

how to

Perform

Operative Procedures in Breast Surgery



Dhananjay Kulkarni, Kenneth Elder,
Cameron Raine, and J. Michael Dixon

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Table of Contents

[Cover](#)

[Table of Contents](#)

[Title Page](#)

[Copyright Page](#)

[Foreword](#)

[Preface](#)

[1 Starting a New Breast Surgical Procedure](#)

[2 Pre-operative, Intra-operative and Post-operative Tips for Breast Surgery](#)

[3 Anatomy of Breast](#)

[Embryology](#)

[Breast](#)

[Suspensory Ligament of Cooper \(Astley Cooper in 1840\)](#)

[Grades of Ptosis](#)

[Regnault's Classification of Ptosis](#)

[Surface Marking for Breast](#)

[Planning Breast-Conserving Surgery](#)

[Axillary Tail of Spence \(Scottish Surgeon\)](#)

[Nipple and Areola](#)

[Arterial Blood Supply](#)

[Venous Drainage](#)

[Nerve Supply](#)

[Lymphatic Drainage of the Breast](#)

[Subareolar Plexus of Sappey](#)

[4 Breast Clinic Procedures](#)

[Fine-Needle Aspiration Cytology](#)

[Breast Core Biopsy](#)

[Punch Biopsy](#)

[Cyst Aspiration](#)

[Seroma Aspiration](#)

[5 Microdocheotomy and Total Duct Excision](#)

[Surgical Anatomy](#)

[Marking/Incision Planning](#)

[Total Duct Excision](#)

[Microdocheotomy](#)

[6 Sentinel Node Biopsy](#)

[Introduction](#)

[Anatomy](#)

[Internal Mammary Nodes](#)

[Targeted Axillary Dissection](#)

[7 Axillary Node Clearance](#)

[Introduction](#)

[Indications](#)

[Anatomy](#)

[8 Wide Local Excision of Breast Cancer](#)

[Introduction](#)

[Indications](#)

[Localisation](#)

[Preparation](#)

[Operative Technique](#)

[Cavity Margins](#)

[Closure](#)

[Complications](#)

[Post-operatively](#)

[9 Marking and Procedure of Mastectomy, Skin-Sparing Mastectomy, Goldilocks Mastectomy](#)

[Surgical Anatomy](#)

Marking/Incision Planning

10 Extended Latissimus Dorsi Myocutaneous Flap

Introduction

Indications

Contraindications

Anatomy

Operative Technique

Mini-LD Flap

11 Free Tissue Transfer in Reconstructive Breast Surgery

Introduction

Indications/Contraindications

Operative Technique

Post-operative Care

12 Autologous Fat Transfer in Breast Surgery

Introduction

Indications

Operative Technique

13 Local Perforator Flaps in Reconstructive Breast Surgery

Introduction

Indications

Preoperative Tips

14 How to Select an Implant in Post-Mastectomy Reconstruction

Breast Implant Types

Implant vs Expander?

15 Pre-pectoral Implant Reconstruction

Pre-Op Workup and Consent

16 Therapeutic Mammoplasty

Introduction

Indications

Pre-Op Workup and Consent

17 Nipple Reconstruction

Introduction

Operative Technique – Local Flap Technique

18 Management of Breast Infection

Introduction

Mastitis

Lactational Breast Abscesses

Non-Lactating Abscesses

Procedure for Abscess Drainage

19 Management of Unusual Presentations of Breast Cancer

Inflammatory Breast Cancer

Male Breast Cancer

Pregnancy-Associated Breast Cancer

Paget's Disease of Nipple

Occult Breast Cancer

Angiosarcoma of the Breast

20 Surgical Management of Metastasis of Breast Cancer and Local Recurrence

Local Recurrence After Mastectomy

Local Recurrence After BCS

Management of Lymphoedema Associated with Recurrence

Systemic Metastatic Disease

Anaesthesia in Palliative Surgery

Lung Metastases

Liver Metastases

Brain Metastases

Bone Metastases/Spinal Metastases

More Surgical Intervention

Conclusion

21 Management of Complications of Breast Surgery

[Haematoma](#)

[Seroma](#)

[Capsular Contracture After Implant Insertion](#)

[Implant Rupture](#)

[Indentation/Contour Deformity After Breast Surgery](#)

[Twitching/Animation Effect](#)

[Asymmetry](#)

[Morphoea of the Breast](#)

[Infection Post Breast Surgery](#)

[Breast Oedema](#)

[Damage to Intercostobrachial Nerve](#)

[Spontaneous Effusion Around Implant](#)

[Breast Implants and ALCL](#)

[22 Surgical Management of Congenital Abnormalities of the Breast](#)

[Introduction](#)

[Embryology](#)

[Congenital Abnormalities of the Breast](#)

[Congenital Abnormalities of Breast](#)

[Asymmetry](#)

[Abnormalities of Shape of the Breast](#)

[Lipofilling Tubular Breasts](#)

[Congenital Chest Wall Deformity](#)

[23 Landmark Surgical Trials, Studies and Papers in Breast Diseases](#)

[Appendix: History-Taking and Clinical Examination of Breast](#)

[History](#)

[Examination](#)

[WHO Surgical Safety Checklist](#)

[Index](#)

[End User License Agreement](#)

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Foreword

The appointment of specialist breast surgeons in the 1980s led to major changes in the surgical management of patients with benign and malignant breast conditions. These surgeons conducted randomized trials and demonstrated that breast-conserving surgery is as effective as mastectomy. They also embraced and coordinated with plastic surgeons and, together in the 1990s, developed what we now know as oncoplastic surgery. This combines cancer removal together with plastic surgery principles, with the aim of achieving complete local cancer removal with an excellent cosmetic outcome. Armed with the knowledge of optimising how the breast looks after surgery, this same approach has been applied to surgery for benign breast conditions. Therapeutic mammoplasty was an outcome of combining the best of plastic and breast cancer surgery, allowing patients even with large cancers to preserve their breasts. Having mastered tissue displacement, the era of tissue replacement emerged using local flaps and immediate lipofilling. Whereas for many years, surgery to the axilla in patients with operable breast cancer consisted of axillary clearance, studies showed that in real-time surgeons could identify which nodes drained the breast and so sentinel node biopsy was developed.

As the largest breast unit in the United Kingdom, the Edinburgh Breast Unit has been at the forefront of many of all these changes and advances. The volume of patients that we see has also allowed us to fine-tune the surgical operations we perform and to develop new procedures. The Unit was amongst the first to perform sentinel node biopsy and was the first to do a so-called Goldilocks mastectomy. As pioneers in fat grafting, the Unit was the first to perform breast-conserving surgery with immediate fat grafting and the first to perform latissimus dorsi with immediate fat grafting to allow a one-stage breast reconstruction without implants. The breast surgeons in Edinburgh have always done large volumes of mastectomy and immediate reconstruction and likely have the largest experience of using the full range of materials available for implant-based breast reconstruction. Quilting with barbed sutures has allowed us to do

mastectomies and axillary clearances without drains as a day case, which has been a huge benefit to patients. The range of procedures we perform and have developed has been possible only because of the full integration of breast and plastic surgery and the great support of management and anaesthetic colleagues.

This operative surgery book is unique in that its authorship is not only multi-generational but also incorporates the expertise of both breast and plastic surgeons. It is underpinned by experience and expertise gained over four decades of breast surgery in Edinburgh. The unit has many visitors from all over the world, and many have asked us to write down what and how we do certain operations and the tips we have learnt that allow us to get the results we do. It is for this reason that we decided to write this book. We dedicate the book to the many trainees who have spent time training with us over four decades, to our nursing, medical and support workers without whose help the operations we perform would not be possible and, most importantly, we dedicate this book to the many patients who have trusted us to perform their surgery.

Preface

Why did we decide that a new book on operations in breast surgery was needed? Well, it is something that we have been thinking about for some time. This book has evolved over many years and is our attempt to describe the best ways to achieve excellent outcomes for patients having breast surgery. Currently, there is no operative surgery book that reflects how we perform breast surgery or provides the tips we have found to improve patient outcomes. Good surgeons are good observers, and the best surgeons are good at taking the best of what they are taught and combining and improving these. We are fortunate to have worked with and discussed operative procedures with some of the best surgeons of our generation. This book takes the best of many surgeons, and we thank each and every one of them who we have worked with over the past four decades.

This book is written for the next and current generation of breast surgeons learning and performing the art of breast surgery. Hopefully by taking what the best of we do they can do what we have done and continue to improve the outcomes for patients having breast surgery. There are some important tools that breast surgeons need to operate optimally on the breast. When performing surgery, a variety of devices are available and we all have our favourites and you will need to find what works best for you.

Although written for you, the reader, we write it for the women and men having breast procedures performed. All patients undergoing surgery deserve the highest standard of care. How patients look after breast surgery is increasingly important, given the improving survival outcomes for patients with breast cancer. Having improved the length of life of patients survive, the aim has to be to optimise cosmetic outcomes so maintaining and even in some improving quality of life by good breast surgery. We hope that you, the reader, find this book helpful in delivering high standard care to those having breast surgery.

1

Starting a New Breast Surgical Procedure

Introducing a new surgical procedure to the breast service is always challenging. So here are some tips before you start on the journey:

- Assess the need for this procedure in your service, check retrospective audit/data of your hospital/unit.
- Assess local resources in the hospital and make sure it is feasible to introduce this procedure.
- Literature review and check national guidelines related to the procedure, and attend conferences.
- Discuss with your department and relevant specialities in the hospital the impact of introducing this procedure on workload, theatre time, etc.
- Apply for appropriate approvals (R&D, Ethics, etc.) if planning a research trial/audit or funding.
- Attend courses/workshops/cadaveric courses to learn the procedure.
- Watch operative videos online.
- Observer posts in specialised units who regularly performs such procedures.
- Get used to the anatomy while doing routine procedures like mastectomy and sentinel node biopsy (SNB)/axillary node clearance (ANC).
- Set up local guidelines, indications and contraindications for the procedure.
- Write a protocol and patient selection criteria document.
- **Multidisciplinary team:** Explain to your team the new procedure and its impact on the service.
- Prepare special consent forms and patient information booklets.

- Create a photo album (print/digital) for patients to see pre- and post-operative results.
- **Theatre coordination:** Arrange staff training and purchase new relevant equipment.
- Explain ward staff about the procedure and post-operative care.
- Video record in theatre (with appropriate consent) for future academic presentations.
- Technical consideration (two surgeons for the first few cases, joint procedures).
- Keep audit of the impact of change in practice and the new procedure on the service.
- Use PROMs (patient-reported outcome measures) questionnaire to record patient's experience and functional outcome, quality of life and cosmesis.
- Develop a network of surgeons/units in the local area who are interested in starting similar procedures and arrange meetings to discuss.
- Keep a long-term follow-up with these patients and arrange 'quality-of-life questionnaire' study.
- Publish your experience, audit when you have done enough cases.
- Organise training for trainees and other surgeons once the procedure is established.

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2

Pre-operative, Intra-operative and Post-operative Tips for Breast Surgery

- The journey of breast surgery begins once a diagnosis is established, and appropriate investigations are carried out.
- Breast cancer cases should be discussed in the multidisciplinary meeting (MDM) to formulate a plan of treatment.
- Other colleagues like plastic surgeons should be consulted for any alternative options of reconstruction, and a full spectrum of treatment options should then be discussed with the patient (oncoplastic MDM).
- If patient requires a wide local excision of cancer, then the oncoplastic level of procedure needs to be assessed:

Level 1 procedures are where less than 20% breast volume is excised. No skin excision is required.

Level 2 technique is where more than 20% breast volume is excised, requiring breast reduction or volume replacement techniques.

- Mastectomy with/without reconstruction (all options including implant and autologous reconstruction) must be explained to the patient when indicated.
- **Consent:** Make sure all the possible consequences and complications have been explained in detail. Patients must be provided with written information about the procedure. It is vital that the patients have consented to the procedure, intraoperative photography, tissue samples for research, etc.
- **Pre-operative marking:** Ideally, patients should be marked appropriately (right/left/bilateral) after checking their reports on the day of surgery. It is important to mark the incision site, boundaries of the breast tissue, important landmarks like inframammary fold (IMF), supra-clavicular notch, midline,

meridian of the breast, mid-axillary line, etc. in standing position.

