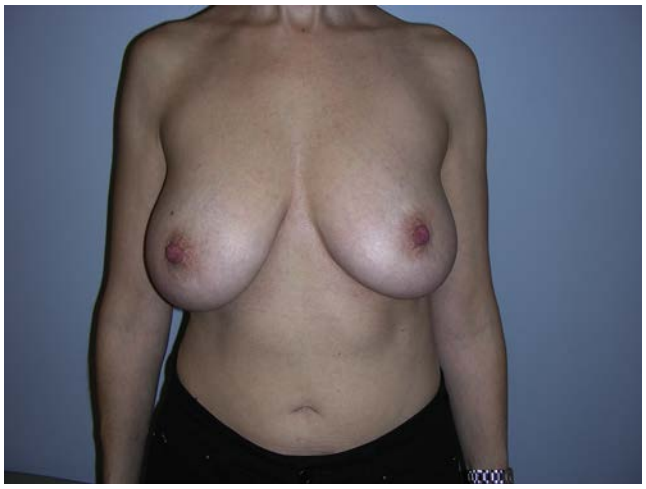
In general, any congenital breast asymmetry should not be surgically addressed in the aesthetic realm until the patient is at a stable breast size and shape and thus an appropriate age. Further asymmetry and even improvement of asymmetry can be seen before completion of breast development and growth.[3] Once breast development is stable, characteristics of the patient's breast envelope and breast tissue may make them poor candidates for certain procedures. The same plastic surgery principles in evaluating the right procedure for a patient with symptomatic breast hyperplasia seeking a reduction, ptosis seeking a mastopexy, and hypoplasia seeking an augmentation apply to the correction of congenital breast asymmetry.

As we know, an implant of significant volume inappropriate for a specific breast footprint and a periareolar mastopexy for significant ptosis will lead to the same poor outcomes as doing these procedures for their primary purposes. Another relative contraindication could be the patient wishing for correction of breast asymmetry who had baseline prepartum asymmetry that has worsened during and after her pregnancy and plans for further pregnancies. Even after appropriate correction, these patients may have a recurrence after further pregnancy and this needs to be fully discussed before any intervention.

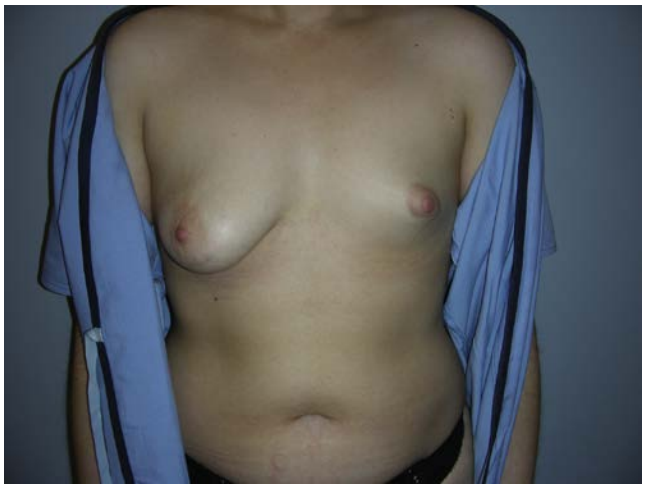
Preoperative Evaluation and Special Considerations

In the senior author's practice, a total of four categories for less extensive breast asymmetry have been classified and thus any treatment recommendations could be based on this classification.[4] We have found that the classification is quite useful and can be used to select appropriate procedures for each patient.

Type 1 is bilateral asymmetric breast ptosis. The ptosis may be classified as the same or different Regnault grade, but the different degrees of ptosis are clear to the plastic surgeon and all discrepancies should be pointed out to the patient. It should be made evident to the patient that different procedures and hence scar patterns could be used on each side to achieve a symmetric result in regard to breast shape (Fig. 24.1).



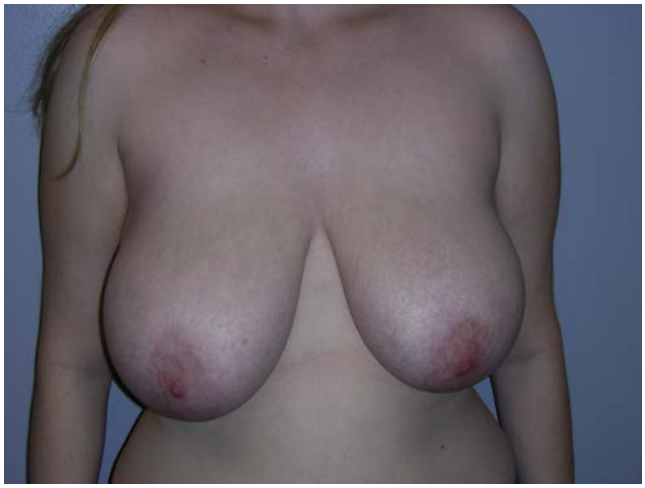
• **Fig. 24.1** Typical type 1 breast asymmetry in a patient with different degrees of bilateral breast ptosis.



• **Fig. 24.2** Typical type 2 breast asymmetry in a patient with different degrees of bilateral breast hypoplasia.

Type 2 is bilateral breast hypoplasia of different sizes. An attempt to classify the approximate amount of hypoplasia on each side quantitatively is recommended, to have an informed discussion with the patient that correction of asymmetry will likely require different sizes of implants and possibly even different projected implants. Despite getting an estimate of size discrepancy quantitatively, commitment to a specific size and projection preoperatively is not recommended (Fig. 24.2).

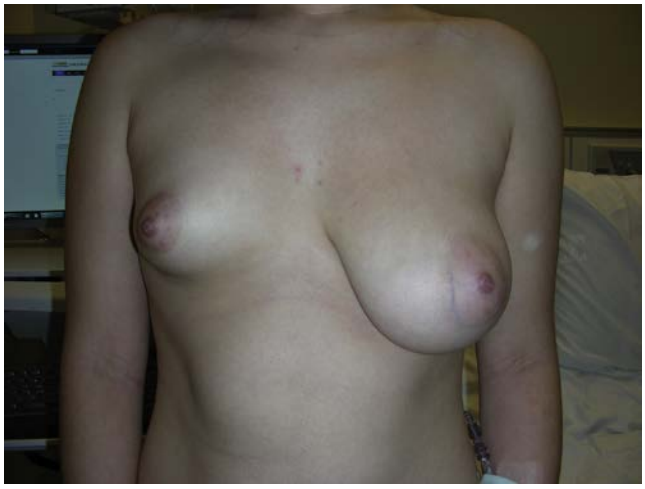
Type 3 is bilateral breast hyperplasia of different sizes. These patients are not uncommon in the plastic surgery practice and often present with concerns of symptomatic macromastia, although unaware of their breast asymmetry. It is critical to identify these size discrepancies and inform the patient. As with type 1, it should be made evident to the patient that different procedures and hence scar patterns could be used on each side to achieve a symmetric result (Fig. 24.3).



• **Fig. 24.3** Typical type 3 breast asymmetry in a patient with different degrees of bilateral breast hyperplasia.

Type 4 is typically the most difficult to correct surgically; these patients have one hyperplastic breast and one hypoplastic breast. For those cases, the patient will require a reduction/lift technique on one breast and an augmentation/lift technique on the other breast to obtain symmetry. These cases require the most formal operative planning and discussion with the patient that the good end result can be time-consuming and difficult to obtain (Fig. 24.4).

Not a separate type but equally important in its own right is differences in inframammary fold (IMF) height. Discussion and correction of discrepancies in IMF height is important for all the asymmetry types.

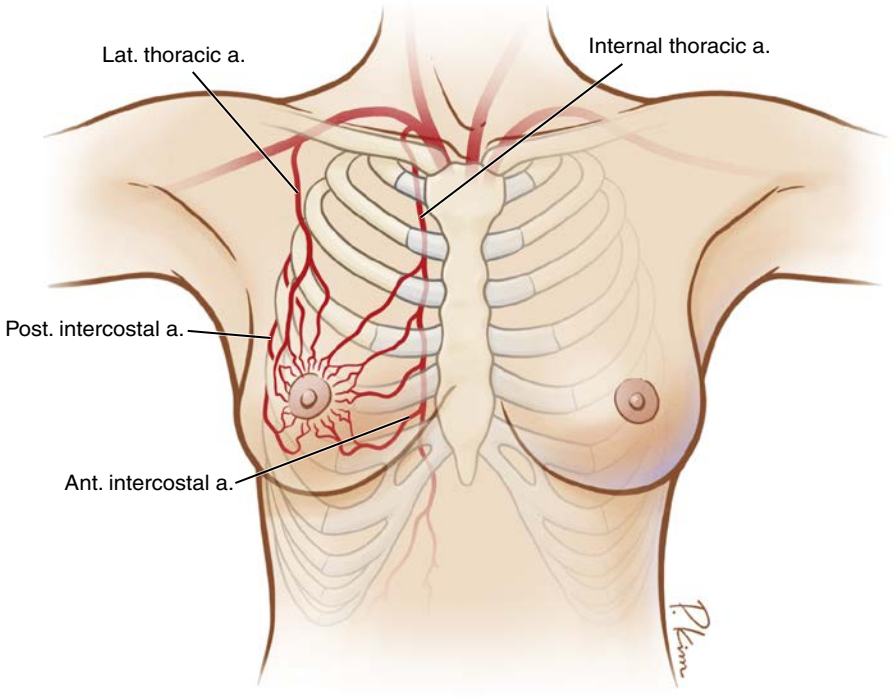


• **Fig. 24.4** Typical type 4 breast asymmetry in a patient with one breast is hyperplastic and one breast is hypoplastic.

Surgical Techniques

Relevant Surgical Anatomy

The breast receives its blood supply from several directions. However, the main blood supply to the breast is based on medial branches of the internal mammary artery (Fig. 24.5). The superomedial perforators from the internal mammary vessels are particularly robust and account for some 60% of



• **Fig. 24.5** Blood supply to the breast. *Ant.* Anterior; *a,* artery; *Lat.,* lateral; *Post.,* posterior.

the total breast blood supply. This rich blood supply allows for designs of various mastopexy or reduction techniques, ensuring the viability of the nipple–areola complex or skin flaps after surgery. The veins of the breast rarely accompany the arteries. Much of the breast is drained by a superficial venous system that lies just under the dermis. The nipple is primarily innervated by the medial and lateral branches of the fourth intercostal nerve. However, the third and fifth intercostal nerves contribute as well.

Common Techniques

Several common breast surgical procedures are used in the senior author's practice for correction of congenital breast asymmetry. These are breast augmentation with implant by inframammary approach, mastopexy (vertical or inverted-T or periareolar pattern), and breast reduction (medial pedicle or inferior pedicle technique). In addition, a combination of breast augmentation and mastopexy also has been commonly performed for the same purpose.[5]

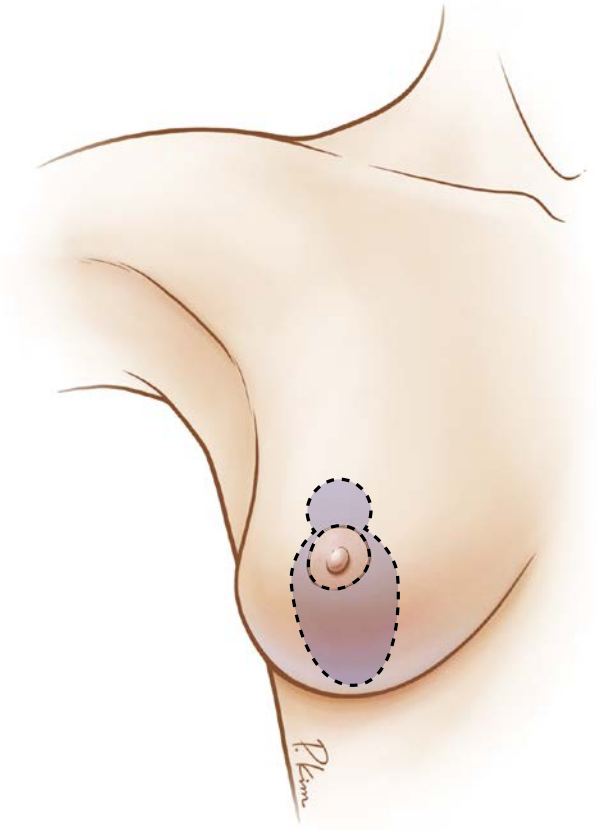
To optimize outcomes, we prefer to work on both sides simultaneously to achieve symmetry because each asymmetric breast is commonly not in the "normal" position as well. This allows the surgeon to have more freedom and make any necessary refinements to obtain the greatest possible symmetry after the major portion of the procedures is completed.