- **Doppler scan:** If perforator flap is planned, then Doppler ultrasound must be performed in the morning and the location of perforator vessels marked (under anaesthesia, the signals are not audible due to lower blood pressure). Apply transparent dressing on the marked site.
- **Pre-operative huddle:** Explain to the team the procedure/procedures and all the equipment necessary. Make sure all the implants, sizers, mesh and acellular dermal matrix are in the theatre.
- **World Health Organization (WHO) checklist** (check for allergy, radiology and pathology reports, comorbidities): As per local protocol, go through a checklist and make sure you are performing the right operation, correct side, etc. (list attached in Appendix).
- **Display mammogram and ultrasound in theatre:** Always display the mammogram and ultrasound images in the theatre and check the location of the tumour etc. It also helps trainees to understand the procedure better.
- **Nerve blocks for breast surgery** (discuss with anaesthetist): Pectoral and serratus blocks are thought to reduce post-operative pain and even long-term chronic chest wall pain.
- **Position and draping:** The patients must be supine for most breast procedures with the arm on the operation side outstretched on an arm board with good support. The intravenous (IV) line must be secured on the other hand so it is not in the operative field. The drapes should cover the patient to maintain sterile field. Only the minimum necessary part must be exposed to avoid hypothermia. A warm blanket/convective temperature management system should be placed to maintain patients' core temperature throughout the procedure.
- **Incisions for breast surgery:** Usually, any incision along the dynamic lines of Kraissl (lines along the maximum resting skin tension) gives the best results. Avoid transverse incisions as they

run across these lines. The scars along Kraissl's line heal much better. In the axilla, these lines follow the hairlines. Also, circumareolar and IMF incisions give good access to tumours in every quadrant and also give good cosmetic results. For the IMF incision, mark the incision about 1 cm above the IMF, so the resulting scar does not get stuck to the chest wall and cause pain. It also means the scar does not get caught up in the bra strap.

- **Cautery setting:** The cautery should be set as per surgeon's choice, usually in the range of 20–30 (blend and fulgurate).
- **Intraoperative photography:** Documentation of procedures in the form of videos and intraoperative photographs is important. It helps in teaching and training and audits, publications, etc.
- **X-ray the specimen (discuss with radiologist if necessary):** The excised specimen, whether a wide local excision or reduction mammoplasty tissue or mastectomy specimen, all must be X-rayed to check if the right tissue has been excised and all the marker clips have been removed. The specimen X-ray is an important medico-legal document as well.
- **Specimen orientation for pathology:** All the specimens must be immediately orientated before handing over for fixing in the formalin. Either sutures or clips can be used for orientation. The usual way to orient the specimen is by placing one suture/clip anterior, two medial and three on the inferior surface of the specimen.
- **Weigh the specimen:** It is a good practice to weigh the specimen and write it down on the operation notes for future reference.
- **Mark the cavity with clips:** The wide excision cavity/site of tumour must be marked with clips. This helps to plan radiotherapy and deliver boost to this area. Also, if the patient needs re-excision of margins, these clips will guide regarding the location.

- **Tissue samples for research:** Make sure that patients are consented and collect fresh samples for research as per instructions.
- **Frozen section:** Frozen section is particularly helpful in assessing the margins of a wide local excision of breast cancer. If the facility is available, then discuss with the pathologist about the case before starting the operation.
- **Quilting:** Any potential cavity after breast or axillary surgery will fill up with lymphatic fluid, resulting in seroma. This in turn delays wound healing and subsequent cancer treatments. Sometimes, patients can also develop chronic seromas requiring repeat aspirations and further complications. So, in order to avoid fluid collection, the potential cavity must be obliterated. This can be achieved with the help of continuous or interrupted loose sutures between two raw surfaces using a barbed absorbable suture. This technique is called quilting, and it avoids seroma so effectively, to the extent that, in select cases, drains are not required even after mastectomy or axillary clearance.
- **Hydro-dissection:** Breast tissue and subcutaneous tissue of the skin are extremely vascular. This can lead to lot of oozing during the procedure. In order to minimise this happening, a mixture of saline (1 l), adrenaline (1 ampule) and local anaesthetic (40 ml of 0.5% chirocaine) agent is injected in the plane of operation between breast tissue and the skin or pre-pectoral plane. This causes vasoconstriction of the smaller vessels and reduces bleeding. Although this technique works well, patients can develop haematomas after surgery as these vessels open up when the blood pressure goes up.
- **Sutures in breast surgery:** Synthetic monofilament absorbable sutures 2-0 for subcutaneous and 4-0 for the skin. Barbed absorbable suture with continuous loose stitches are preferred for obliteration of cavities and ‘quilting’.
- **Meticulous haemostasis:** Haemostasis is essential in order to avoid post-operative haematoma. If patients get haematoma, they require a second procedure to evacuate the clots and the

cosmetic results are affected too. The cautery settings for any breast procedure should be set at 30–30 blend and fulgurate.

- **Tranexamic acid:** 1 g IV tranexamic acid injection can be given at the end of the procedure if there was lot of oozing from minor vessels and the wound still does not appear dry when closing. It can be particularly given for major procedures like mastectomy, mammoplasty or latissimus dorsi (LD) flap reconstruction where a significant subcutaneous raw area has been created. Always discuss with the anaesthetist if it is contraindicated.
- **Local anaesthesia** injection into surgical wound (helps in smooth reversal of anaesthesia and post-op recovery). If a drain is placed, then the local anaesthetic can be simply injected into the breast cavity through the drain and the drain should be clamped for about 30 minutes.
- **Drains:** Suction drains of closed systems are usually preferred in breast surgery. Place the drain in the cavity and secure it away from the skin incision with a drain stitch. Ideally, the drain should be anterior to the mid-axillary line so patients can sleep on their back without the drain poking them.
- **Dressing:** Multiple layers of skin glue and waterproof dressings are desirable so as to allow patients to have shower from day one after the surgery without getting the wound wet.
- **Glyceryl trinitrate (GTN) patch or ointment:** It improves the microcirculation by its vasodilator action and helps for survival of flaps such as mastectomy, LD or even perforator flaps. It can be applied as a transdermal ointment or patch for the first 24 hours after surgery. The patch should be removed if patient complains of headache, one of its side effects.
- **Post-operative instructions for the ward staff (blood loss etc.):** The operative notes must describe all the important steps during the procedure. The post-operative instructions like analgesia, antibiotics, thromboprophylaxis, IV fluids, drain chart monitoring and physiotherapy should be clearly documented.

- **Soft bra, prostheses:** Any patient having procedures like reconstruction, mastectomy and mammoplasty should be given a post-operative soft bra (without any wires or cups) for support. This itself will reduce the pain and analgesic requirement. Patients who have had a mastectomy should be offered a soft prosthesis. This helps reduce the psychological trauma following surgery.
- **Analgesia:** Adequate analgesia as per local protocol is essential for quick recovery. The patients will be encouraged to mobilise and do the physiotherapy exercises if they are pain free. Oral analgesia including 300 mg gabapentin as loading dose and 100 mg OD for four to six days can be considered, especially for major procedures like mastectomy and LD flap reconstruction.
- **Anti-coagulants:** There is good evidence that thromboprophylaxis in the form of calf compression (during procedure), stockings and low-molecular-weight heparin injections after surgery help reduce the chance of deep venous thrombosis (DVT) and pulmonary embolism (PE).
- **Antibiotics:** Antibiotics are not necessary unless patients have an implant reconstruction or some specific indication. A single IV broad-spectrum antibiotic injection during the operation can be given depending on local protocol. If operating on an infected or potentially vulnerable area such as mammary fistula, then antibiotics can be used locally (cefuroxime vial for IV use is preferred. Sprinkle the powder from the vial into the wound before closure), although the evidence for this practice is sketchy. Some surgeons also use a bowl of saline and gentamycin mixture to wash the implant before insertion to minimise the chances of infection.
- **Physiotherapy:** Immediate mobilisation, arm and shoulder exercises are very important for recovery (especially following any axillary procedure) and avoid stiff shoulder and restricted movements later on.
- **Wound check and seroma aspiration:** Patients are typically assessed 10 days to 2 weeks following the surgery in the outpatient clinic. Any dressings must now be removed for

wound check. If there is any seroma collection, it could be aspirated. Many patients are likely to require post-surgery treatment like chemotherapy and radiotherapy. So, it is vital that the wound has healed well and that there is no collected fluid under the scar.

- **Silicone tape and gel:** Silicone scar tape or gel can be applied to wounds every day for 10–12 weeks after the surgery. Usually, breast wounds heal very well, and these tapes or gel are not necessary. But these can reduce scar formation (probably by retaining moisture in the wound and reducing collagen formation) in LD flap wounds or abdominal wounds following deep inferior epigastric perforator (DIEP) procedure, thus giving better scars. Sometimes, these products can cause itching and bad odour.
- **Negative-pressure wound dressing:** These are silicone dressings connected to a pump, which maintain a negative pressure, decrease tension on the wound, remove moisture, increase blood flow and thus help in the healing of closed surgical wounds and prevent infection. They are usually used in DIEP abdominal wounds, mammoplasty wounds, etc. when an increased risk of wound infection is suspected due to comorbidities.

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3

Anatomy of Breast

Embryology

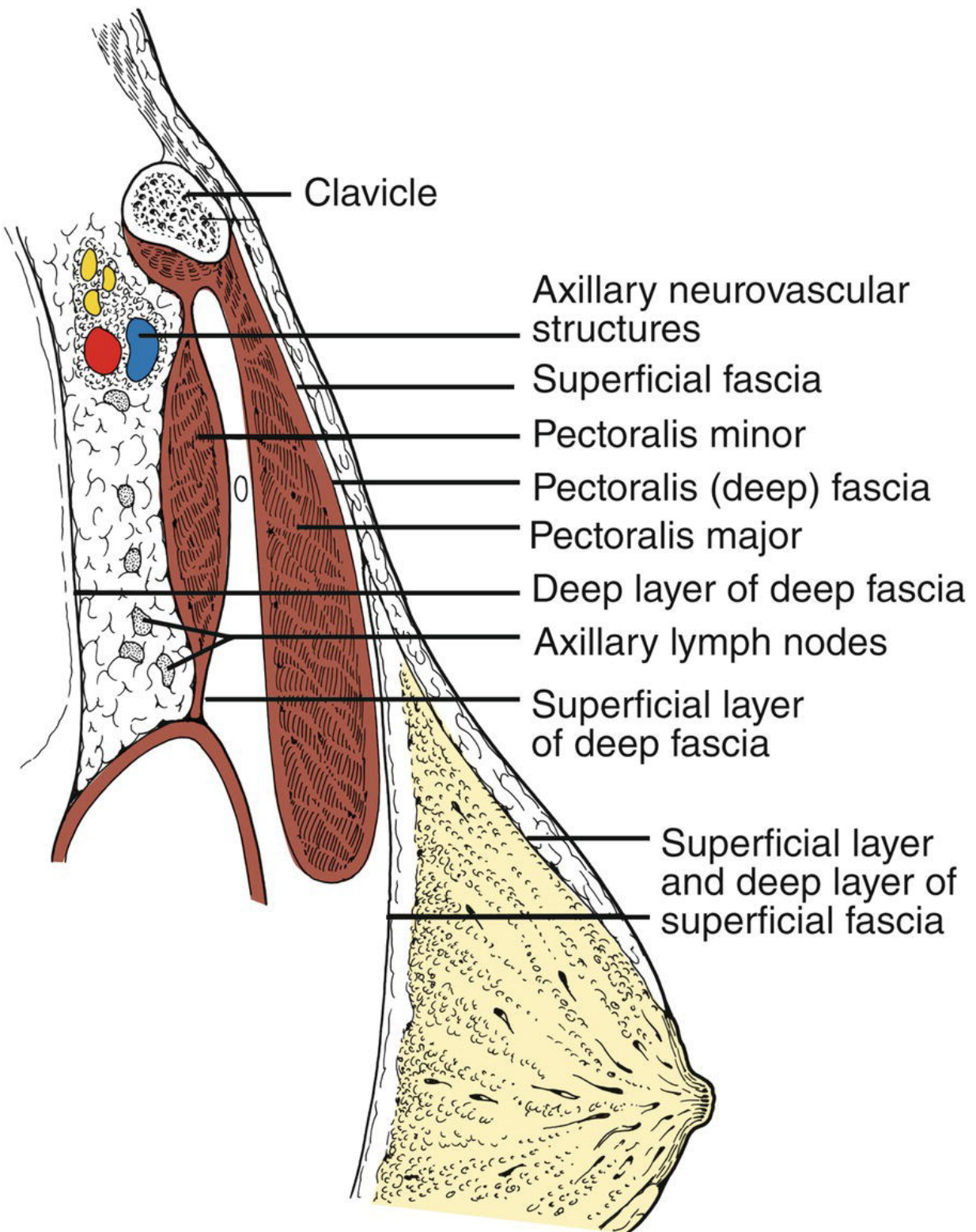
The breast is a modified apocrine gland. During four to six weeks of gestation, an ectodermal 'mammary ridge' or the 'milk-line' develops that extends from the future axilla to groin.

The epithelial cords appear as 15–20 buds. These buds disappear or coalesce in the human embryo, and usually, one bud that is in the 4th or 5th intercostal space persists and develops into mesoderm as mammary ducts by 15–20 weeks (same process in male and female).

The nipple and areola develop from the ectoderm at the junction of 15–20 lactiferous sinuses, which arise from the ducts.

The breast tissue undergoes lobular proliferation in females at puberty when the breast buds develop into adult-size breasts; the process is called thelarche.

Breast



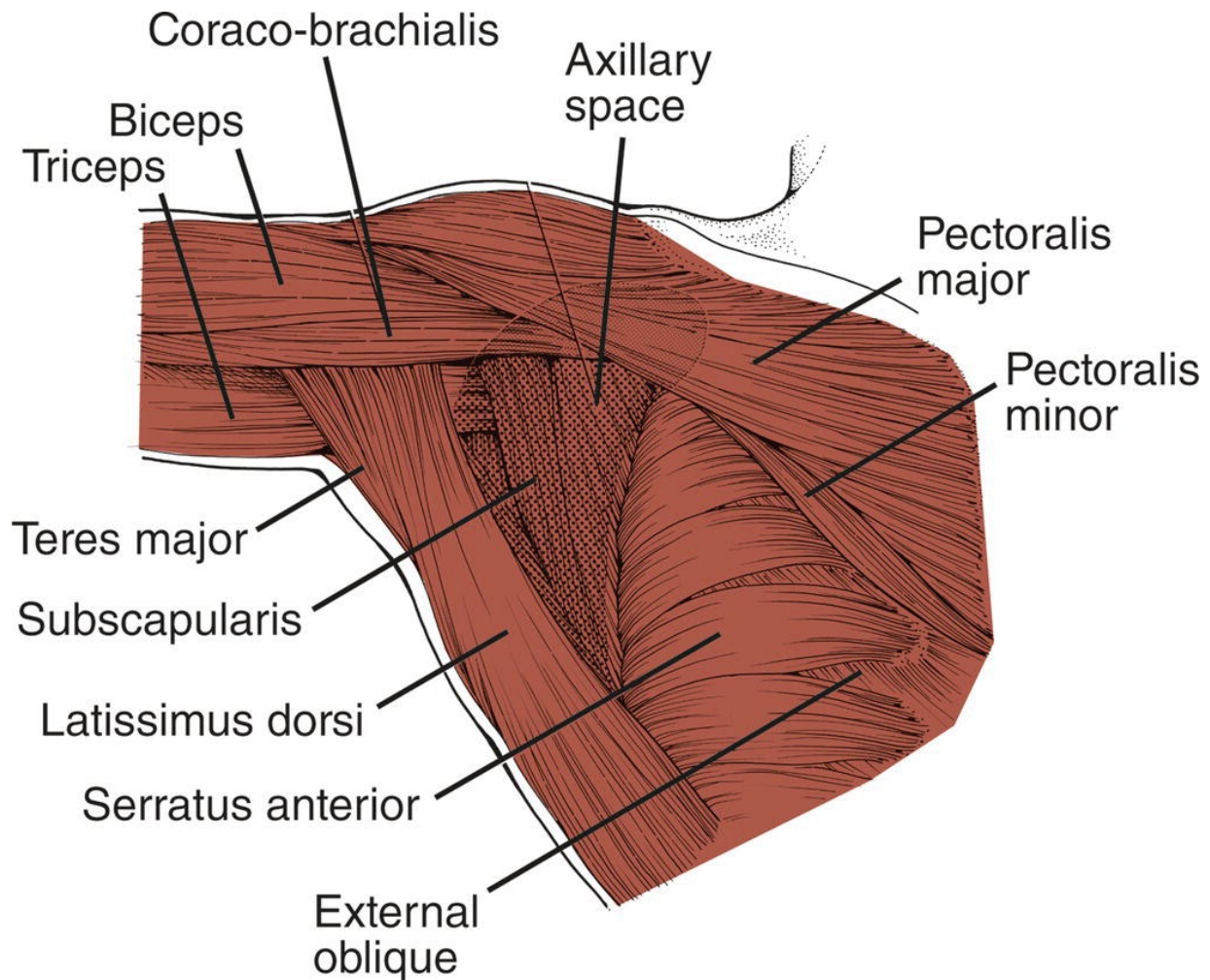
Anatomy of the breast

Modified sweat gland/apocrine gland/mammary gland that is situated within the superficial pectoral fascia. The superficial fascia splits to enclose the breast to form the anterior and posterior lamellae.

Extent: Vertically: 2nd to 6th ribs (from the clavicle above to the 7th/8th rib below)

Horizontally: Midline/lateral border of sternum to mid-axillary line

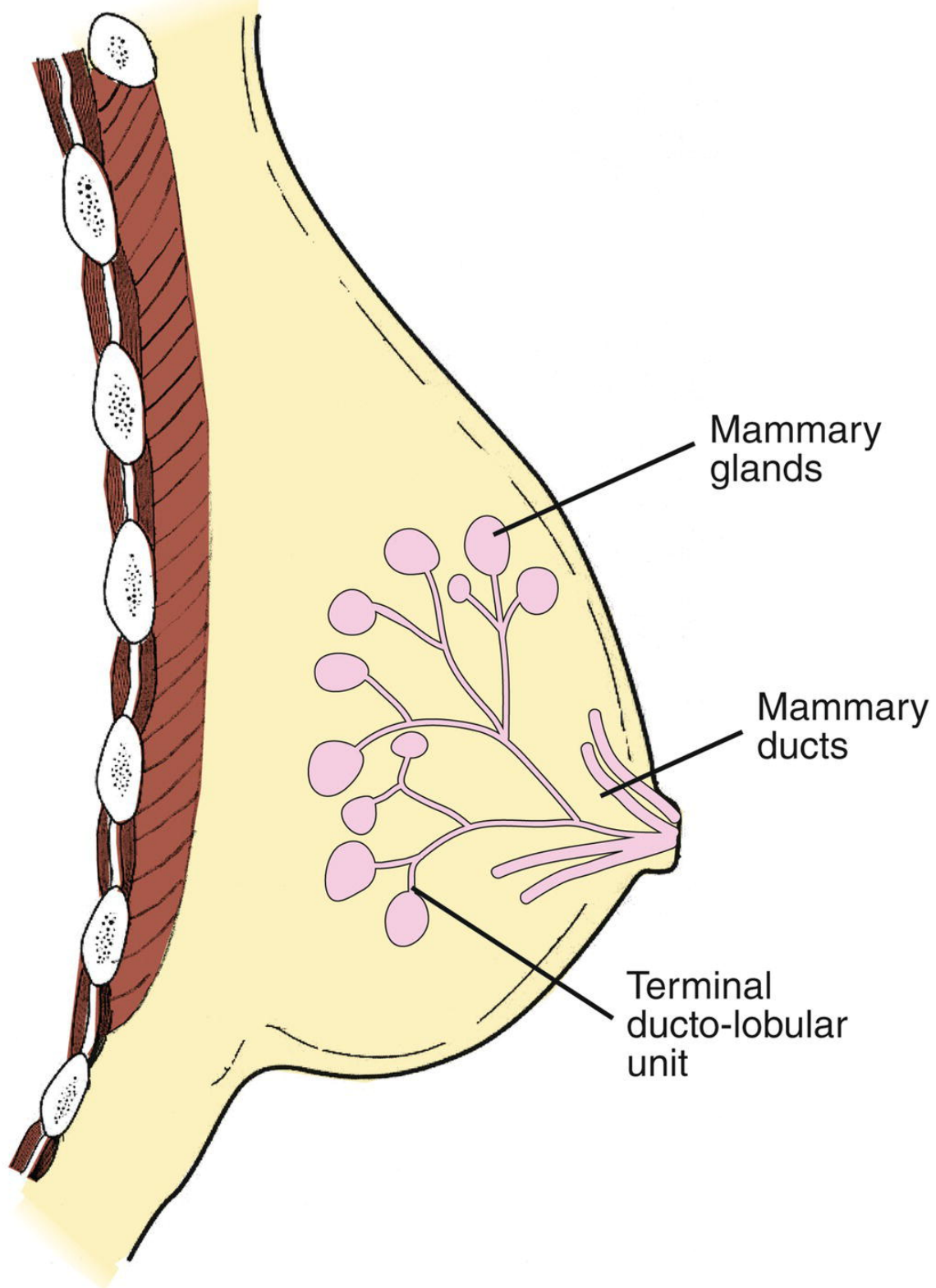
Breast tissue lies on the pectoralis major, serratus anterior and rectus abdominis muscles, and the floor is formed by the deep pectoral fascia.



Anatomy of the breast and axilla

The size and weight of breast tissue vary, ranging from <100 to >2000 g each. There are about 15–20 mammary ducts starting at each nipple, leading to the terminal duct lobular unit at the periphery. The rest of the tissue is formed of fibro-fatty tissue, with lymphatics and blood vessels forming the supporting tissues around mammary ducts and ducto-lobular units.

Lobes: 15–20 in number, composed of glandular structures called lobules, which empty via ductules into lactiferous ducts. The lactiferous ducts, draining each lobe of the breast, pass through the nipple and open onto its tip as 15–20 orifices. At the tip, these ducts contain an ampulla.



Suspensory Ligament of Cooper (Astley Cooper in 1840)

Anchored to the pectoralis fascia by the suspensory ligaments. These run throughout the breast tissue parenchyma from the deep fascia beneath the breast and attach to the dermis of the skin. Being somewhat lax allows for the natural motion of the breast. Relax with age and time, eventually resulting in breast ptosis.

Grades of Ptosis

Breast ptosis is the inferior descent of the nipple relative to the IMF and the lower pole. It is associated with breast size, ageing, weight loss, pregnancy and menopausal hormonal changes.

Regnault's Classification of Ptosis

Minor ptosis (1st degree): Nipple at IMF

Moderate ptosis (2nd degree): Nipple below IMF but above lower breast contour

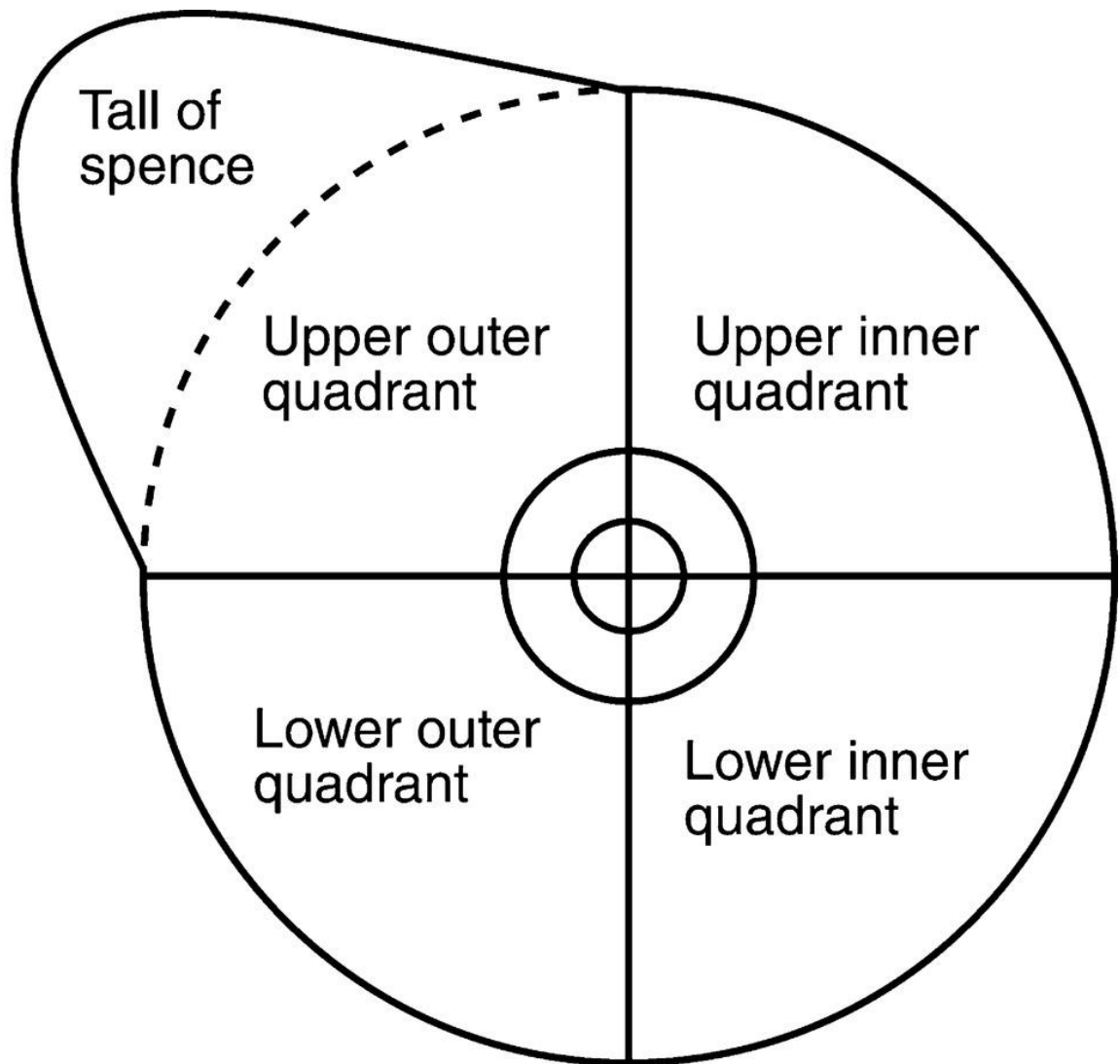
Severe ptosis (3rd degree): Nipple below IMF and at lower breast contour