Type 1 Breast Asymmetry

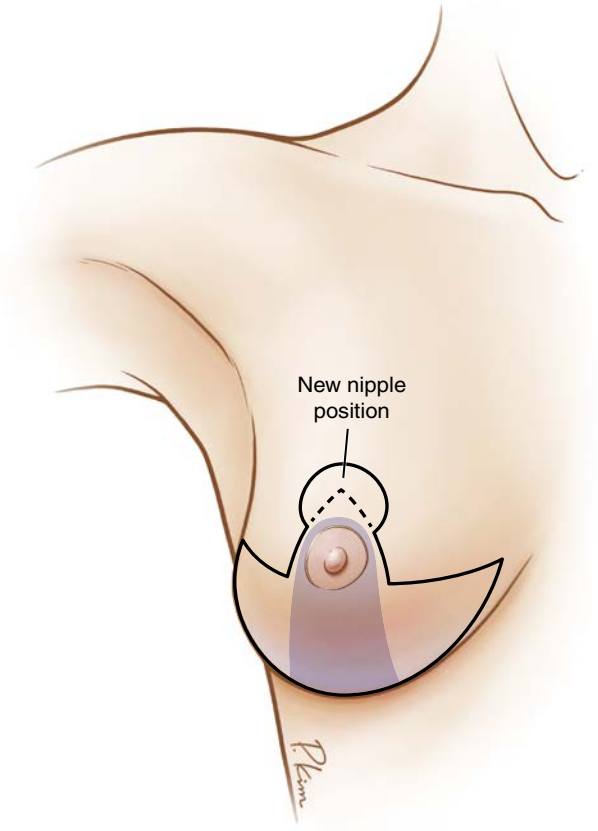
When addressing type 1 asymmetric breasts with differing degrees of bilateral ptosis, the surgical technique implemented on the more ptotic side is typically a vertical or inverted-T mastopexy or even breast reduction, as indicated (Figs. 24.6 and 24.7). The chosen procedure will be based on the degree of ptosis and what the surgeon and patient agreed to proceed with during the preoperative evaluation. A vertical or periareolar mastopexy is often executed on the less ptotic side (Fig. 24.8), but again this is guided by degree of ptosis and preoperative discussion with the patient. The skin pattern of mastopexy for each side can be determined intraoperatively by the tailor-tacking technique. Once the appropriate procedure for the degree of ptosis is implemented, with the patient in the sitting position, further refinements are made based on the nipple position and breast shape using the same principles described for mastopexy.

Type 2 Breast Asymmetry

For type 2 asymmetric breasts with differing sizes of bilateral breast hypoplasia, we prefer to perform bilateral breast augmentation with different sizes of implants.[6] The implant can be placed subpectorally or subglandularly by an inframammary approach (Figs. 24.9 and 24.10). Intraoperatively, different implant sizers are used, and with the patient in the sitting position, an appropriate size of breast implant for each side can be selected to allow for adequate breast size symmetry. Once the appropriate sizes are verified, any small adjustments to the breast pocket can be made and the permanent implants are placed. Although we have an idea of the discrepancy of the implant sizes that comes with experience, we also discuss the amount of size discrepancy with the patient or have her try on any



• **Fig. 24.6** The pattern of a vertical mastopexy.



• **Fig. 24.7** The pattern of an inverted-T mastopexy.

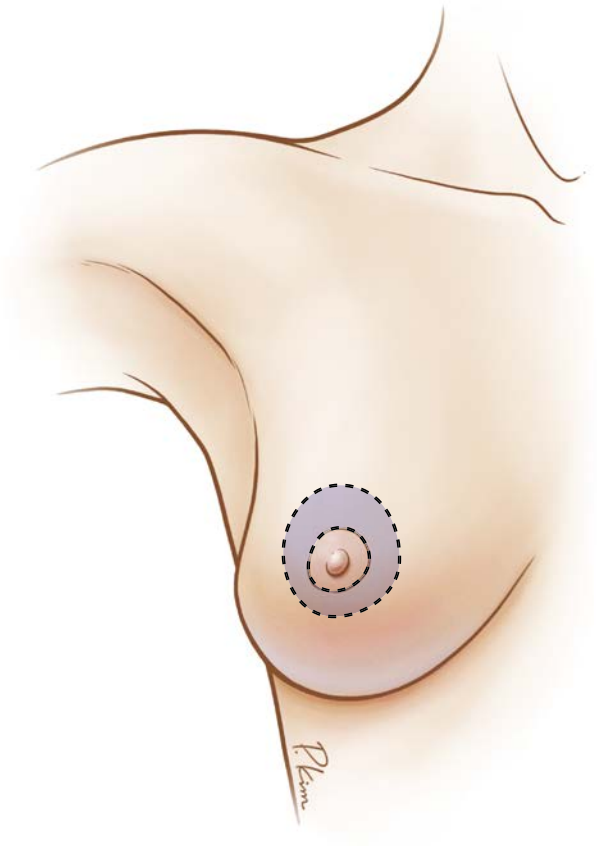
preoperative sizers; however, we do not make any commitment to the patient for the final size of the breast because the goal of surgical correction is to achieve symmetry. The inframammary approach is commonly used in the senior author's practice for those patients because it will give the surgeon more flexibility to make breast pocket adjustment, release the restricted breast, and ensure proper placement of the breast implant.

Type 3 Breast Asymmetry

For type 3 asymmetric breasts with differing sizes of bilateral breast hyperplasia, we typically perform an inverted-T inferior pedicle (Fig. 24.11) or vertical medial pedicle reduction (Fig. 24.12) on the more hyperplastic side and a vertical medical pedicle reduction on the less hyperplastic side. If the patient is happy about her smaller size of the breast, mastopexy also can be performed instead of reduction to achieve symmetry. The preoperative marking can be critical because each pattern of breast resection is determined in this way. The surgeon should be fully aware of how much breast tissue can be removed from each side. The important concept for symmetric correction of asymmetric hyperplasia may mean that it is necessary to perform an asymmetric resection, leaving behind almost the same amount of breast tissue. Being conservative to not overresect and constantly chasing the symmetry back and forth is paramount. If, as the surgeon, you tailor the breasts as you perform the resection, you can dictate the outcome of the reduction for each side and hence symmetry will be achieved.

Type 4 Breast Asymmetry

When addressing type 4 asymmetric breasts, a detailed preoperative plan is paramount. Essentially, an augmentation and mastopexy may need to be done on one side and a vertical reduction or mastopexy may need to be done on the contralateral larger side. It is the senior author's preference that breast augmentation via inframammary approach should be performed first for the smaller side. The actual volume of the needed implant can be estimated by a sizer, and tailor-tacking is then used intraoperatively to determine the pattern of mastopexy or breast reduction on the contralateral larger side (Fig. 24.13). If only mastopexy is needed, its skin pattern can be determined precisely in this way (Figs. 24.14 and 24.15) and final symmetry for type 4 asymmetric breasts can be accomplished with the previously mentioned combined procedures



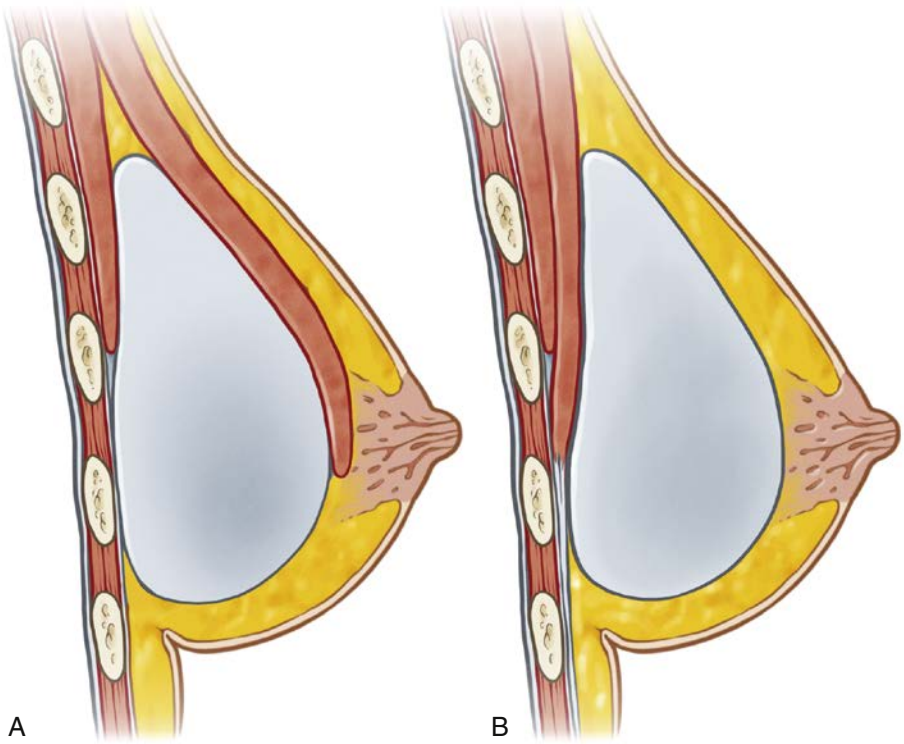
• **Fig. 24.8** The pattern of a periareolar mastopexy.

(Fig. 24.16). Serial fat grafting also can be performed on the hypoplastic side as a more contemporary approach if the patient desires to do so with an adequate amount of fat.[7]

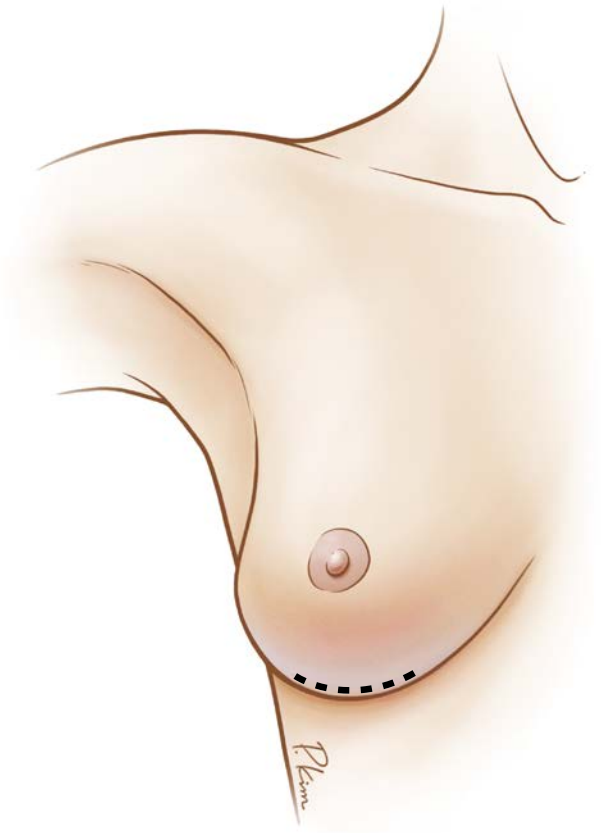
The classification of congenital breast asymmetry and recommended treatment options are summarized in Table 24.1.

Postoperative Care and Expected Outcomes

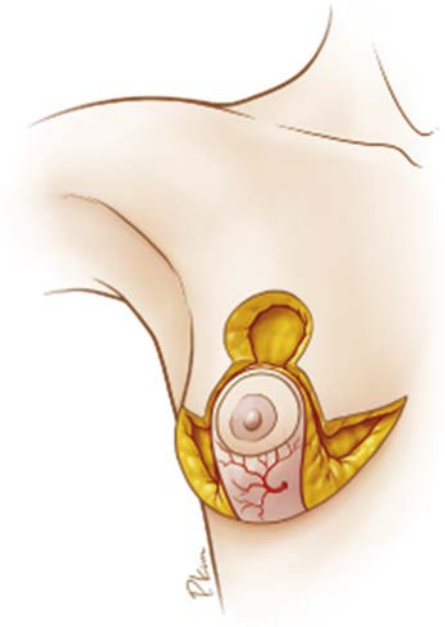
Postoperative care is the same as after each type of aesthetic breast surgery. Short-term use of foam tape may also further flatten the closure and define the IMF if needed. The remaining incisions will be covered with Steri-Strips, and a surgical bra is applied to the patient. The patient should wear a surgical bra for 2–3 weeks until the incisions have healed, and then convert to a new bra without an underwire. Drains are typically not used in the senior author's practice when implementing any of the described procedures. All procedures are typically performed in an outpatient setting with the patient going home the same day. The incisions are usually adequately healed within 2–3 weeks, and the patient should avoid heavy lifting for 6 weeks. Scars are typically well tolerated by most patients as instructed during preoperative counseling. The patients in general are happy with the outcome for breast symmetry, and secondary procedures can be done to further improve symmetry between breasts.



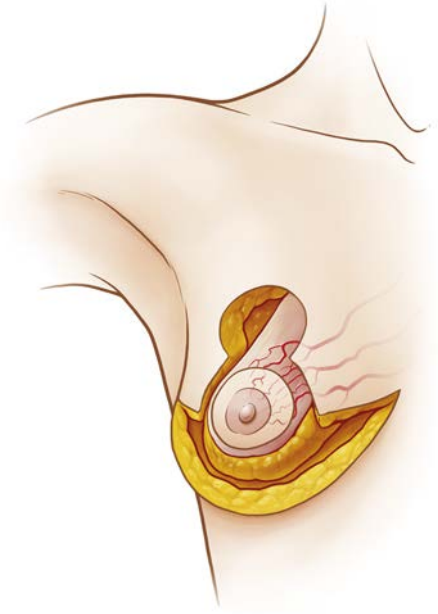
• **Fig. 24.9** The (A) subpectoral or (B) subglandular placement of a breast implant.



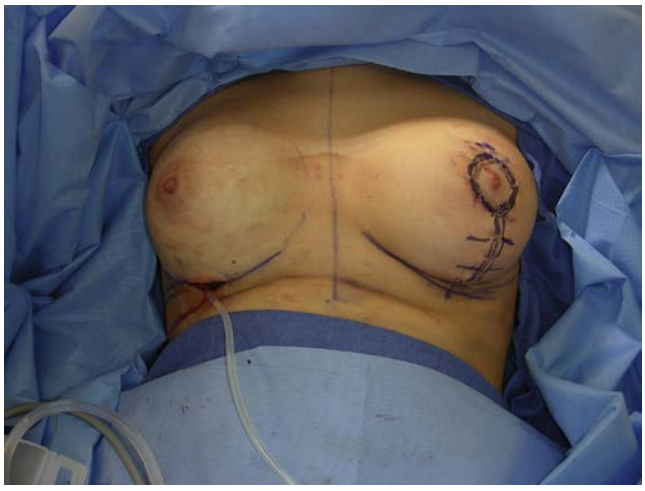
• **Fig. 24.10** An inframammary approach of breast augmentation.



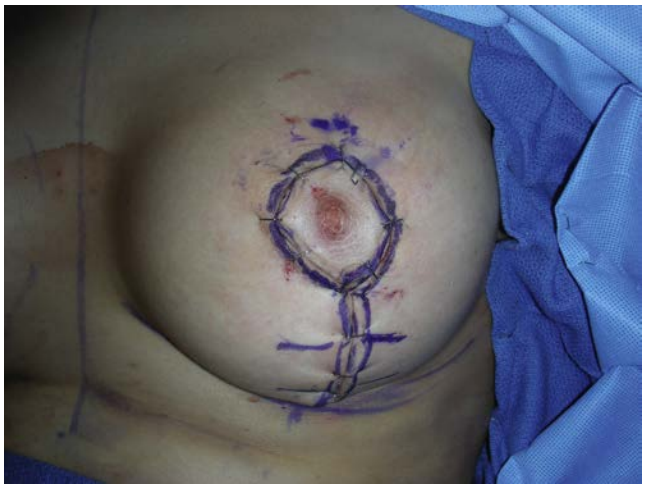
• **Fig. 24.11** The blood supply of an inferior pedicle breast reduction or mastopexy.



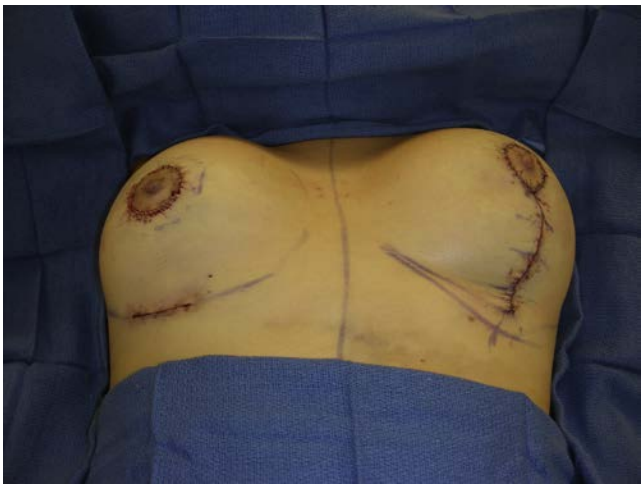
• **Fig. 24.12** The blood supply of a medial pedicle breast reduction or mastopexy.



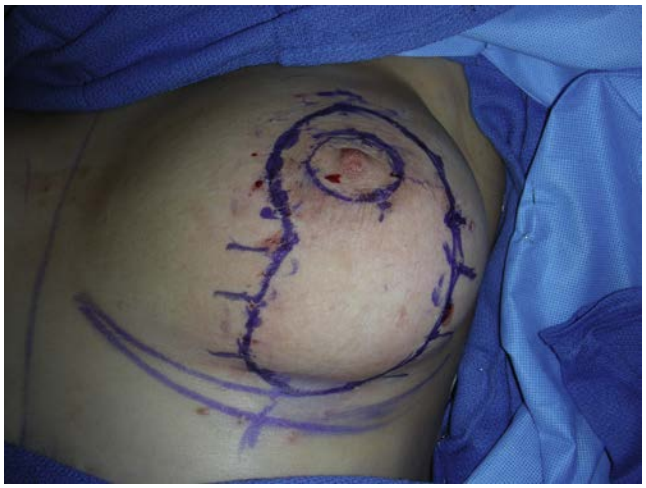
• **Fig. 24.13** Intraoperative view showing the planning for correction of type 4 breast asymmetry. The right breast augmentation with a sizer is just completed, and a tailor-tacking technique is used for determination of the skin pattern for left vertical mastopexy.



• **Fig. 24.14** Intraoperative close-up view showing a tailor-tacking technique used for determination of the skin pattern for left vertical mastopexy.



• **Fig. 24.16** Intraoperative view showing the result for the same patient after right breast augmentation with an implant, periareolar mastopexy, and left vertical mastopexy.



• **Fig. 24.15** Intraoperative close-up view showing the skin pattern for left vertical mastopexy determined by the tailor-tacking technique.

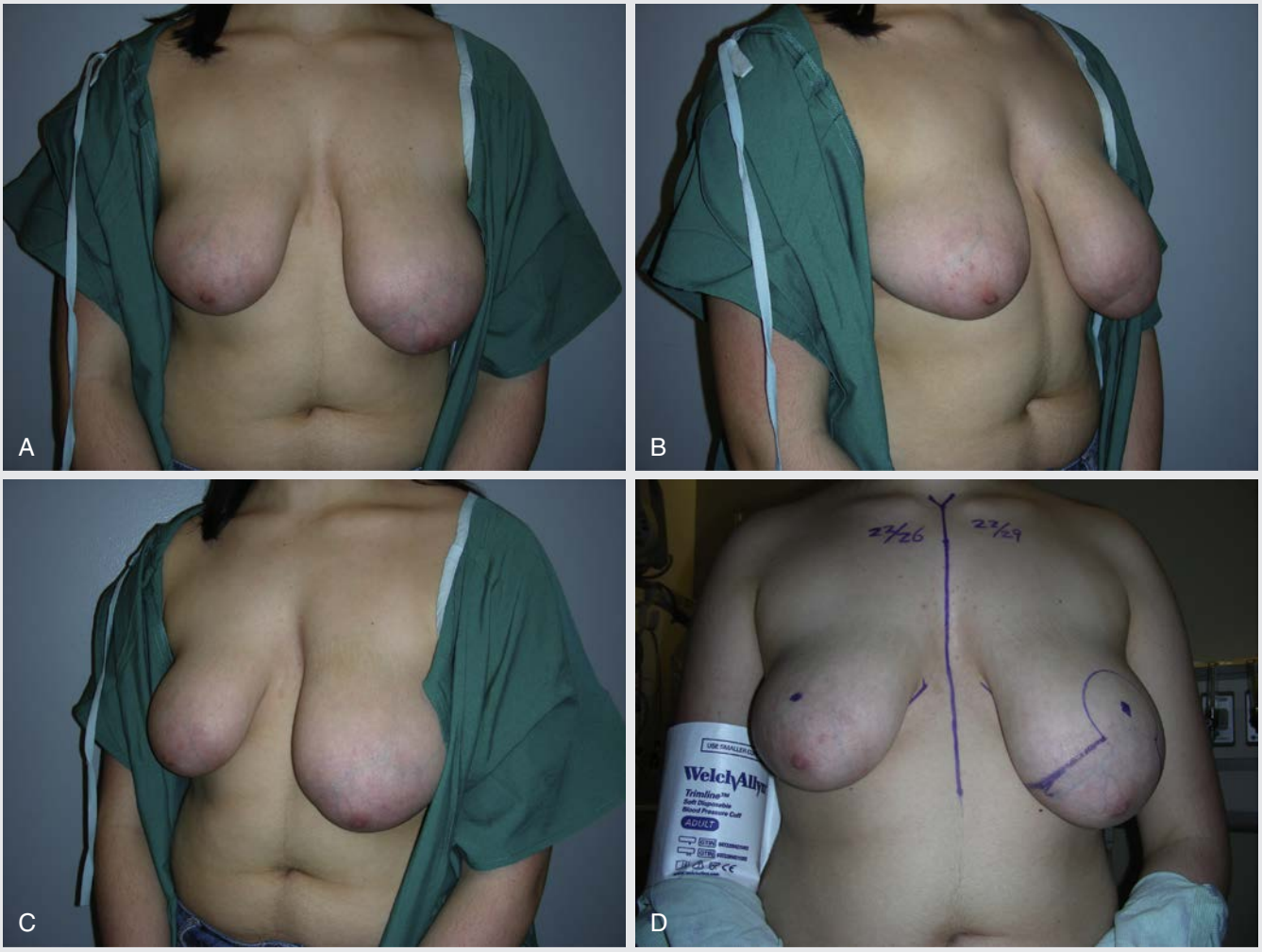
TABLE 24.1 Classification of Congenital Breast Asymmetry and Surgical Options for Cosmetic Improvement

Type 1: Both breasts are ptotic	Larger side: Mastopexy/reduction (inverted-T or vertical)
	Smaller side: Mastopexy (vertical)
Type 2: Both breasts are hypoplastic	Augmentation to each side with different sizes of breast implant
Type 3: Both breasts are hyperplastic	Larger side: Reduction (inverted-T or vertical
	Smaller side: Reduction/ mastopexy (vertical)
Type 4: One breast is hyperplastic	Larger side: Reduction/ mastopexy (inverted-T or vertical)
One breast is hypoplastic	Smaller side: Augmentation or serial fat grafting if desirable

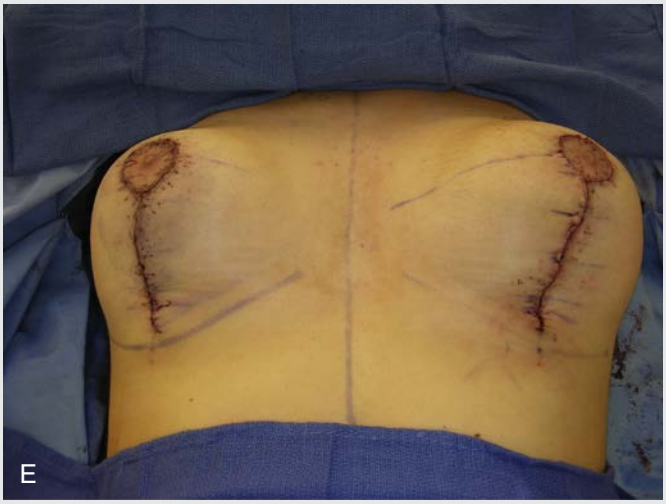
Case Examples

CASE 24.1

An 18-year-old white woman had type 1 breast asymmetry (Case 24.1A–C). She was offered right vertical mastopexy and left vertical breast reduction for correction of her breast asymmetry (Case 24.1D). Her surgery went well, and 255 g of tissue was removed from her left breast. The immediate intraoperative result is shown in Case 24.1E. Her postoperative course was uneventful. The result is shown at 3 months postoperatively in Case 24.1F–H.



CASE 24.1—CONT'D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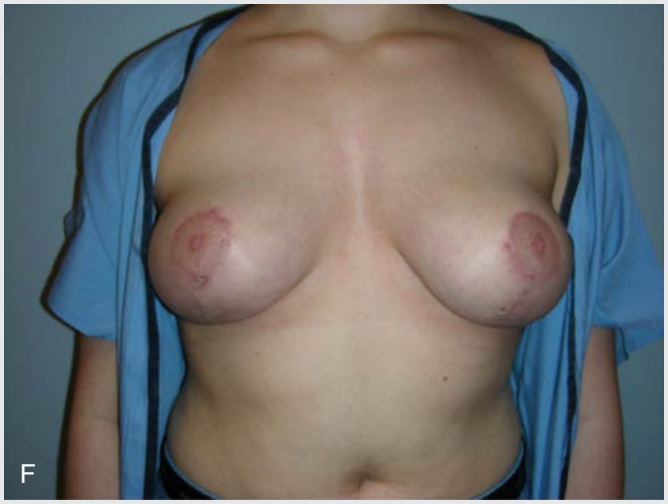
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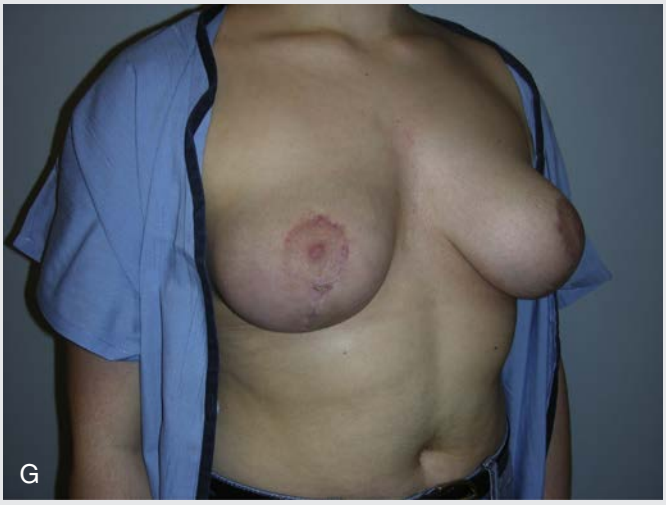
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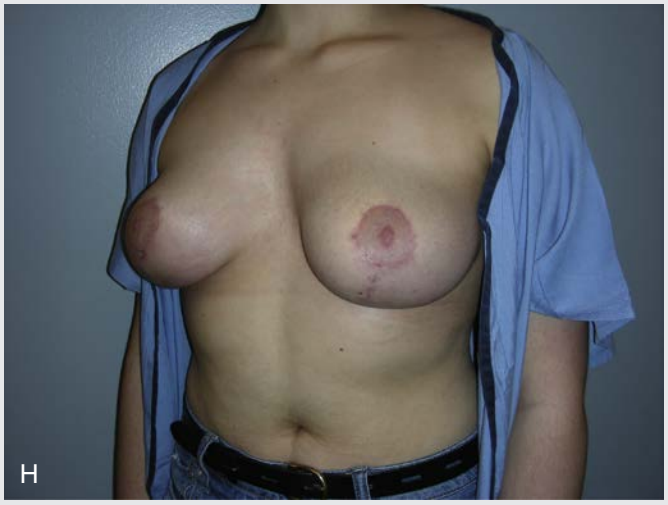
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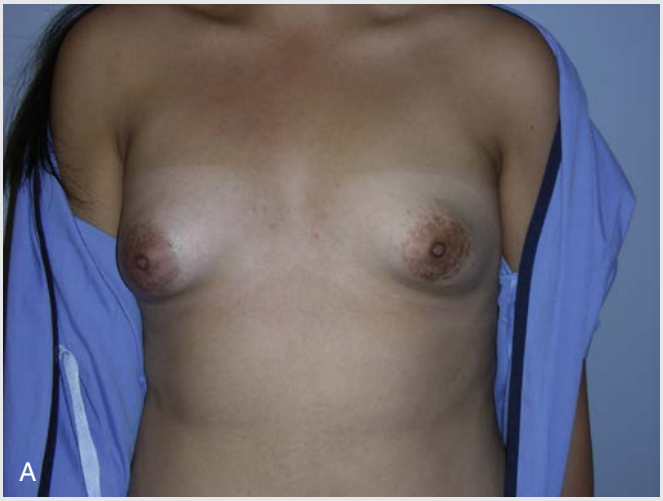
CASE 24.2