Glandular ptosis: Nipple above IMF, but breast hangs below fold

Pseudoptosis: Nipple above IMF, but breast is hypoplastic and hangs below fold

Surface Marking for Breast

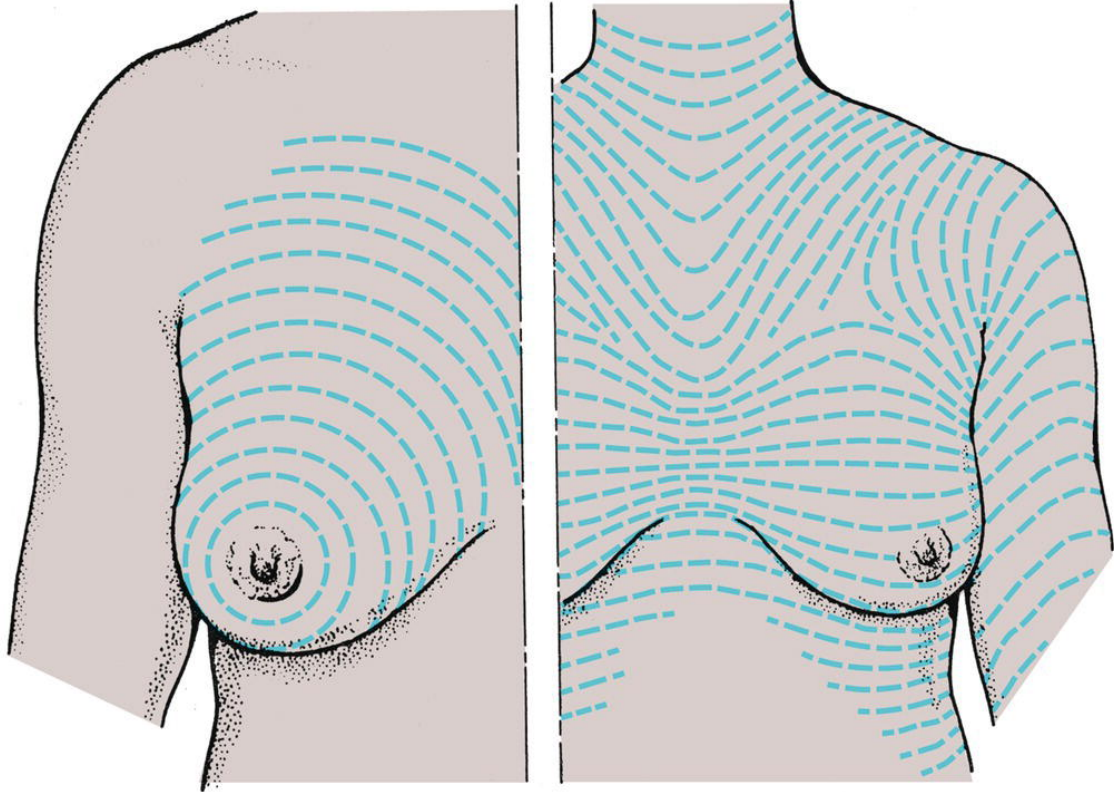
Naming the quadrants for the purpose of describing a lump: upper medial, upper lateral, lower medial, lower lateral, central



Anatomy of the breast

Planning Breast-Conserving Surgery

Incisions: Along Langer's lines or Kraissl's lines



Langer's lines

Kraissl's lines

Langer's lines: (Karl Langer in 1861) Skin tension lines due to collagen. Any incision along these lines exerts minimal tension across the wound.

Kraissl's lines: 'Wrinkle lines' are secondary to underlying muscle actions, correlating well with natural skin crease lines at rest and during movement. More commonly used in breast surgery.

Axillary Tail of Spence (Scottish Surgeon)

Extends under the axilla beyond the pectoralis major, may extend through the deep fascia up to the apex of axilla. Sometimes mistaken for the lymph node on clinical examination

Nipple and Areola

It consists mostly of collagenous dense connective tissue and numerous elastic fibres, which wrinkle the overlying skin. Usually lies above the inframammary crease, level with the 4th rib (just lateral to the mid-clavicular line). The average nipple to sternal notch measurement in a youthful, well-developed breast is 21–22 cm. An equilateral triangle formed between the nipples and sternal notch measures an average of 21 cm per side. **Tubercle of Montgomery** on the areola.

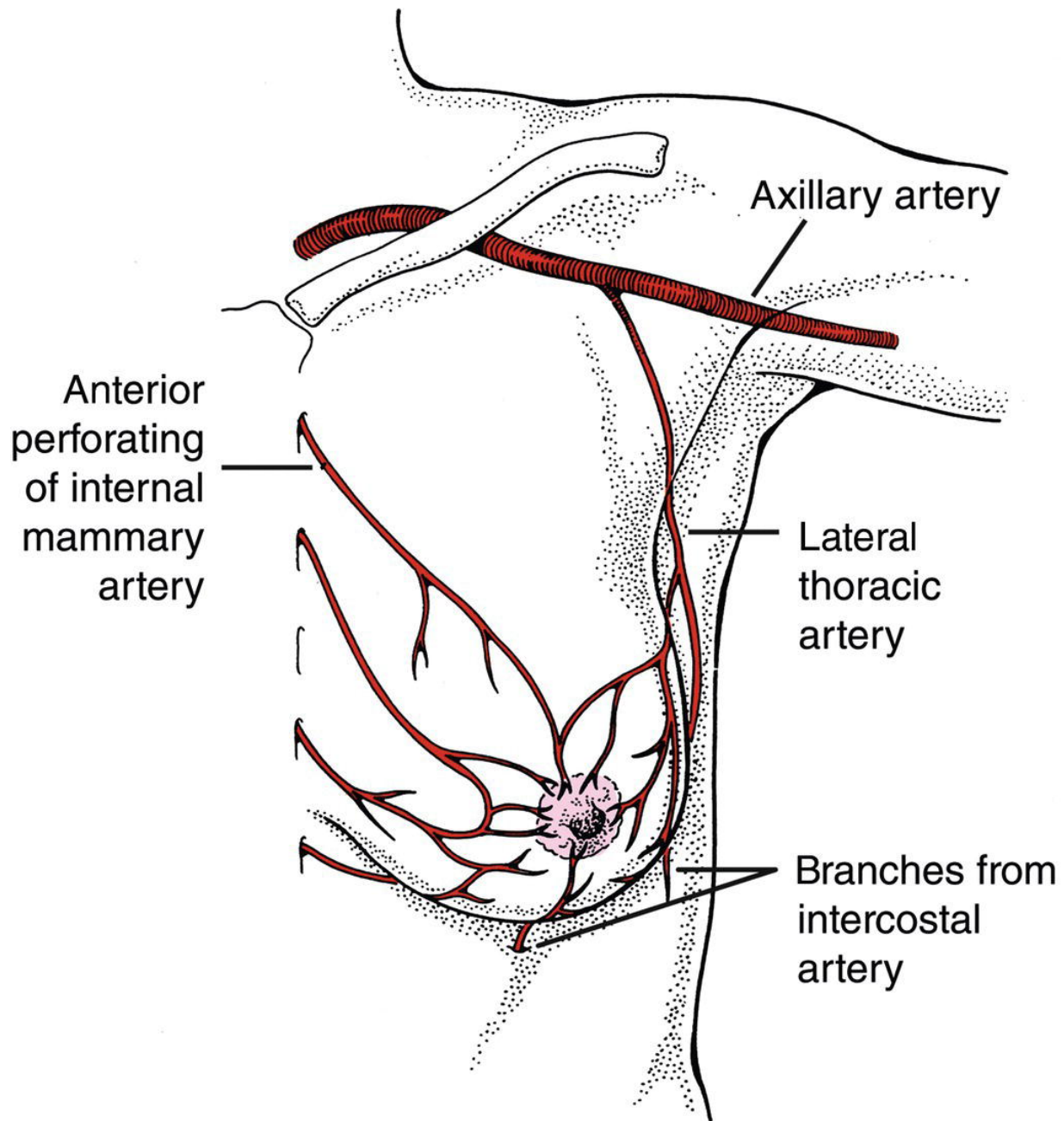
Nipple has blood supply arising medially from the internal mammary (IM) artery perforator branches (2nd, 3rd and 4th perforators). The 'superomedial pedicle' mammoplasty procedure is based on these vessels. Nipple also receives branches from the lateral thoracic and thoracoacromial arteries (superolateral aspect), and the intercostal arteries supply anteromedial and anterolateral aspects of the nipple.

As the nipple has end arteries, there is some concern about using local anaesthetic agent with adrenaline. To be safe, some surgeons prefer using agents without added adrenaline.

The techniques of nipple discharge cytology and breast duct micro-endoscopy have been described for the diagnosis of underlying pre-malignant/malignant changes in the lining cells of the mammary ducts.

Arterial Blood Supply

Axillary artery: Superior thoracic, thoracoacromial artery, lateral thoracic artery, subscapular artery. Internal thoracic: Perforating branches to the anteromedial breast. 2nd to 4th anterior intercostal arteries: The 2nd perforating artery is usually the largest; supplies the upper region of the breast, the nipple, areola and adjacent breast. Posterior surface is relatively avascular. Medially: From perforating branches of the IM artery that arise from the lateral margin of the sternum penetrating through the deep surface of pectoralis major. These branches are often encountered at the medial most dissection in a mastectomy.



Arterial supply of the breast

Laterally: The lateral thoracic artery, which is usually the 2nd branch of the axillary artery, follows the lower border of pectoralis minor before supplying the superolateral aspect of the breast; these branches are often encountered when dissecting the axillary tail of the breast.

There are in addition (particularly in the lower pole of the breast) perforating branches of intercostal arteries (often encountered in the posterior dissection plane of a mastectomy) that are used in inferior breast reduction pedicles.