A 26-year-old Hispanic woman had type 2 breast asymmetry (Case 24.2A–C). She also had enlarged areolar circle on both sides. She was offered bilateral subglandular breast augmentations with different size of implants by inframammary approach and bilateral periareolar mastopexy for correction of her breast asymmetry (Case 24.2D). Her surgery went well, and a 300-cc moderate-size smooth, round silicone breast implant was placed in her right breast and a 250-cc implant was placed in her left breast. Bilateral periareolar mastopexy was designed and performed after bilateral breast augmentations (Case 24.2E). The immediate intraoperative result is shown (Case 24.2F). Her postoperative course was uneventful. The result is shown at 6 months postoperatively (Case 24.2G–I).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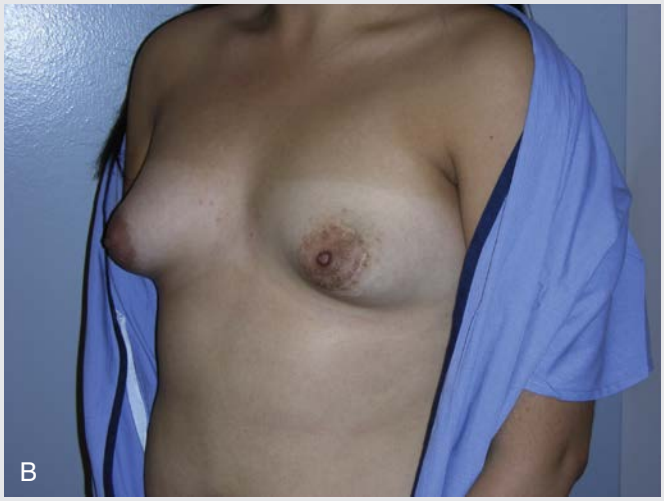
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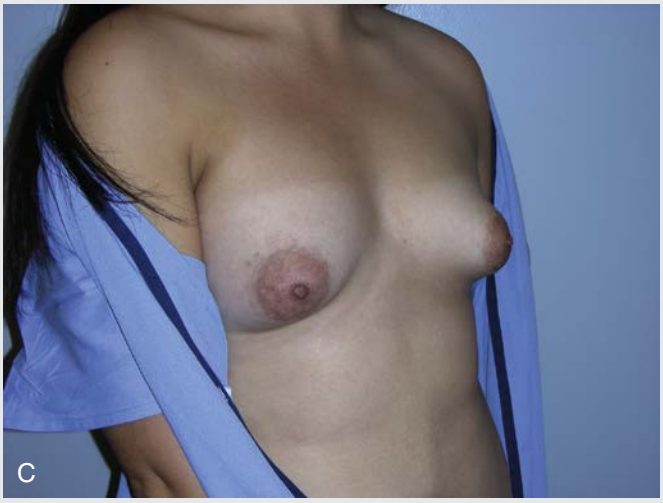
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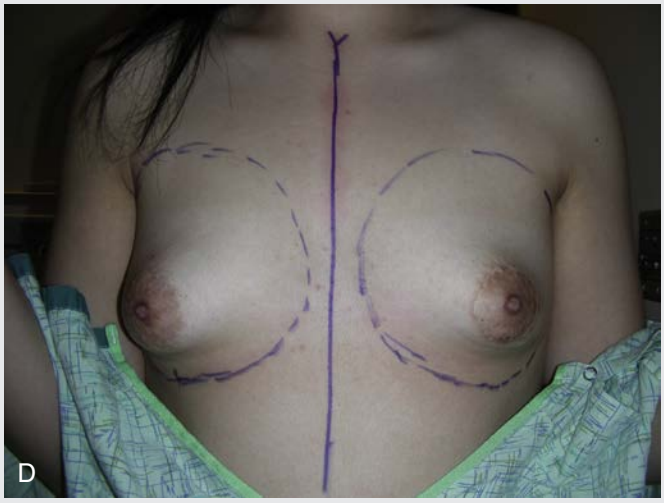
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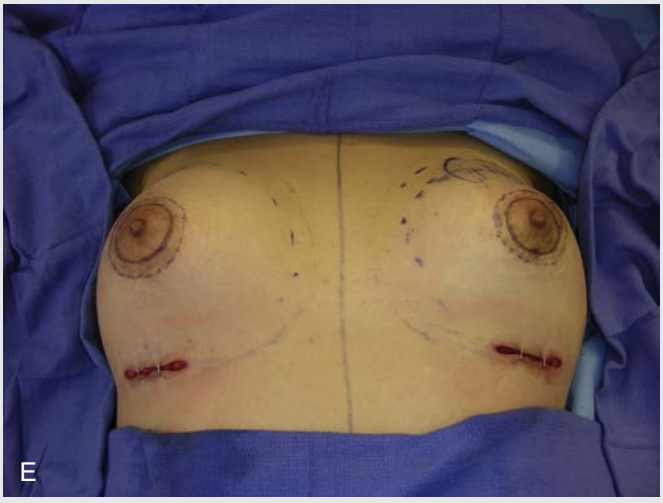
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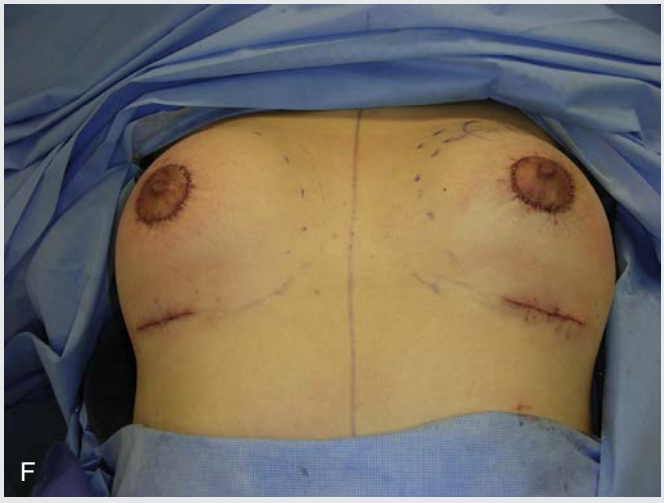
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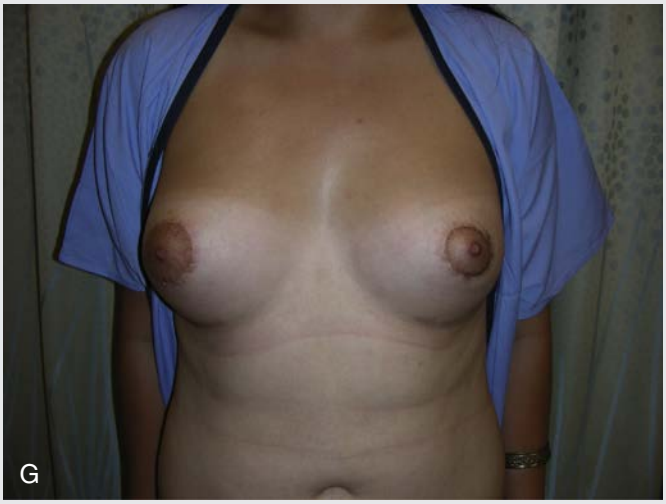
CASE 24.2—CONT'D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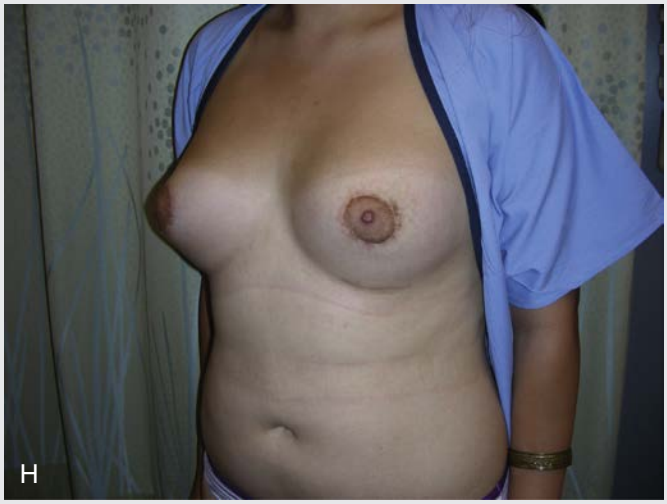
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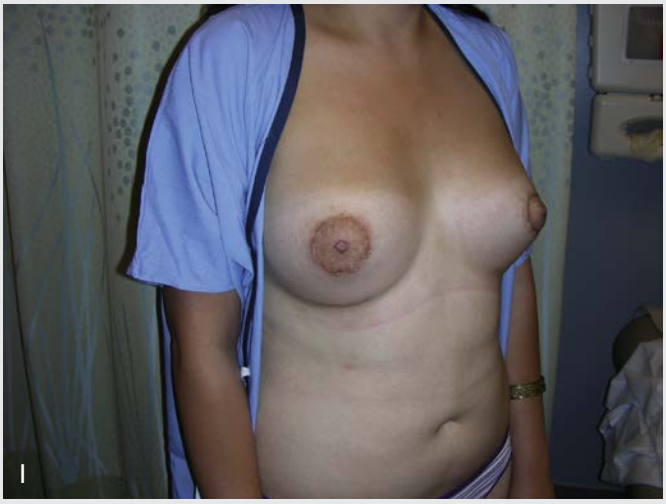
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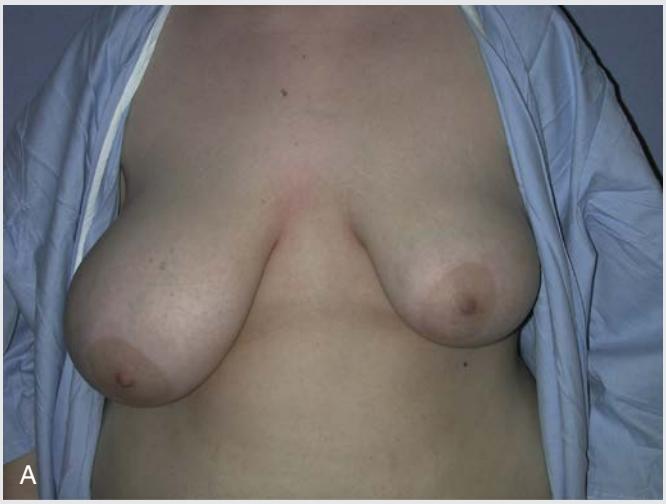
CASE 24.3