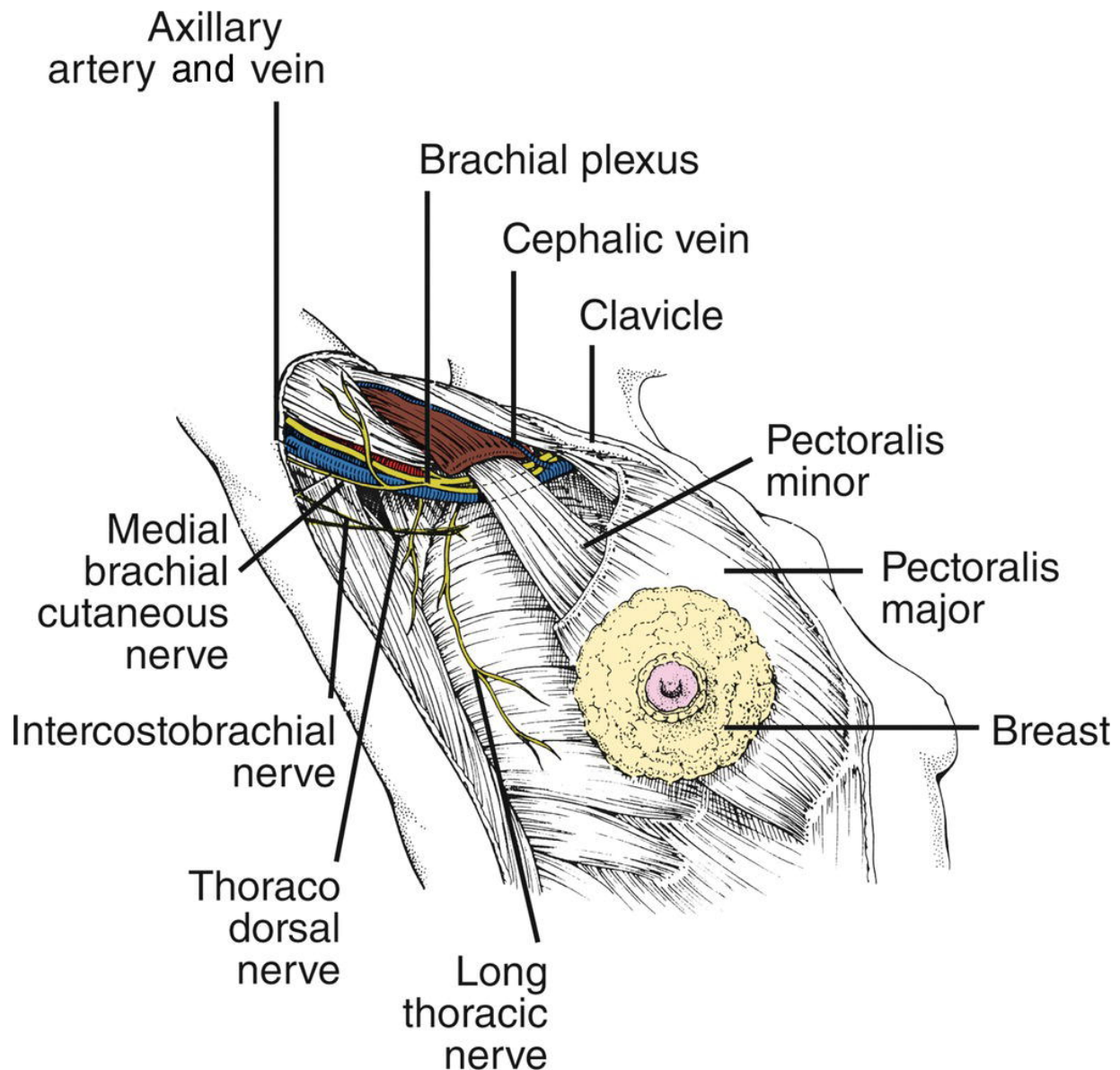
The chest wall perforator flaps used in breast reconstruction are based on perforator branches arising from lateral intercostal artery perforator (LICAP), lateral thoracodorsal artery perforator (LTAP), thoracodorsal artery (TDAP) and anterior/medial intercostal artery (AICAP/MICAP) perforators. The perforators are typically located about 1–2 cm posterior to the lateral mammary fold and about 2–3 cm anterior to the posterior axillary fold from 3rd to 7th intercostal space (LICAP, LTAP and TDAP) and 1–2 cm inferior to IMF at 6 o'clock (AICAP) and 2–3 cm lateral to sterna edge (MICAP).

Venous Drainage

Veins follow the arteries. First converge around the nipple to form an anastomotic venous circle and then form two sets of veins.

Superficial veins: drain into the internal thoracic vein and superficial veins of the lower part of the neck. Deep veins: drain into internal thoracic, axillary and posterior intercostal veins. Intercostal veins communicate with the vertebral veins. This route is thought to be responsible for metastasis of CA breast to vertebral bodies, sacrum and pelvic bones. There is a subcutaneous plexus that is richest around the nipple areolar complex, and this drains medially to the IM vein. Laterally and deep veins drain into the azygos and vertebral veins and subsequently into the inferior vena cava (IVC).

Nerve Supply



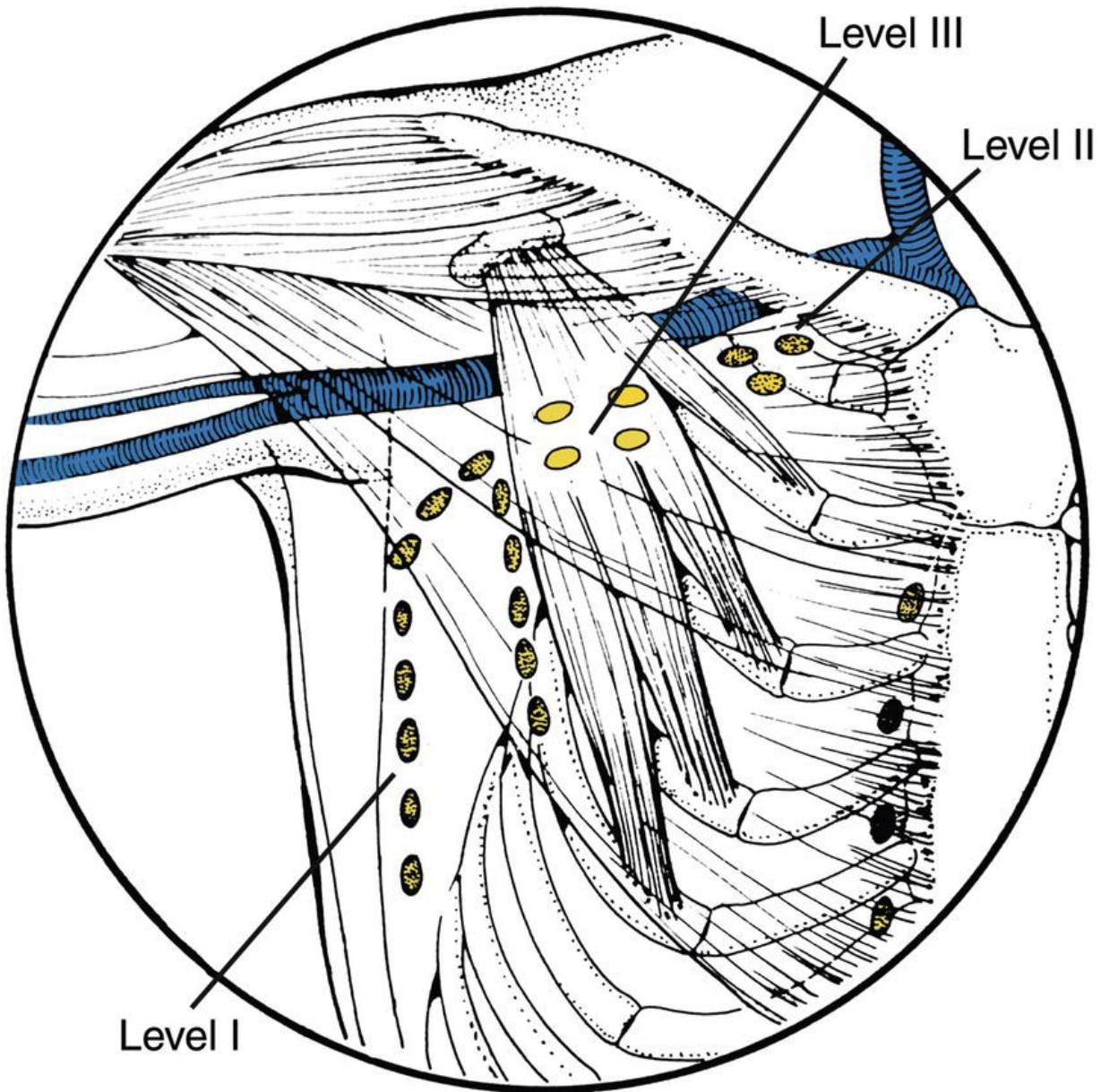
Anatomy of the breast

4th to 6th intercostal nerves by their anterior and lateral cutaneous branches. The nipple is supplied from the anterior branch of the lateral cutaneous branch of T4 (the concept of sensation-preserving mastectomy and allografting is based on this nerve).

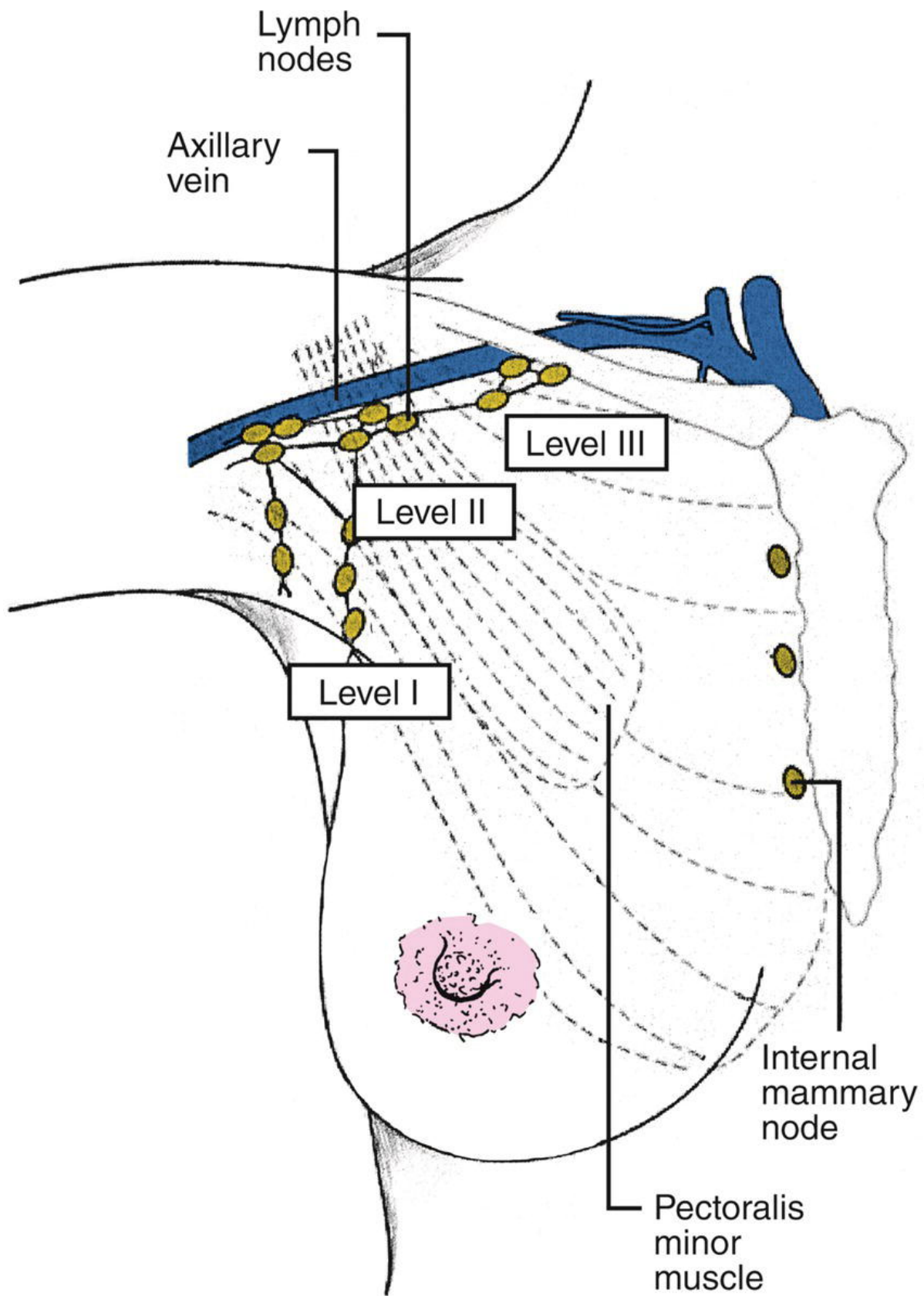
Forms an extensive plexus within the nipple; its sensory fibres terminate close to the epithelium as free endings, **Meissner corpuscles** and **Merkel disc** endings. These are essential in

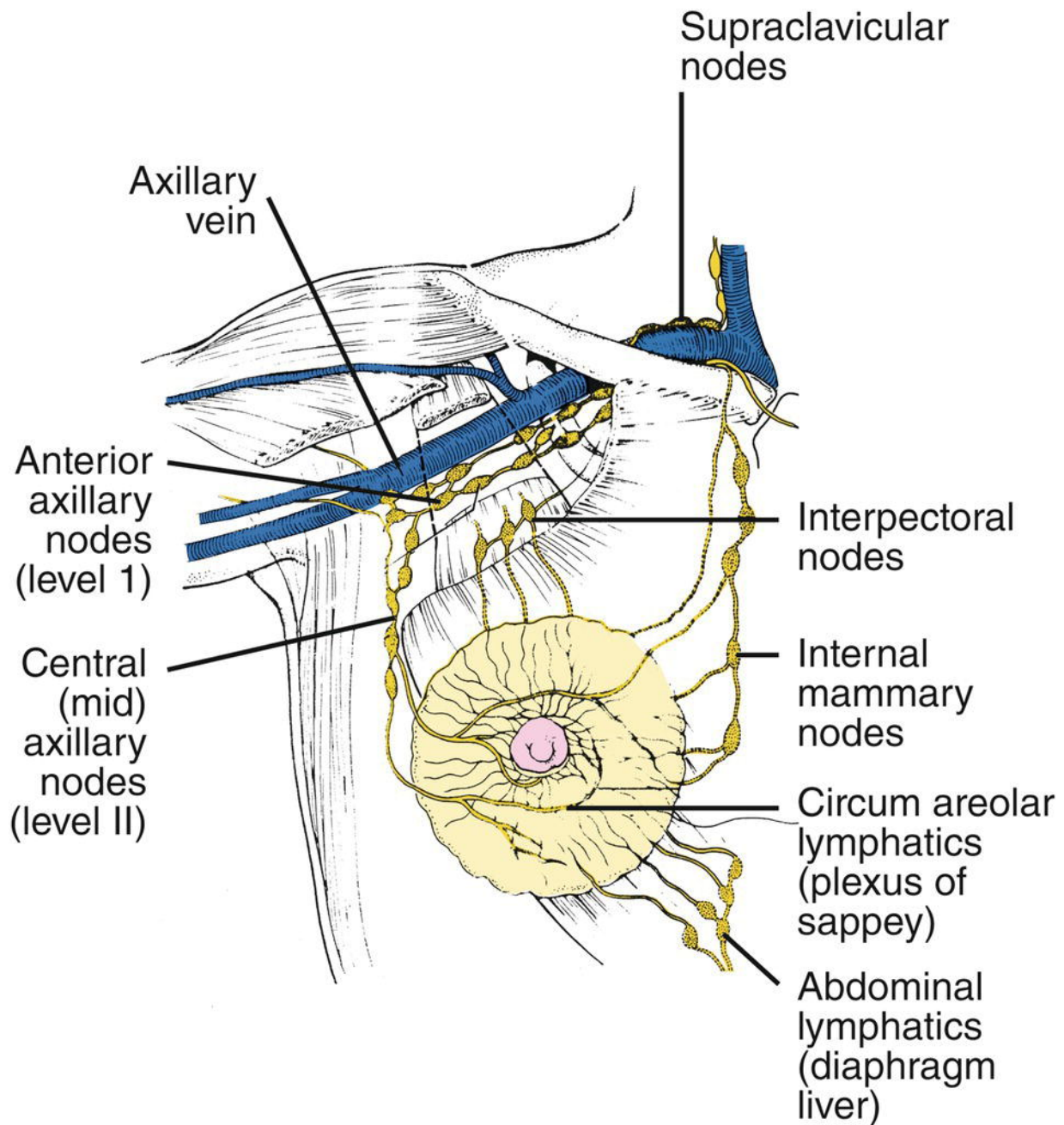
signalling suckling to the central nervous system. The areola has fewer sensory endings.

Lymphatic Drainage of the Breast



Lymphatic drainage of the breast





Anatomy of the breast and axillary nodes

The breast is originally an ectodermal tissue; thus, its lymphatic drainage is mostly parallel to the lymph flow of the overlying skin. The lymphatic flow of the breast is of great clinical significance because metastatic dissemination occurs principally by the lymphatic routes. Superficial lymphatics: skin over breast, except nipple and areola; Deep lymphatics: parenchyma as well as nipple and areola.

Subareolar Plexus of Sappey

Network of lymphatics in the areola (French Anatomist **Marie Philibert Constant Sappey**, who published his comprehensive atlas in 1874). It is a good site for injecting dye during an SNB.

Breast lymphatic drainage is 85% to axillary nodes, 10–15% to IM nodes and 5% to the retromammary pathway to **Rotter's nodes** along the thoracoacromial vessels and to the infraclavicular nodes.

There are between 15 and 40 nodes in axilla.

Axillary (85%): These are some 20–40 in number, grouped as:

Anterior: Lying deep to pectoralis major along the lower border of pectoralis minor

Posterior: Along the subscapular vessels

Lateral: Along the axillary vein

Central: In the axillary fat

Apical: Through which all the other axillary nodes drain, at the apex of the axilla above pectoralis minor and along the medial side of the axillary vein. Only the apical group is terminal.

IM/parasternal (10%): They are variable in number and lie along the IM vessels deep to the plane of the costal cartilages. Most are near the bifurcation of the intercostal and IM veins. IM node: Recurrence is rare, some emerging evidence suggests external beam radiation therapy (XRT) to IM nodes may improve outcome, degree of benefit of treating IM nodes unclear, drainage to IM nodes depends on where you inject. Not standard to excise IM sentinel nodes.

Others (5%):

Apical

Supraclavicular

Cephalic/deltopectoral

Posterior intercostal

Subdiaphragmatic

Subperitoneal

Efferent drain into the jugular veins. Interpectoral nodes
(Rotter's nodes): A few nodes lying between the pectoralis major and minor muscles. Supraclavicular and other nodes: Some lymph from the breast also reaches the supraclavicular nodes, deltopectoral nodes, posterior intercostal nodes, subdiaphragmatic and subperitoneal plexuses.

SNB: All the axillary nodes (drains 85% of the breast) are connected to one another, and breast cancer follows a pattern of spread from lower to higher nodes. So, if the lowermost nodes from the chain (sentinel or guard) are unaffected, then it is extremely unlikely that higher nodes are involved. Hence, the practice to check SNBs.

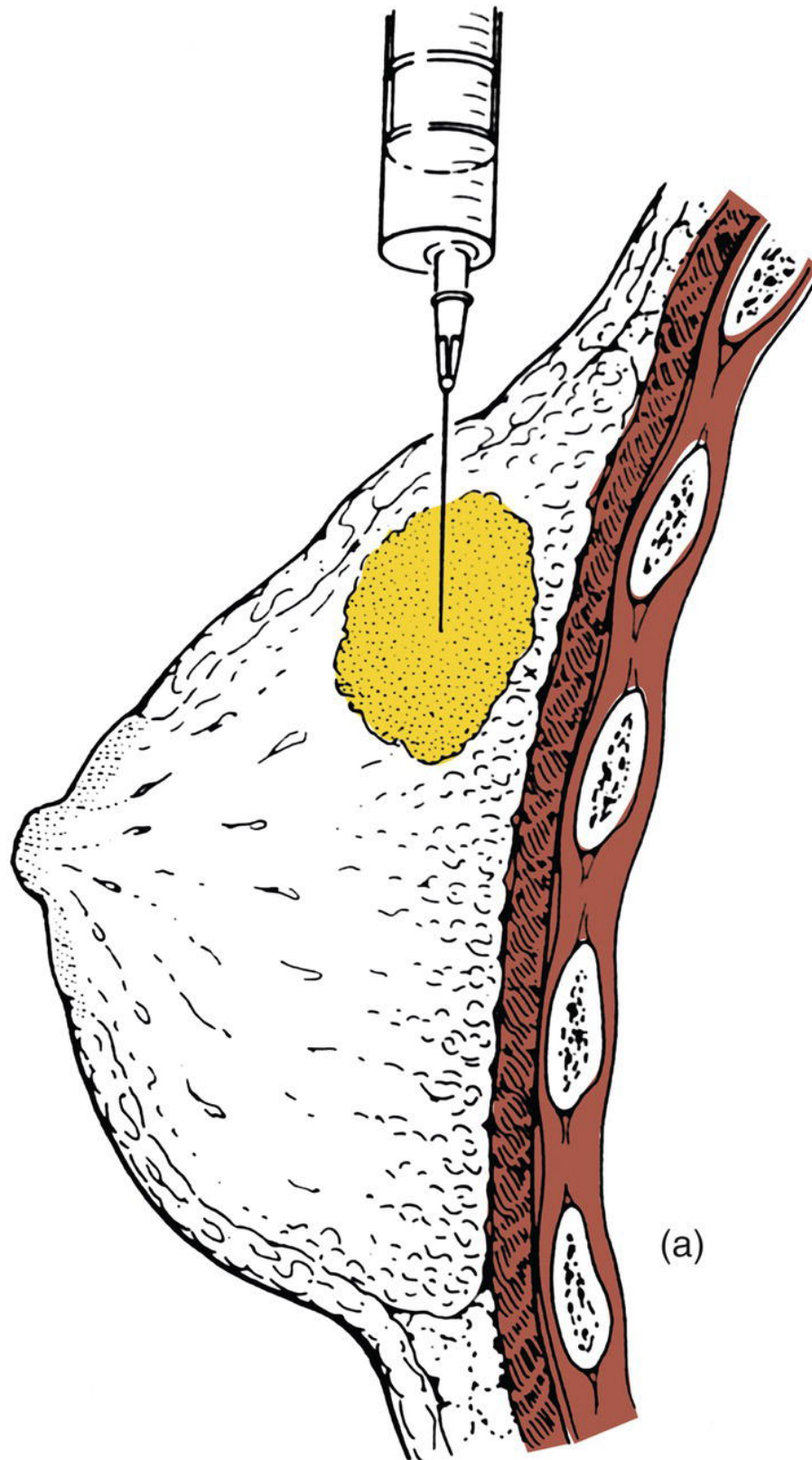
How to Perform Operative Procedures in Breast Surgery, First Edition. Dhananjay Kulkarni, Kenneth Elder, Cameron Raine and J. Michael Dixon.

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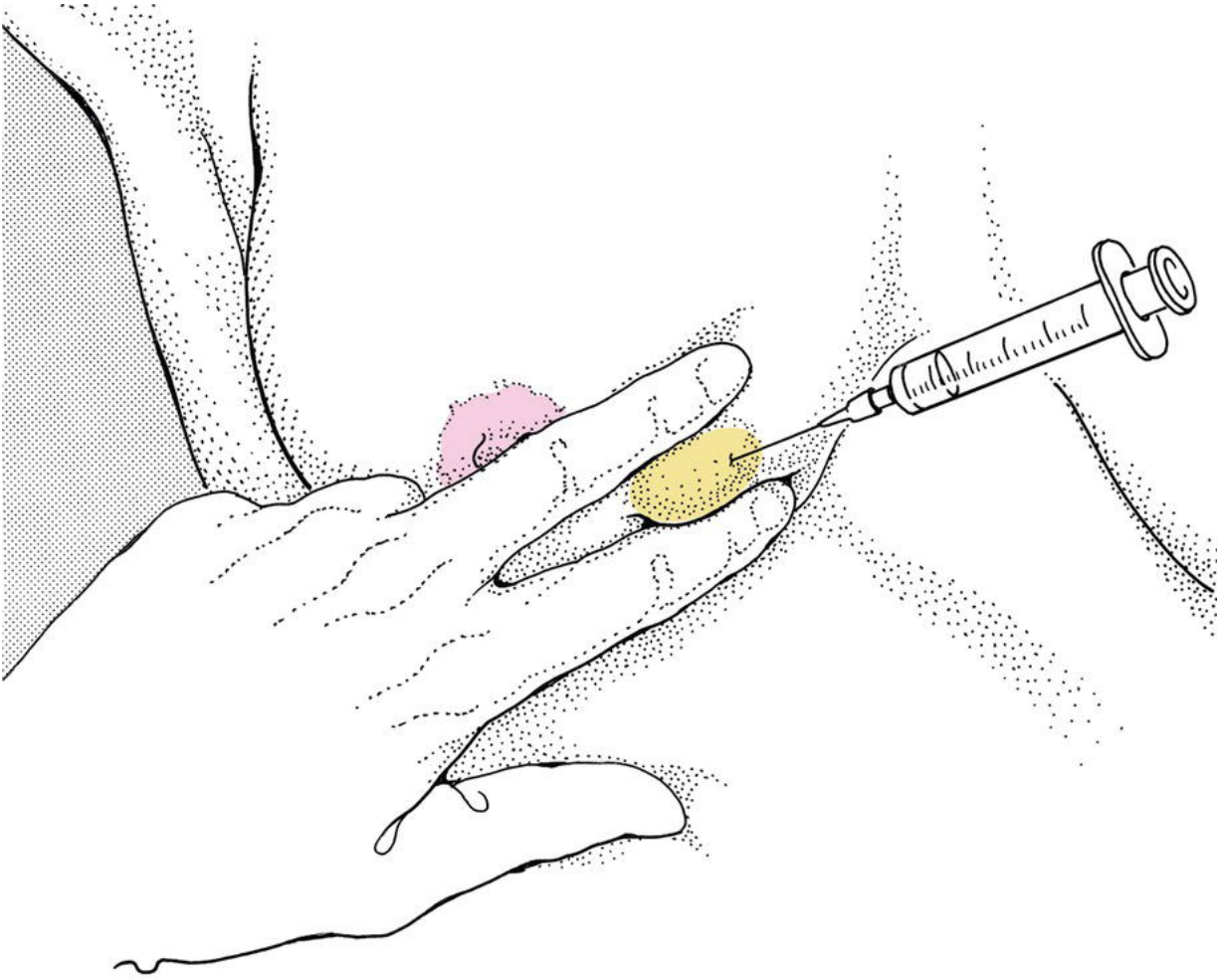
4