An 18-year-old white woman had a type 3 breast asymmetry (Case 24.3A). She was offered right inverted-T breast reduction and left vertical mastopexy for correction of her breast asymmetry (Case 24.3B). Her surgery went well, and 464 g of the breast tissue was removed from her right breast. Her postoperative course was uneventful. The result is shown at 2 months postoperatively (Case 24.3C) and 12 months postoperatively (Case 24.3D).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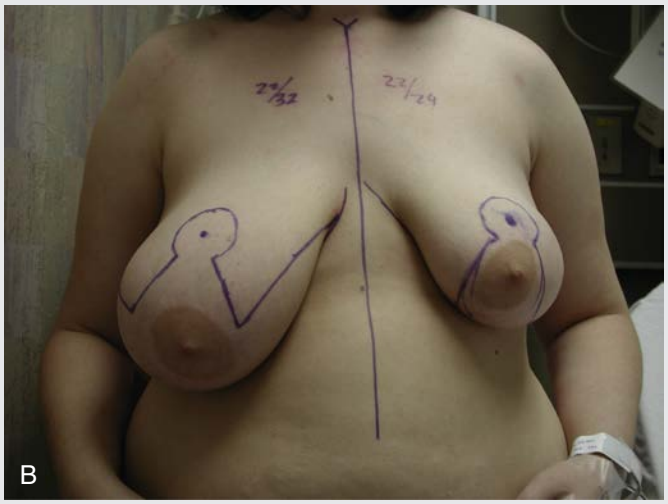
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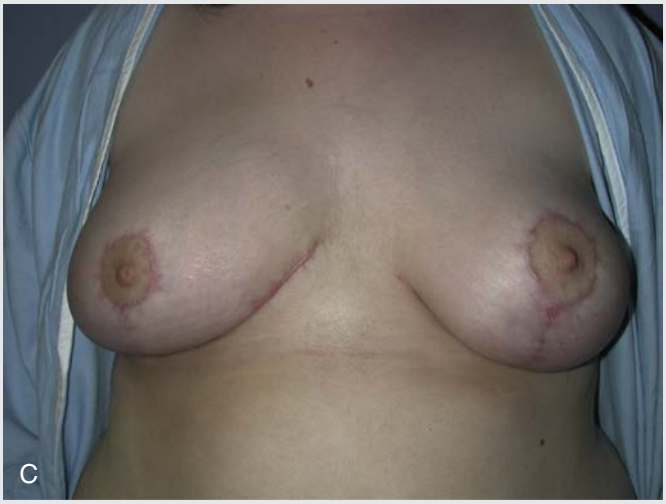
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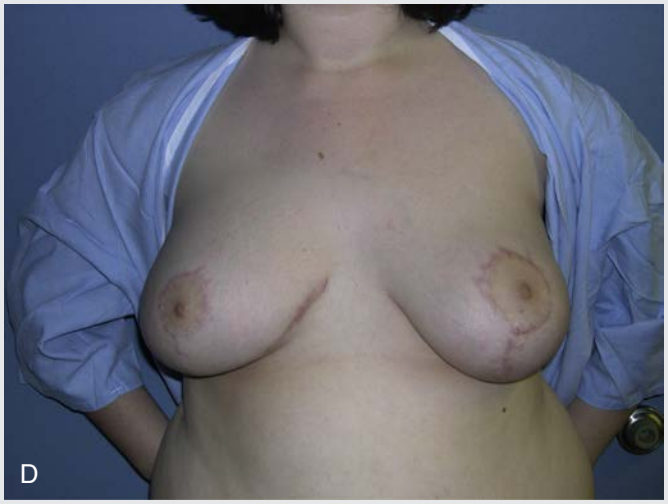
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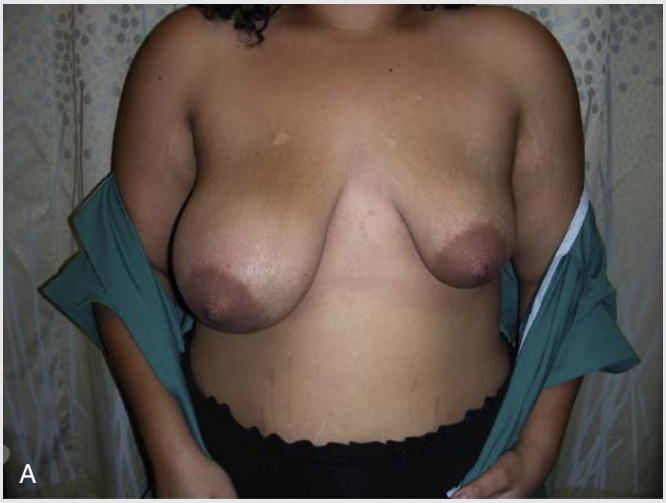
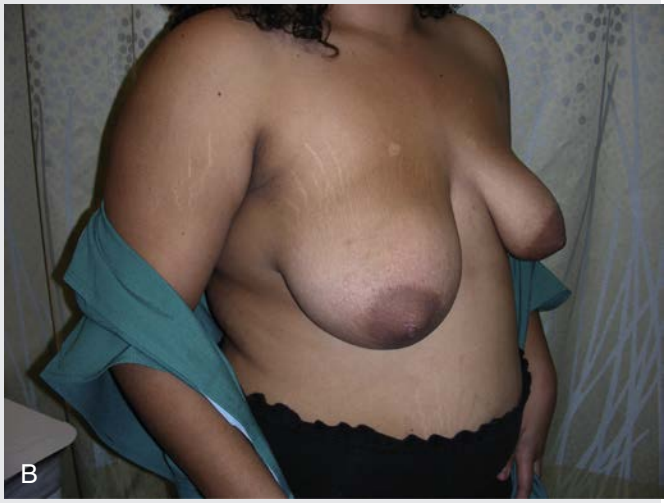
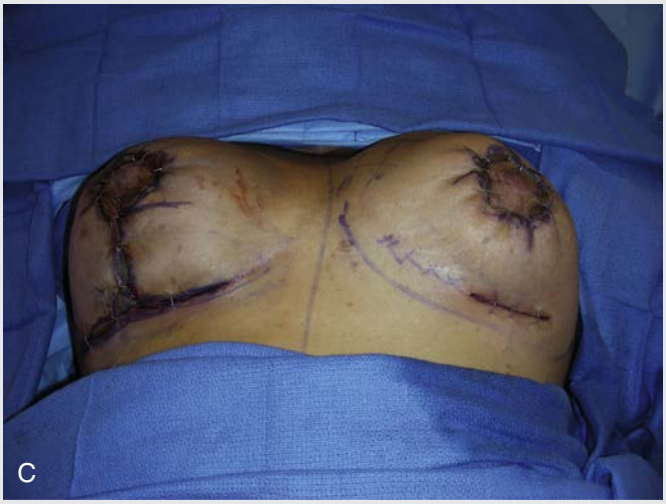
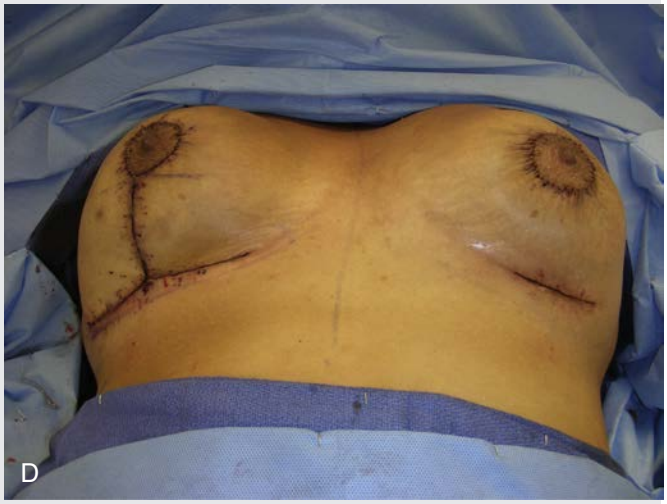
CASE 24.4

A 23-year-old African American woman had type 4 breast asymmetry (Cases 24.4A, B). She also had enlarged areolar circle on both sides. She was offered right inverted-T mastopexy and left breast augmentation with an implant by inframammary approach for correction of her breast asymmetry and left periareolar mastopexy for correction of enlarged areolar circle. (Case 24.4C). Her surgery went well, and a 550-cc moderate plus smooth, round silicone breast implant was placed in the subglandular location in her left breast. After left breast augmentation, left periareolar mastopexy and right inverted-T mastopexy were designed and performed (Case 24.4D) and immediate intraoperative result is shown (Case 24.4E). Her postoperative course was uneventful. The result is shown at 5 months postoperatively (Case 24.4F, G).

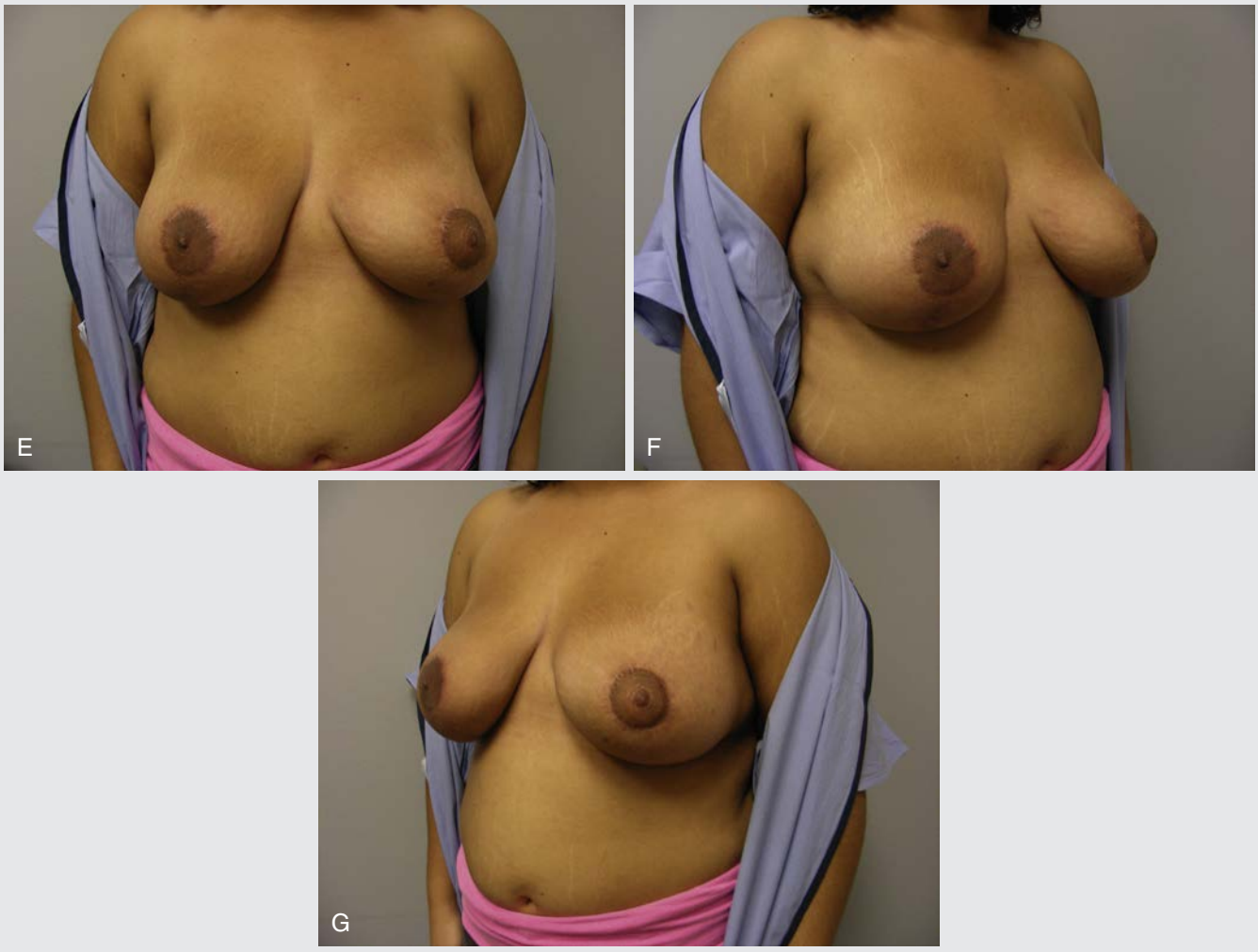








CASE 24.4—CONT'D



Management of Complications

In general, the complication rate is low and is similar to the complication profile when each of these breast procedures is performed in isolation. Wound healing issues at the T point in an inverted-T mastopexy or reduction and at the purse-string location of a vertical mastopexy or reduction occur with a similar risk profile to when each is performed in isolation. Most of these complications usually require only local wound care and can be managed in the office with proper dressing changes. Breast implant–related issues such as infection, contracture, malposition, and rupture are all possible and similar to the same risk profile when these are performed in a straightforward breast augmentation. We recommend the same standard contracture and infection precautions as taken with breast implants. Removal and replacement are discussed preoperatively with the patient as is typically done. Fat necrosis is also a possibility when a fat grafting procedure is performed and should be managed accordingly. Occasionally the patient may develop a hematoma or seroma just as after any type of breast surgery. These complications can be managed accordingly with evacuation of the hematoma or seroma in the office or in the operating room.

Secondary Procedures

Secondary procedures in correction of congenital breast asymmetry are more common than when performing each of the operations in isolation. It is more so the rule that when you correct asymmetric breasts, some residual asymmetry may be left because of the nature of the breasts themselves, and a small amount of asymmetry may occur in the healing phase. Patients should be counseled during

their preoperative evaluation that a secondary procedure is not an operative failure of the primary procedure but an expected outcome to obtain as symmetric a result as possible. Some of the most common secondary procedures are areolar size adjustment and nipple shape adjustment, both of which, depending on the amount of correction required, may be able to be performed under local anesthesia in the office. If the breast footprint itself is still asymmetric after the primary procedure, a secondary reduction or mastopexy may be required to obtain a symmetric result. Scar revision is another secondary procedure that can be performed under local anesthesia in the office.

Conclusion

Correction of congenital breast asymmetry is not an easy condition to correct, with no single procedure sufficient to create a symmetric breast outcome. Nevertheless, it is often sought by patients and understanding of operative strategies is important for any practicing plastic surgeon. The degree of artistry required by the surgeon to visualize the preoperative asymmetry, choose the correct procedure, implement the correct procedure, and tailor any intraoperative refinements is where the learning curve is drawn. These procedures can be an arduous and time-consuming endeavor. However, when performed correctly, with precision and accuracy the results can be tremendous for our patients.

PEARLS FOR SUCCESS

- Proper preoperative evaluation is critical for correction of breast asymmetry.
- Selection of appropriate procedures for the patient should be based on preoperative analysis.
- Always perform procedures on both sides to achieve breast symmetry.
- Selected procedures for both breasts are based on the patient's classification.
- A combination of selected breast surgical procedures is always needed.
- Secondary procedures may be needed to achieve better breast symmetry.
- There is a learning curve before one can become an expert.

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25

Transgender Breast Surgery (Male-to-Female and Female-to-Male)

WROOD KASSIRA, KAREN KAPLAN, AJANI NUGENT, SAMIRA E. CARABALLO, AND CHRISTOPHER J. SALGADO

Introduction

Gender dysphoria, quite often referred to as gender identity disorder, is defined by an individual's persistent discomfort with his or her own assigned sex.[1] Individuals with gender identity disorder have a desire to live as members of the opposite sex and therefore often modify their primary and secondary sexual characteristics. Today there are many surgical and medical options for transsexual patients to transition into their desired gender.

Transsexual females are persons who were born with male anatomy and assigned to be male sex at birth, but the gender they associate with is female and vice versa for transsexual males.[3] These individuals often undergo hormonal therapy and sex reassignment surgery to transition and alter their appearance in a way that aligns with their gender identity.[4] The term "trans" or transgender female refers to a transexual woman and "trans" male refers to a transexual man; wheras the term "cis" or cisgender are individuals who identify with their assigned gender at birth.

Before any of these procedures or starting hormone therapy, a mental health evaluation is required. A psychiatrist must diagnose the individual with gender identity disorder.[1] This evaluation rules out any endocrine disorders, psychosis, and mental health disorders. Once the patient is cleared by the psychiatrist, hormone replacement therapy is initiated before surgical intervention.[1]

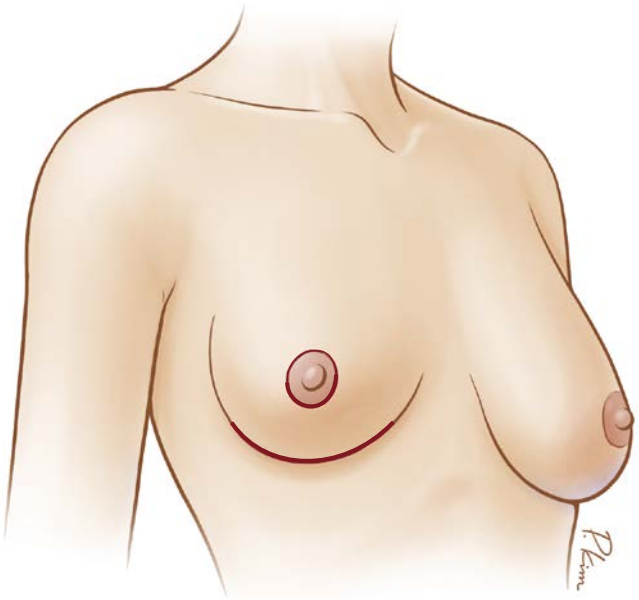
Many transgender male-to-female patients see breast development after long-term hormone replacement therapy. However, for those who desire larger breasts, breast augmentation is an alternative or supplemental option. Breast augmentation is the enlargement of breast by using silicone or saline implants to enhance the size and shape of the chest (Fig. 25.1). The prosthesis is chosen to fit the contour of the breast by the surgeon according to the patient's desired appearance.[9] In some male-to-female patients, consideration of a tissue expander as a first step to develop a breast mound may be considered. The use of breast implants requires a thorough discussion with the patient and informing the patient that implants are not lifetime devices and thus often require further operations over one's lifetime.

Transgender female-to-male patients usually seek bilateral mastectomy, which is the removal of the breast and the shaping of the male contoured chest.[6] The technique chosen for this procedure depends on the amount of breast tissue present and the tissue elasticity.[6] The breast parenchyma and fat can be removed through multiple incisions ranging from a periareolar incision to a double-incision mastectomy with free nipple graft.[2,10]

Although hormone therapy is preferred for most gender reassignment procedures, it is not required for top surgery eligibility. Top surgery may be performed 6–12 months before bottom surgery, which includes vaginoplasty or metoidioplasty/phalloplasty; for some trans-individuals, top surgery may be the only surgical procedure throughout transition.[3]

Indications and Contraindications

Augmentation mammaplasty for the transgender female patient is a commonly performed procedure. Despite the frequency with which the procedure is performed, there are very few articles that address this specifically in the published literature. For the transgender female patient seeking improvement of her chest appearance, it is incumbent on the treating physician to distinguish these operative indications from those of a cis-female patient seeking aesthetic or even reconstructive measures for breasts. Therefore, the treating physician should be knowledgeable of the World Professional Association for Transgender Health (WPATH) guidelines for top surgery in trans-female patients and should strictly adhere to the parameters outlined. The full extent of these guidelines exceeds the scope of this chapter; however, the surgeon should have a letter from a licensed mental health specialist who has an established relationship with the patient, and the patient should be on hormone therapy and living as the desired gender for at least 12 months.[3] Adherence to these guidelines is important not only to ensure that the patient



• **Fig. 25.1** Types of incision used for breast implants.

TABLE 25.1 Implant Types for Breast Augmentation Procedure

	Saline filled	Silicone Gel
FDA approval	Yes, must be >18 years old	Yes, must be >22 years old
Filling	Saline water solution	Silicone gel
Volume	Volume can be adjusted during surgery	Filled before surgery
Surface of shell	Smooth or textured	Smooth or textured
Warranty	Manufacturer dependent	Manufacturer dependent

FDA, U.S. Food and Drug Administration.

meets criteria from a gender dysphoric standpoint but also from a medico-legal standpoint for the surgeon.

Once the dysphoria is addressed and/or documented, surgical evaluation can proceed as standard for an augmentation mammaplasty. The indications for a subcutaneous mastectomy in transgender males follow the same guidelines as for trans-females with the exception of being on hormone therapy.[10]

Preoperative Evaluations for Male-to-Female Transgender Patients

Most patients would have been on a feminizing hormone protocol before evaluation by a plastic surgeon for augmentation mammaplasty. These hormones generally result in some breast tissue growth, which is usually consistent with a Tanner stage 3 or 4 seen in adolescent girls.[3] This development is usually not sufficient for the patient's aesthetic desires and in our experience not sufficient for the patient to "pass" as the female gender, so it is important for the plastic surgeon to determine what are the patient's aesthetic goals and expectations. Generally speaking, we have found that most trans-female patients desire a relatively larger appearance than most cis-females. The challenge with this, however, is that their tissue is usually less conducive to large volume (augmentations).[9] We have found that virtual imaging has helped both the treating plastic surgeon and the patient come to a better understanding of the patient's desired appearance. This also allows for better management of expectations preoperatively. After virtual imaging, we proceed with our routine breast/chest examination as we would for any patient desiring a change in appearance of the breasts, which includes assessing breast footprint (breast width), inframammary fold (IMF) level and symmetry, nipple-to-IMF distance both at rest and on stretch, sternal notch–to-nipple distance, nipple–areolar complex diameter, skin pinch, evaluation of underlying pectoralis muscle, and determination of preexisting ptosis.[9] It is also important to evaluate for any abnormalities such as masses in the breast tissue and axilla, because, although rare, estrogen exposure in these patients can increase their risk for breast malignancy.[5] There is limited literature regarding the risks and incidence of breast cancer in this population.

Depending on the patient's body mass index, most differences are noted in the relatively less elasticity of the overlying skin envelope, as well as thinner superior pole tissue. The pectoralis major muscle is usually more developed in these patients as well.[9] It is important to identify any asymmetry preoperatively, because it might be more pronounced postoperatively, leading to patient dissatisfaction.

The choice of prosthesis should be guided by patient preference after the risks and benefits of both silicone and saline are explained by the plastic surgeon.[9] It has been our preference to proceed with silicone prostheses because of the softer postoperative texture (Table 25.1). Textured implants have a risk of anaplastic large cell lymphoma (ALCL), so it is our practice to place smooth implants. Recent FDA recommendations are for ultrasound or MRI at 5-6 years postoperatively to look for a silent leak and then every 2-3 years in the asymptomatic patient.

Surgical Techniques

Relevant Surgical Anatomy

As mentioned earlier, the breast base width is important. This can be determined by applying pressure directly onto the nipple–areolar complex and determining the circular footprint created subcutaneously from the breast tissue that is present. The width of pectoralis muscle is also important,

because some of these patients will undergo subpectoral prosthesis placement. This width is determined by measuring the horizontal distance from parasternal insertion of muscle fibers to the anterior axillary fold.

The underlying neurovascular supply to the breast tissue and nipple–areolar complex also should be taken into consideration. The innervation of the nipple–areolar complex comes from the lateral cutaneous branch of the fourth intercostal nerve. This is important when performing pocket dissection of the lateral-to-lateral pectoralis border. The blood supply to the breast and nipple–areolacomplex has been well documented in the past. Of importance, however, is that the second intercostal perforator from the internal mammary artery is frequently encountered when performing subpectoral pocket creation and can be a source for postoperative hematoma if not adequately controlled intraoperatively. The subpectoral pocket is the safest from a perfusion standpoint because the blood supply from the pectoral branch of the thoracoacromial artery is maintained.

Preoperative Markings

We begin by marking the midline by drawing a line from the sternal notch to the umbilicus. We then mark the native IMFs bilaterally. The native breast footprint is usually demarcated and outlined as described earlier. Depending on the thickness of the pectoralis muscle, we might have the patient adduct the shoulders to delineate the pectoralis border for preoperative markings as well.

Our standard approach is to use an IMF incision, because the preoperative nipple–areolar complex width of trans-females is usually not sufficient to allow periareolar prosthetic insertion. Transaxillary approaches to breast augmentation are well documented in the literature; however, in our experience, we think that better final contour and symmetry are better attained via an IMF approach.

Because of the larger sized implants that most of these patients desire, if an IMF incision is placed directly within the IMF, the problem of postoperative scar migration onto the breast might result. Therefore, we generally place our IMF incision at least 1 cm inferior to the native IMF, depending on the size of the implant being placed.[9]

Surgical Exposure

Determination of the pocket placement is usually done preoperatively. For a very thick pectoralis muscle, a subglandular or subfascial approach might be more desirable, because the risk of postoperative animation deformities is minimized. Dual-plane III placement also can aid with prevention of that problem. Of note, the skin envelope is usually thinner in these patients, which conversely makes subglandular placement more tenuous from a post-operative standpoint.[10] Because of this, it is our practice to perform subpectoral placement, with a dual-plane II release if necessary. We determine the need for dual-plane release depending on the extent of preoperative ptosis present.

Details of the Procedure

We begin by ensuring pneumatic compression stockings are in place before induction of anesthesia, because these patients are at a higher risk of venous thromboembolism. Typically patients are advised to hold estrogen 4 weeks preoperatively. Preoperative antibiotics are administered, usually consisting of vancomycin and cefazolin or clindamycin if penicillin allergy is present.

Ensure the patient is symmetrically supine on the operating table, with arms either abducted to 45 degrees or crossed over the abdomen, while padded and secured with tape or elastic wrap. The entire chest to umbilicus is prepared with povidone-iodine (Betadine) or chlorhexidine solution. Lidocaine 1% with epinephrine is infused into the intended incision sites bilaterally.

Incise through subcutaneous tissue down to the pectoralis fascia. Perform glandular release up to the nipple–areolar complex if the dual-plane II procedure is needed. Elevate and divide pectoralis insertions inferiorly starting laterally and extending medially to about the fourth interspace. Subpectoral pocket dissection is then performed with electrocautery according to the preoperative determination of breast footprint. Sizers are placed and the operative table back raised to determine adequacy of size and symmetry.

Once appropriate size is determined, 3-0 Vicryl sutures are placed through the fascia superiorly, fibrofatty tissue/rib periosteum inferiorly to facilitate pocket closure after implant placement. The implant pocket is then irrigated with betadine and then triple antibiotic solution of cefazolin (Ancef), bacitracin, and gentamicin (assuming no contraindications).

Implant is placed and 3-0 Vicryl sutures are then tied. 3-0 Monocryl and 4-0 Monocryl are then used to close both the deep and superficial dermis and cyanoacrylate glue is applied over the incision. A surgical support bra is placed finally.

Postoperative Care and Expected Outcomes

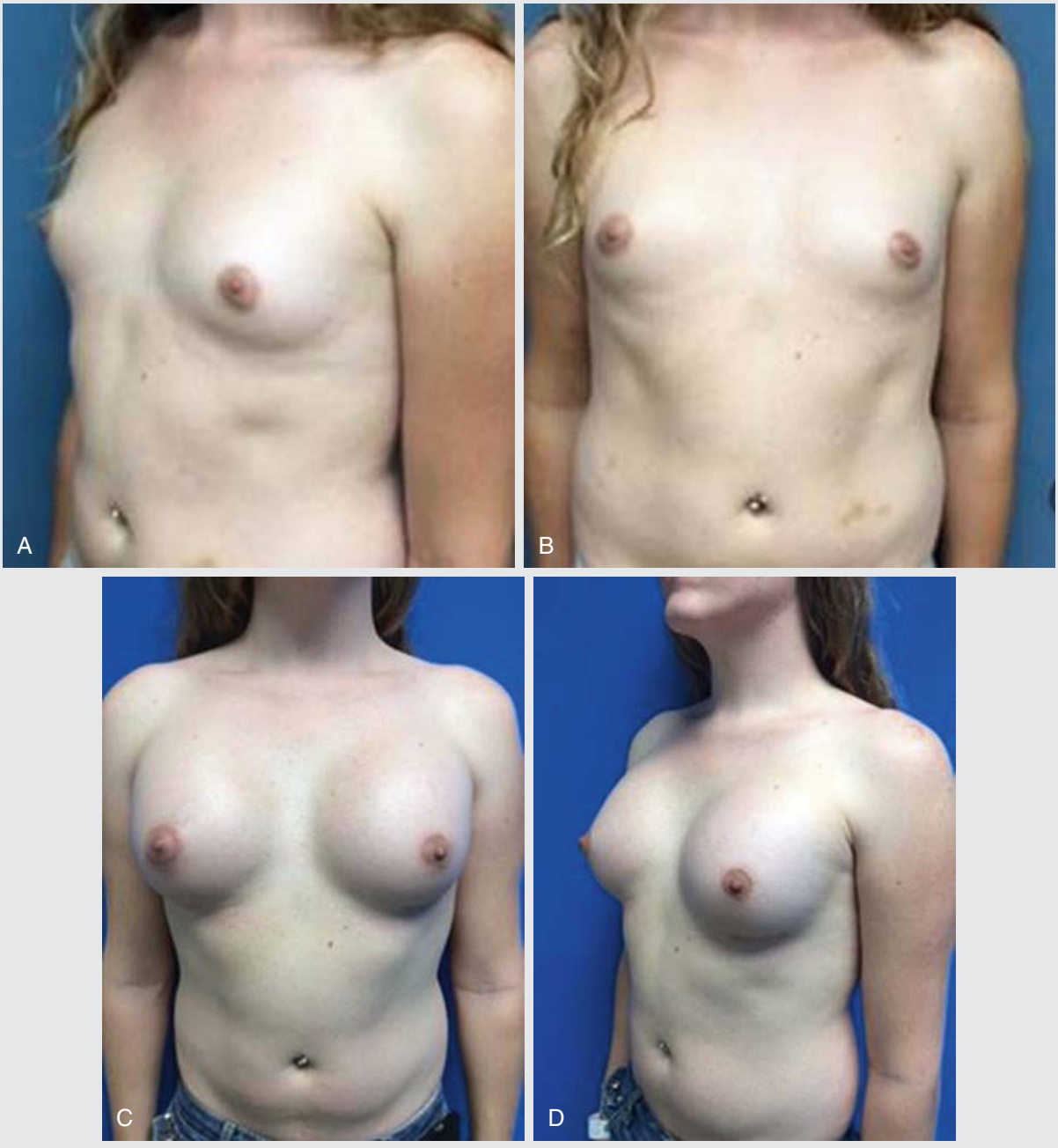
The surgical bra is usually the only dressing required postoperatively. Depending on vertical displacement of the implants, superior pole compression using foam tape or an elastic bandage can be used to apply gentle but constant downward pressure on the implants. Patients are usually instructed to avoid shoulder abduction beyond 45 degrees for the first 2 weeks, along with avoidance of strenuous activity and heavy lifting for 6 weeks. They are encouraged to ambulate as soon as possible postoperatively. Augmentation mammaplasty can be safely performed as an outpatient procedure; however, each patient should be risk stratified accordingly.