Breast Clinic Procedures

Fine-Needle Aspiration Cytology

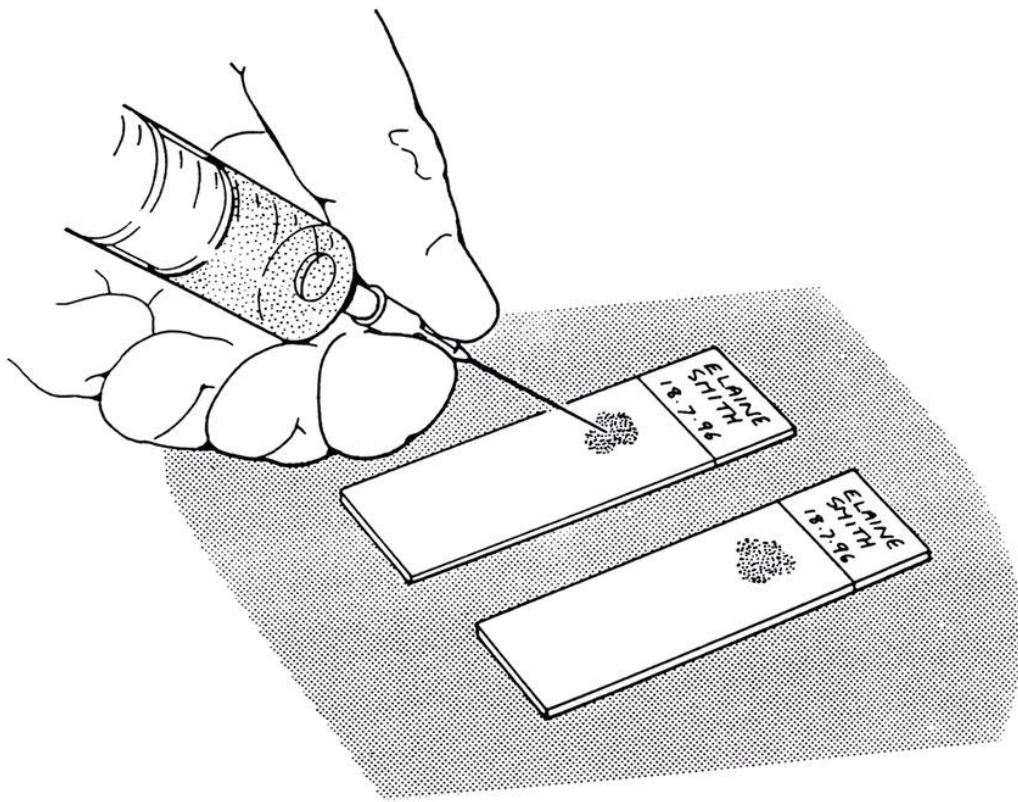
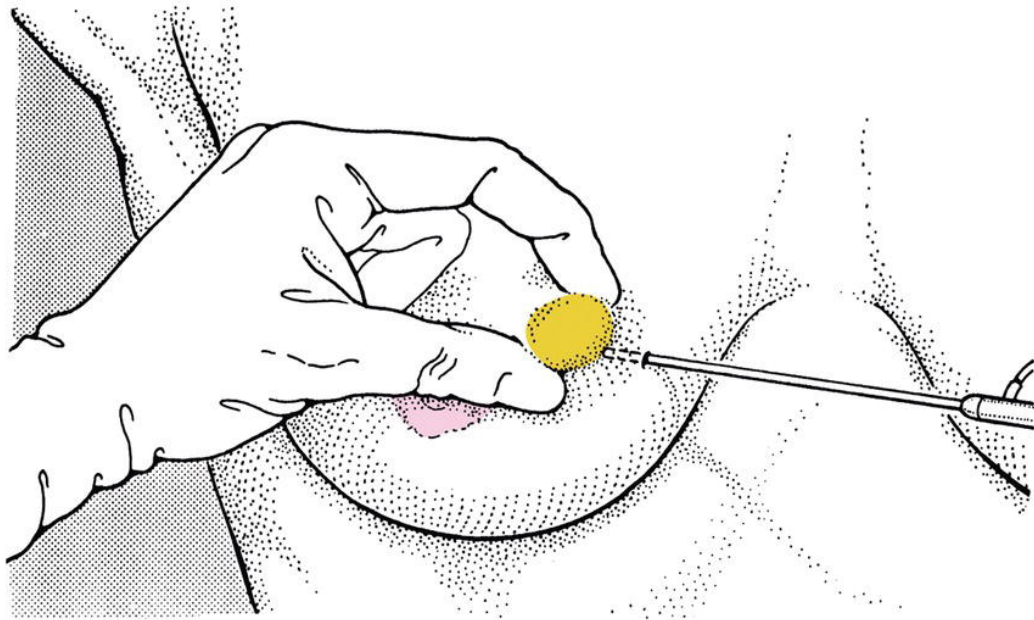


Fine needle aspiration cytology



Fine needle aspiration cytology

Core biopsy of breast lesion



Fine needle aspiration cytology (b)

Indications

- Rarely performed for diagnosis now as core biopsy is replacing cytology
- Mainly when core biopsy is contraindicated (bleeding disorder, anticoagulants)
- Difficult higher axillary suspicious nodes near vessels
- Cystic lesion
- If a benign cyst is aspirated, but the aspirate is bloodstained, send it for cytology.
- If a benign cyst is aspirated under ultrasound guidance but the cyst does not entirely collapse, send the aspirate for cytology.

Procedure

- Explain the procedure, obtain consent from and check for any allergies and anticoagulants.
- Supine position with arm under the head.
- Local anaesthetic can be used.
- Green number 18 needle is generally used for fine-needle aspiration.
- If lesion not palpable, then perform aspiration under ultrasound guidance.
- Insert needle at an angle, usually 45° .
- Always gently introduce needle till the tip enters middle of the lesion.
- Use a 10-ml syringe for aspiration.
- Spread the aspirate on a glass slide and send it for examination. At least four slides (two air-dried and two fixed) should be prepared. Usually, half the slides are fixed with 95% ethanol immediately (these slides are stained with Papanicolaou stain in the lab), and the other half are air dried and unfixed (these

slides are fixed in the lab using 100% methanol and then stained with Giemsa stain to examine the cell cytoplasm).

- If the amount of aspirate is more than 1 m l, it can be sent for cytology in a sterile pot.

Breast Core Biopsy

Indications

- Workhorse for breast pathology as it is more reliable, sensitive and allows immunohistochemistry, receptor status etc.
- Any palpable lesion
- Can be performed under ultrasound, mammogram (stereotactic) or even MRI guidance
- Even axillary nodes can be biopsied.

Procedure

- Explain the procedure, obtain consent from the patient and check for allergies and anticoagulants.
- Supine position with arm under the head. Request patient to rotate slightly away from the clinician if necessary.
- Skin marks the lesion with a pen, even if palpable to keep the orientation. Also, sometimes, the lesions can become less easily palpable once local anaesthesia is injected.
- Clean and drape the parts.
- If lesion is not palpable, then perform ultrasound scan and hold the probe in appropriate position so the lesion is visible on screen.
- Use xylocaine with adrenaline (to minimise bruising) for local anaesthesia as per body weight calculation.
- Inject local anaesthetic about 2–3 cm away from the lesion and inject all along the planned core biopsy track, i.e. from the site of

skin incision to the lesion.

- If the lesion is very close to the chest wall or if the axillary node is close to a vessel, then local anaesthetic can be used to lift the lesion off the chest wall or away from the vessel by injecting around the lesion/node.
- Always try and choose core biopsy site for incision, which is in the lower quadrants or at the junction of areola and the skin for better cosmetic scar.
- Make a 2–3 mm cut with a 15 number blade at the site of local anaesthesia.
- Load the core biopsy gun and explain the patient about the loud click, so it does not come as a surprise. It is worth firing the core biopsy gun outside so patient can hear the click before starting the procedure.
- Insert the core biopsy gun and always position it parallel to the chest wall. Never point it towards the chest wall. Take the biopsy sample and put it in the biopsy pot.
- Usually at least four core biopsies are taken from a lesion for adequate tissue sample for pathology.
- Usually, a marker clip is inserted in the lesion after biopsy and a check mammogram is performed to confirm that the clip is in the right place. This helps to confirm that the lesion in question has been sampled and it is a medico-legal document as well. It is also important to mark all the lesions biopsied in case neoadjuvant chemotherapy (NACT) is contemplated.
- If there are any research projects in the department, explain and obtain consent from the patient in advance so more core biopsies can be obtained if necessary.
- The biopsies from a cancer (except lobular cancer) are usually thick, dense and will sink to the bottom of the pot. If the biopsy samples float in the pot, maybe the lesion has been missed and only surrounding fatty tissue has been cored. In this situation, repeat the core biopsy.
- Keep pressure for few minutes till oozing is stopped.

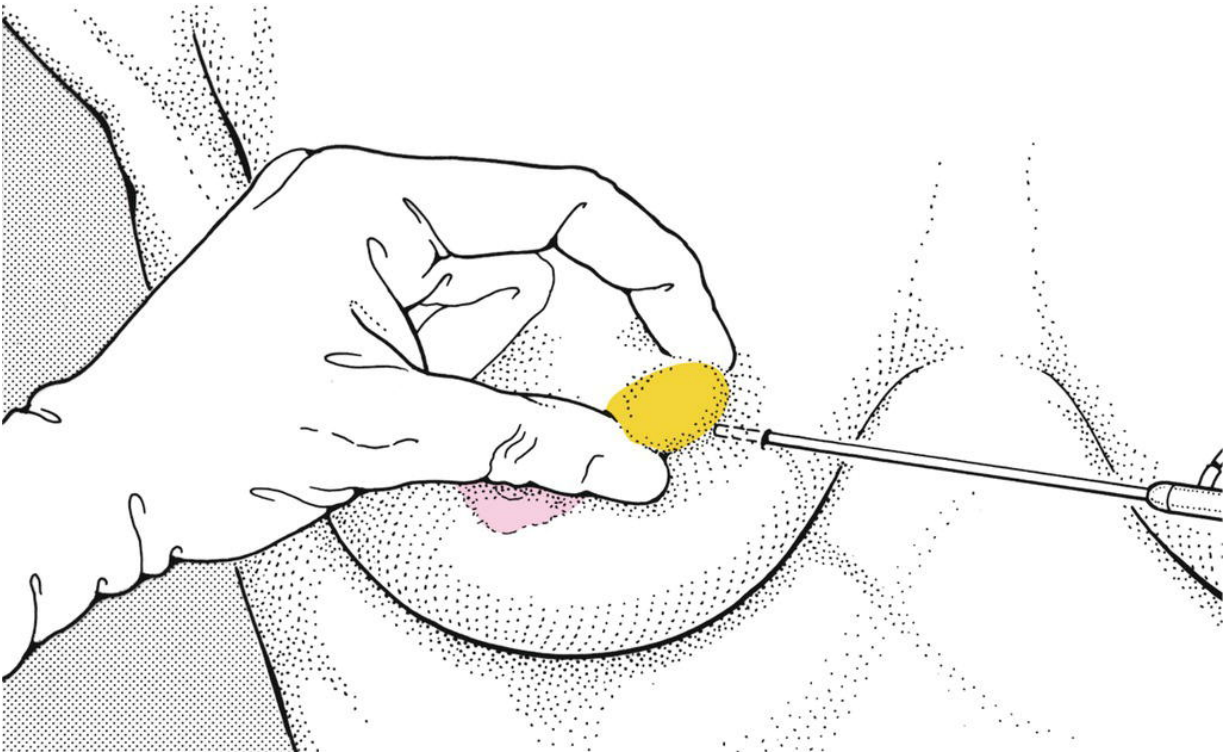
- Apply waterproof dressing and give instructions/leaflet to patient about the post biopsy care.
- Analgesics for at least 24 hours
- Make appointment for follow-up with the biopsy results.