The literature does not support prolonged antibiotics; however, most plastic surgeons will administer postoperative oral antibiotics. We also administer a muscle relaxant to be used as needed (PRN) for the first 5 postoperative days.

Case Examples

CASE 25.1

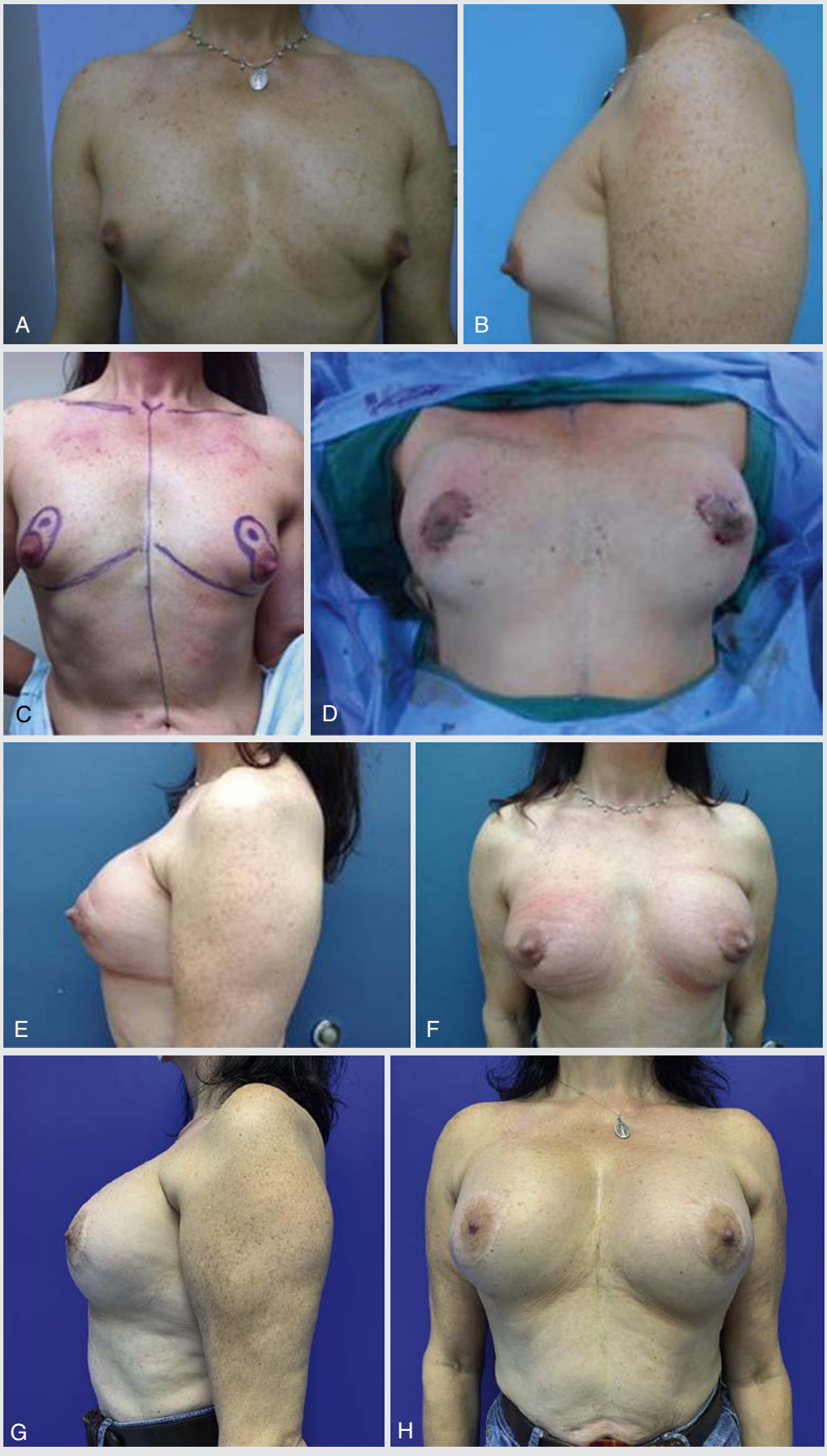
A 28-year-old trans-female patient presented with hypomastia, widened nipple-to-nipple distance, and constricted lower pole (Case 25.1A, B). Postoperative photographs demonstrate dual-plane placement of 450-cc round silicone implants (Case 25.1C, D).



• **Case 25.1** Preoperative view of a male-to-female patient (Case 25.1A, B). Postoperative view of the same patient after placement of implants (Case 25.1C, D).

CASE 25.2

A 43-year-old trans-female patient presented with ptotic and lateral nipple areolar complexes. She underwent dual plane silicone breast augmentation via a lower periareolar approach with bilateral mastopexy to raise and medialize the nipples. (Case 25.2A, B).



• **Case 25.2** Preoperative view of a male-to-female patient (Case 25.2A, B). Preoperative markings (Case 25.2C). Postoperative view of the same patient (Case 25.2D–H). 9 years postop, lateral and frontal views, respectively (Case 25.2G-H).

Management of Complications

Complications from augmentation mammaplasty can be stratified into both early and late categories. Early complications include hematoma, infection, wound breakdown, and venous thromboembolism. If a hematoma is identified, it must be addressed with immediate return to the operating room for a washout at minimum, and less likely control of any potential ongoing bleeding. A hematoma washout is crucial to decrease the risk of long-term capsular contracture.

If postoperative infection is of concern, the surgeon should keep a low threshold for hospital admission and placement on intravenous antibiotics. If clinical suspicion is present for an underlying infection process, breast ultrasound can be obtained, and return to the operating room for incision and drainage as well as prosthesis removal is paramount. Clinical examination findings with concern for dehiscence or overlying skin envelope compromise can be managed expectantly with local wound care involving topical antimicrobials and/or enzymatic debridement as needed. However, if implant exposure is present, prompt return to the operating room must be carried out, with possible implant exchange and primary closure if possible.[9]

The most frequently encountered late complication is capsular contracture. The degree of capsular contracture should be determined, and if found to be a Baker grade III or IV, operative management is indicated. This usually necessitates implant removal, capsulectomy, pocket closure, and new pocket placement. Some might consider the use of acellular dermal matrix placement as well. Other late complications include implant malposition, which is also addressed by operative management for better pocket definition with capsulotomy, capsulectomy, capsulorrhaphy, and/or fat grafting.

Secondary Procedures

As mentioned previously, most of the late complications of augmentation mammaplasty are addressed by reoperation. It is important to make patients aware that studies have shown the re-operation rate to be as high as 30% in the first 7 years after augmentation.[9] The secondary surgical procedures are determined by the nature of the long-term complaint (e.g., capsular contracture, implant malposition, rippling).

Preoperative Evaluations for Female-to-Male Transgender Patients

Subcutaneous mastectomy is performed for each patient. Each patient's breast volume, degree of excess skin, nipple–areola complex size and position, and skin elasticity are evaluated preoperatively to determine which subcutaneous mastectomy technique will be used.[6] Patients with smaller breasts are candidates for the semi-circular technique.[7] In cases of smaller breasts with large prominent nipples, the trans-areolar technique is used. In breasts with a medium-size skin envelope or smaller breasts with poor skin elasticity, the concentric circle technique is a good option. For better exposure and excision of greater amount of excess tissue, an extended concentric circle technique can be performed. Finally, for large ptotic breasts the double-incision free nipple graft technique is the technique of choice.[10]

Surgical Techniques

Relevant Surgical Anatomy

Attention should be given to the location of the nipple–areola complex and borders of the pectoralis major muscle.

Preoperative Markings

We begin by marking the midline from the sternal notch to the umbilicus. We then mark the native IMF bilaterally.

If performing a free nipple graft, we perform a pinch test and mark the planned superior aspect of the resection in the preoperative holding area. Additionally, we mark the planned location of the nipple 4 cm above the IMF and approximately 11 cm lateral from the sternum.

Surgical Exposure

For each of the five techniques the way we obtain surgical exposure differs slightly. For the semi-circular technique an incision is made along the lower half of the nipple–areola complex to expose the breast parenchyma. For the trans-areolar technique an incision is made through the areola and nipple transversely.

For the concentric circle technique, two incisions are made, one around the nipple–areola complex to set the desired circumference and a second circular or elliptical incision through the dermis that will set the tightness of the skin. The full-thickness incision to access the breast parenchyma is made through the inferior aspect of the outer circle.

With the extended concentric circle technique the exposure is similar to the concentric circle technique, with an additional incision lateral to the nipple–areola complex to resected skin and subcutaneous tissue.[10] With the double-incision free nipple graft technique exposure is through the superior incision.

Details of the Procedure

We begin by ensuring pneumatic compression stockings are in place before induction of anesthesia, because these patients are at a higher risk of venous thromboembolism. Preoperative antibiotics are administered, consisting of cefazolin or clindamycin if penicillin allergy is present. Ensure patient is symmetrically supine on the operating table, with arms either abducted to 45 degrees or crossed over the abdomen, while padded and secured with tape or elastic wrap. The entire chest to the umbilicus is prepared with povidone-iodine or chlorhexidine solution.

With each of the five mastectomy techniques we cut down to the breast parenchyma via the incisions discussed earlier and try to preserve the subcutaneous fat while ensuring resection of all the glandular tissue. We raise the

mastectomy flaps to the clavicle superiorly, to the sternum medially, and laterally to the anterior axillary line. We raise the flap inferiorly past the IMF to break up the fold. Once the flaps are raised, we cut down to the pectoralis fascia and raise the breast tissue off the fascia, being careful to leave the fascia intact. The lateral extent of the incision is curved up along the lateral border of the pectoralis. This is especially important in preventing dog ears and the need for secondary procedures which can be encountered in the patient with excess skin and/or obesity. A 19-French drain is used. The differences in the surgical techniques of the five mastectomies we perform are as follows:

- Semi-circular technique
  - Glandular tissue is left under the nipple–areola complex to avoid depression.
  - The incision is closed with 3.0 Monocryl deep dermal sutures and a subcuticular running 4.0 Monocryl.
- Transareolar technique
  - The incision is made through the nipple–areola complex, and the breast parenchyma is resected as described previously.
  - The superior half of the nipple is resected, and the inferior half of the nipple is folded up. The resulting incision is across the nipple–areola complex and around the superior aspect of the nipple.
  - The incision is closed in layers.
- Concentric circle technique
  - The skin between the inner incision and outer incision is de-epithelialized.
  - A purse-string suture is placed and set to the desired areolar diameter (usually 25–30 mm).
  - Then 3.0 Monocryl deep dermal sutures and a subcuticular running 4.0 Monocryl are placed around the nipple.
- Extended concentric circle technique
  - Similar to the concentric circle technique, one or two additional triangular excisions of skin and subcutaneous tissue laterally and/or medially depending on how much excess skin there is to resect.
- Free nipple graft technique
  - We start by making an incision around the nipple–areola complex and remove it as a full-thickness skin graft. We place the nipple–areola complex on the back table.
  - Next we make the IMF incision and raise the flaps as previously described. In this case we also raise a skin flap inferior to our IMF incision.
  - Then we pull the skin from the superior mark down to the IMF to determine the extent of our skin resection. Once we determine what we can safely remove, we make the superior incision and remove the skin and breast parenchyma en bloc.
  - We then close the incision with 2.0 polydioxanone suture (PDS) followed by 3.0 Monocryl deep dermal sutures and a running 4.0 Monocryl subcuticular suture.
  - On the back table the nipple–areola complexes are defatted and thinned until they are transparent when held up to the light.
  - Next, we sit the patient up to determine the appropriate place for nipple placement. We place the nipples along the existing vertical nipple line which is approximately 3 cm medial to the lateral pectoral border and approximately 2–3 cm above the lower border of pectoralis major. This usually corresponds to the fourth or fifth intercostal space. The diameter of the nipple–areola complex is 20–25 mm and is cut while the area is stretched circumferentially.
  - The nipple–areolar complexes are then placed and trimmed to size. They are secured with 3.0 chromic suture, and a bolster is placed on top.

Postoperative Care and Expected Outcomes

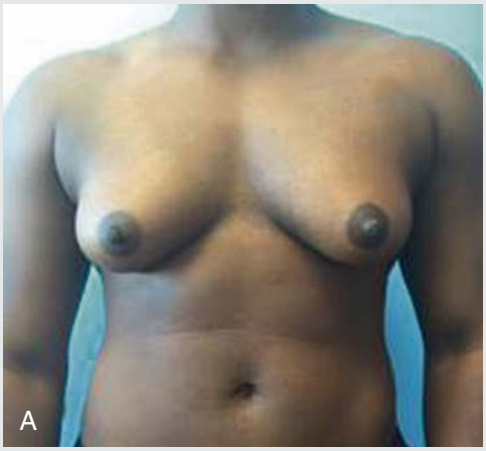
The patient's chest is wrapped circumferentially with a compression wrap on the operating room table. The patient is admitted for 23 hours of observation, and on postoperative day 1 the dressings are removed to evaluate the skin flaps and assess for hematoma. The wrap is replaced, and the patient is instructed to wear the wrap 24 hours a day for the next 4–6 weeks.

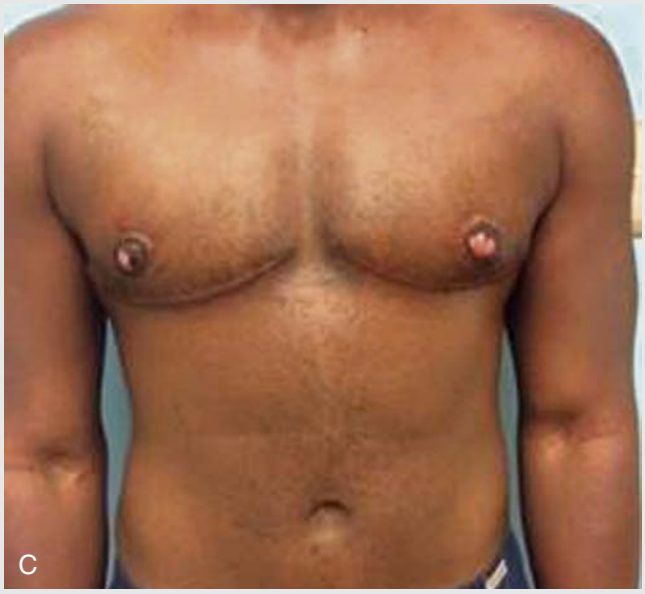
If a free nipple graft was performed, the drains remain until the output is less than 30 cc over 24 hours. Tie-over bolster dressings are removed in the office approximately 5 days postoperatively.

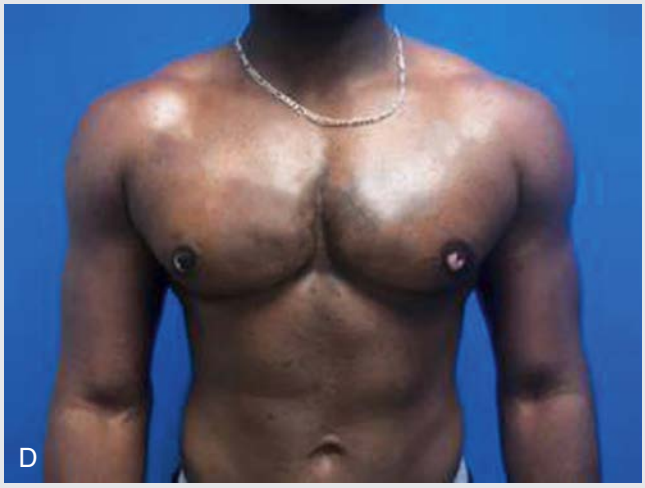
Case Examples

CASE 25.3

Preoperative view of trans-male patient demonstrating grade II ptosis with moderate skin excess (Case 25.3A–B). Postoperative view of the same patient (Case 25.3C-D) at 3 months and at 6 months after bilateral mastectomies with free nipple grafts.



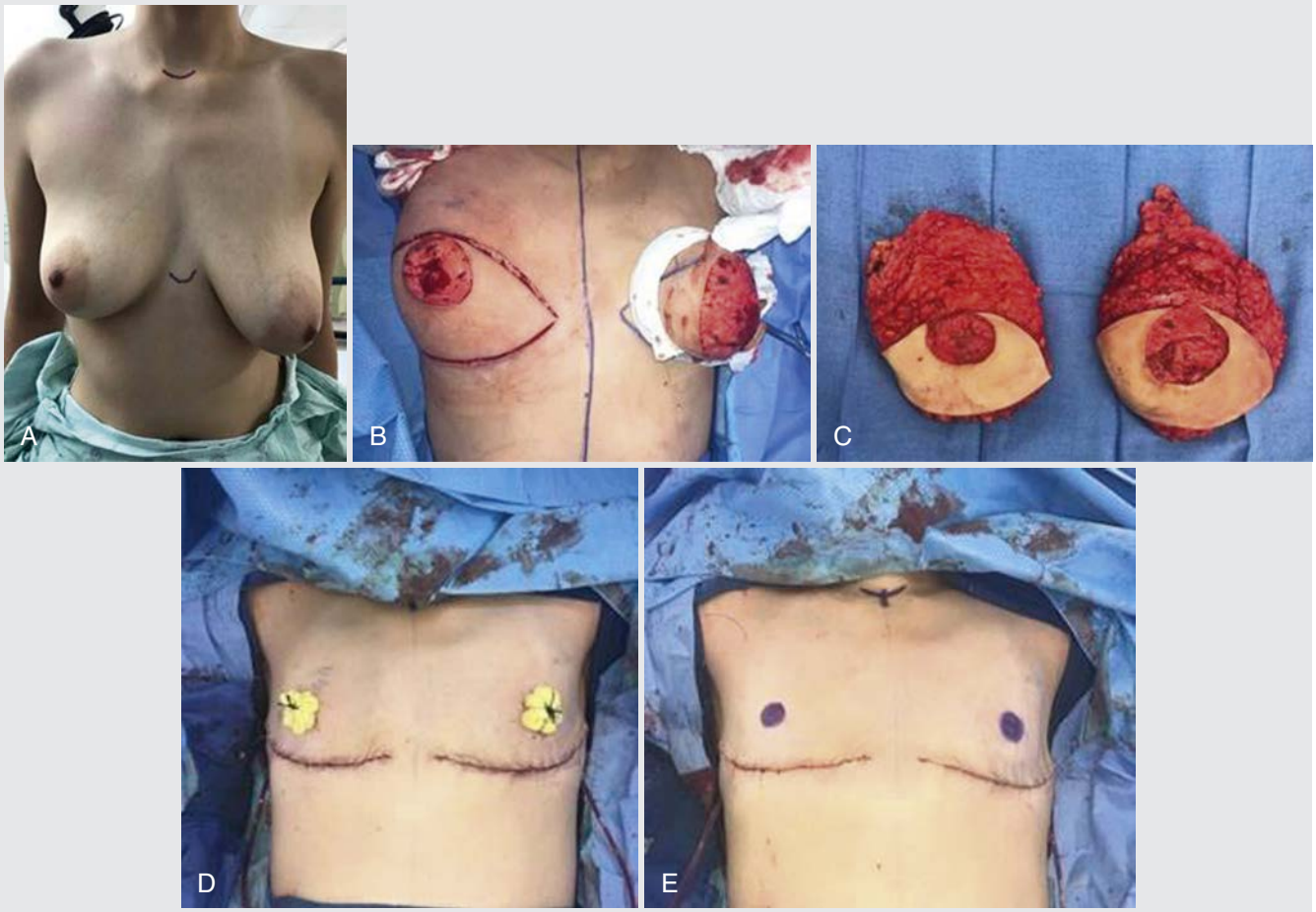




• **Case 25.3** Preoperative view of a female-to-male patient (Case 25.3A, B). Postoperative view of the same patient (Case 25.3C, D).

CASE 25.4

A 33 year-old female-to-male patient bilateral breast asymmetry with excess skin and left grade 3 ptosis. (Case 25.4A). A double-incision mastectomy with free nipple grafts was performed (Case 25.4B–D). Postoperative view (Case 25.4E).



• **Case 25.4** Preoperative view of a female to male patient (Case 25.4A). Surgical view during the procedure (Case 25.4B–D). Postoperative view of the same patient (Case 25.4E).

Management of Complications

The most common early complication is a hematoma. A small hematoma that is not compromising the skin flap can be evacuated through a small puncture without return to the operating room. However, larger hematomas require return to the operating room for evacuation.

Later complications include poor aesthetic outcomes, including contour abnormalities, issues relating to the nipple–areola complex, skin redundancy, and poor scarring, which may require further revision surgeries in the future.

Secondary Procedures

Secondary procedures in the female-to-male breast surgery are similar to those encountered in patients undergoing subcutaneous mastectomy with regard to known surgical complications that require operative management such as scarring, symmetry, or fat grafts to address contour defects.

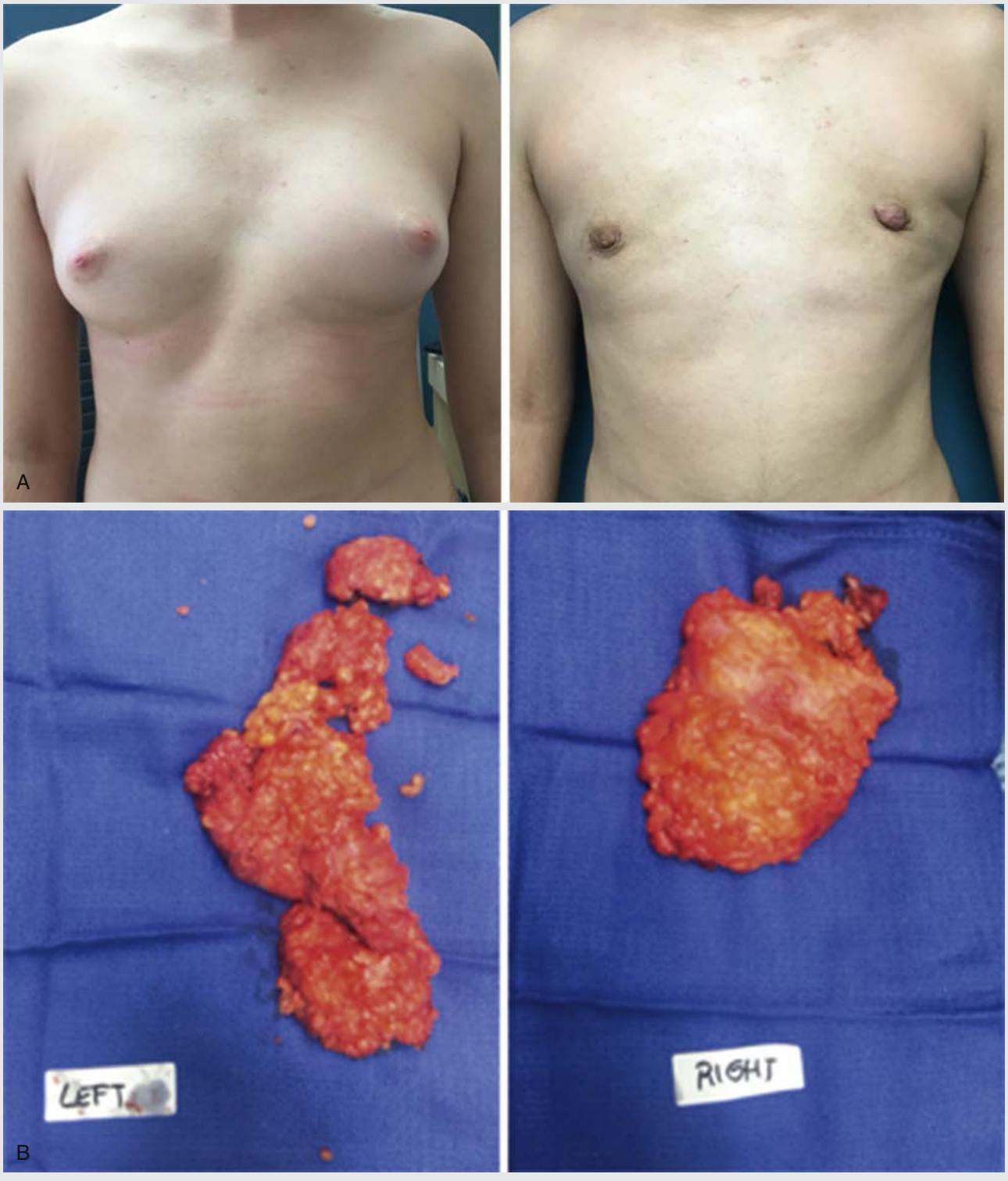
Conclusion

Top surgery allows patients to live more comfortably in their gender role and is generally the first surgical step in alleviating their gender dysphoria.[1] The creation of a male chest for a trans-man is achieved by subcutaneous mastectomy. A subcutaneous mastectomy involves removing excess breast tissue and skin, reducing the nipple and areola, obliterating the IMF, minimizing the appearance of scars, and possibly a nipple graft.

Trans-women generally undergo breast augmentation, keeping in mind that with hormone replacement therapy alone breast growth is poor. The choice of prosthesis should be guided by patient preference after the risks and benefits of both silicone and saline are explained by the plastic surgeon.[9] Typically because of their increased chest circumference a larger volume implant is chosen. A larger, wider implant may be needed because male anatomy is normally wider. Despite the difference in

CASE 25.5

22-year-old trans-male patient who underwent the semicircular technique for direct excision.



anatomy the technique used in a breast augmentation for a trans-woman is not very different from a female breast augmentation procedure. It has been our preference to proceed with silicone prostheses because of the softer postoperative texture and to use a retro-pectoral/dual-plane position for implant placement. Fat grafting also can be combined with a breast augmentation procedure using an implant to make the implant less visible and the aesthetic results more natural.

PEARLS FOR SUCCESS

- Transgender men commonly undergo simple or subcutaneous mastectomy.
- Male chest contouring usually involves the repositioning of the nipple–areola complex, or removing the original areola and replacing it with a nipple graft.
- Various techniques are available for subcutaneous mastectomy. The surgeon and patient will choose the most appropriate technique.
- Transgender women commonly undergo breast augmentation surgery.
- The prosthesis is chosen to fit the contour of the woman's breast by the surgeon according to the patient's desired appearance.
- Patients typically have been on a feminizing hormone protocol before evaluation by a plastic surgeon for augmentation mammaplasty.

Further Reading

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Note: Page numbers followed by 'f ' indicate figures, 't' indicate tables, and 'b' indicate boxes.

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