Punch Biopsy

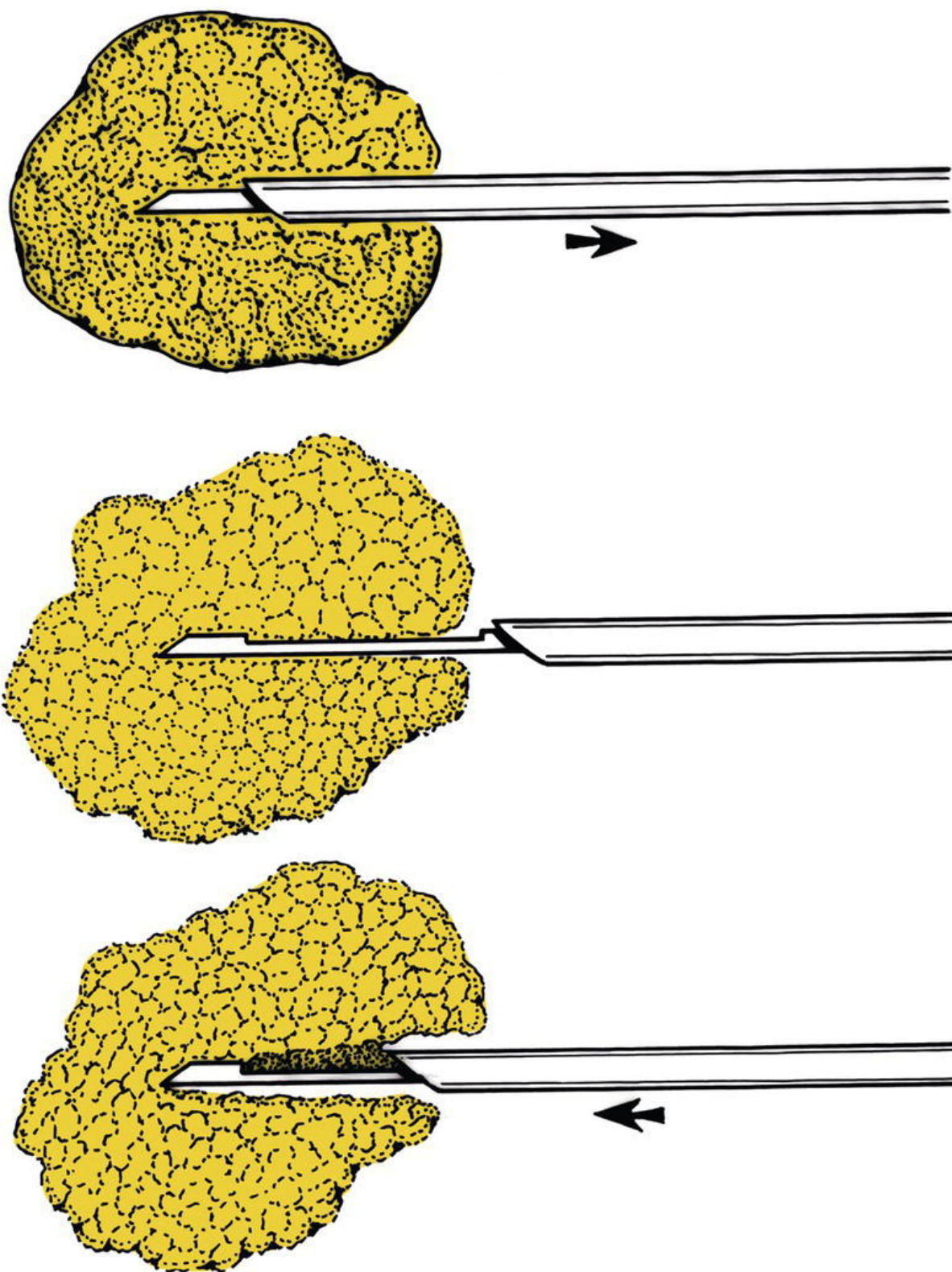
Indications

- Breast skin lesion
- Skin rash/discolouration on breast skin or nipple areola
- Ulceration on the nipple

Procedure



Breast core biopsy procedure



Core biopsy of breast lesion

- Explain the procedure, obtain consent from the patient and check for any allergies and anticoagulants.
- Supine position with arm behind the head.
- Clean and drape the parts.
- Xylocaine 1% with adrenaline is the local anaesthetic of choice to minimise oozing.
- Inject with an orange 24 number needle very superficial just below the biopsy site.
- Usually, number 3 or 4 punch biopsy needle is ideal for breast biopsies.
- Insert the punch biopsy needle into the skin at the most representative area of the lesion.
- Take full-thickness skin biopsy or nipple biopsy.
- Usually, 1–2 punch biopsies are sufficient.
- Apply pressure to stop any oozing.
- Waterproof dressing and analgesics for 24 hours
- Review appointment in the clinic with biopsy results.

Cyst Aspiration

Indications

- Palpable cyst or symptomatic cyst, i.e. pain
- Cyst with thick wall or signs of inflammation (send aspirate for cytology)
- Patient's choice

Procedure

- Explain the procedure, obtain consent from the patient and check for allergies and anticoagulants.
- Local anaesthesia can be used if necessary.

- Supine position with arm behind the head.
- Ultrasound scan can be used for better accuracy of the procedure and in case the cyst is not clinically palpable.
- Usually, number 18 green needle is used with a 10–20 ml syringe attached (depends on the size of the cyst).
- Insert the needle and aspirate when the tip enters the cyst.
- Check the colour of the aspirate. If clear golden or dark green, the fluid can be discarded. But if red, bloodstained or brown in colour, then send the fluid as cytology sample for examination.

Seroma Aspiration

Indications

- Post-operative patient with significant collection of fluid in the breast wound or in the axilla
- Symptomatic patient (pain, swelling, difficulty in moving the shoulder, sloshing noise from the wound due to fluid collection)
- If there is any sign of cellulitis or wound infection, then aspirate the fluid to avoid abscess formation.
- If patient has implant reconstruction, then any seroma should be aspirated to avoid infection and loss of reconstruction (ideally should be performed under ultrasound guidance to avoid injury to the implant).
- Patient who are about to start radiotherapy. The seroma can interfere with radiotherapy planning.

Procedure

- Explain the procedure, obtain consent from the patient and check for allergies and anticoagulants.
- Use ultrasound scan if it is a peri-implant seroma.
- Supine position with arm behind the head.

- Clean and drape the parts.
- Local anaesthesia can be used.
- Usually, number 16 white needle or a venous cannula number 18 is used.
- Insert the needle with 20-, 30-, 50- or 60-ml syringe attached (depends on the size of the seroma).
- Occasionally, a three-way connector can be used if the seroma is more than the capacity of the syringe used. This prevents repeated disconnection of the syringe to empty content and avoid spillage.
- If infection is suspected, then collect the seroma fluid in a sterile jar and send it for microbiology examination.
- Aspirate the cavity dry. Sometimes, the needle may have to be manoeuvred if the fluid is loculated.
- If the seroma refills, it can be aspirated again.
- Seromas can be avoided by quilting the wound and obliterating dead space at the time of operation.
- If a chronic seroma develops, patient will need treatment like injection of steroids or tetracycline. The last option would be to perform operation to excise the lining capsule of the seroma cavity and to quilt the wound.

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5

Microdochectomy and Total Duct Excision

Surgical Anatomy

- There are about 15–20 mammary ducts starting at each nipple leading to the terminal duct lobular unit at the periphery.
- The ducts are lined by ductal epithelium. These ducts can develop ‘periductal inflammation/infection’, as seen mainly in smokers. Also, the ducts undergo dilatation after menopause, called ‘duct ectasia’.
- Sometimes, the ductal epithelium can develop ‘papilloma’. Although very rare, these papillomata can give rise to cancerous change.
- All these conditions including periductal mastitis/duct ectasia/papilloma and even malignancy can cause nipple discharge.

Nipple discharge can be normal as in lactation, physiological/benign or suspicious/pathological.

In pathological cases, the most common caused are intraductal papillomas (40%), duct ectasia (25%) and malignancy (10%).

Total duct excision (TDE) is a surgical procedure where all the ducts behind the nipple are removed.

Microdochectomy is a targeted surgical procedure where a single duct behind the nipple is removed. It is usually recommended for discharge from a single duct in the nipple. It is suitable for younger women who wish to preserve the ability to breastfeed after surgery.

Indications for TDE

- Spontaneous, unilateral discharge

- Bloody nipple discharge (red/brown/black discharge, positive for haemoglobin on dip stick test)
- Discharge associated with a mass or abnormal radiological findings
- Chronic nipple discharge, which is distressing to the patient
- Persistent discharge following microdochectomy
- Persistent periductal mastitis in patients who are proven to have quit smoking and where conservative management has failed
- Biopsy-proven ductal papilloma

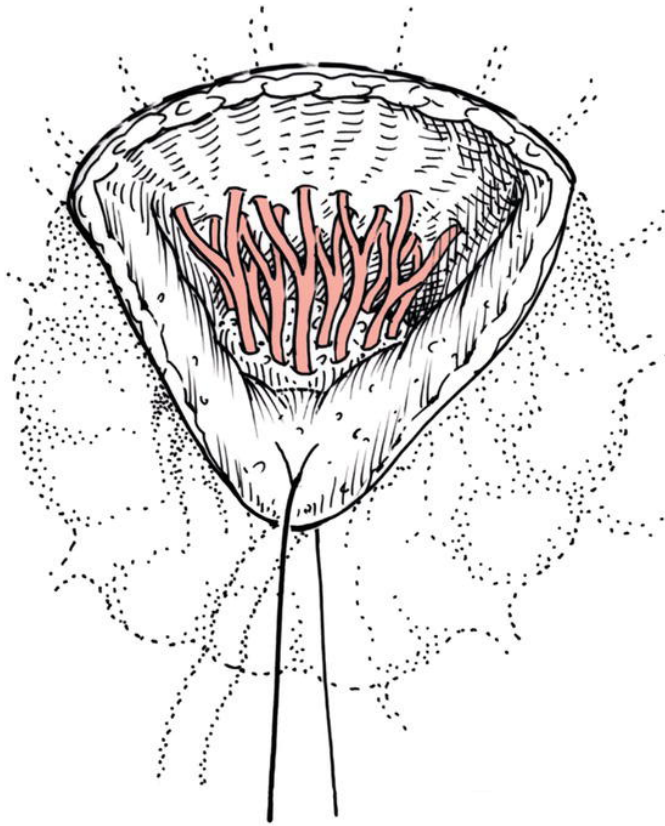
Indications for Microdochectomy

- Single duct, non-bloody spontaneous discharge, which does not resolve
- Single, biopsy-proven ductal papilloma
- Blood-stained single duct discharge

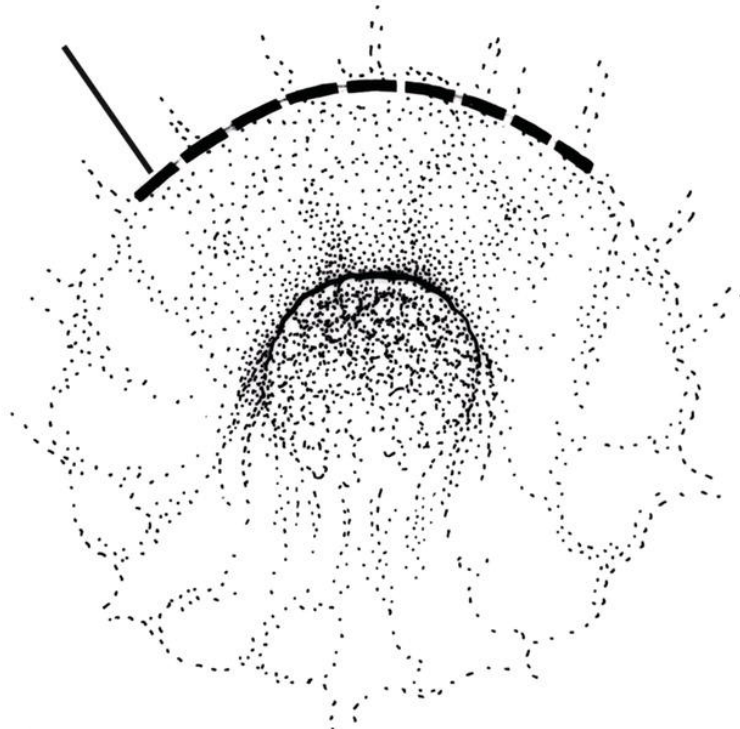
Pre-op Workup and Consent

- Any pathological discharge from the nipple requires a full workup with history and examination as well as imaging (triple assessment).
- Radiologically detected lesions as well as malignant appearing calcifications should be biopsied and clipped appropriately.
- MRI scan may be indicated in younger women with dense breast tissue.
- Investigations like nipple discharge cytology and breast duct micro-endoscopy have been described, but not used in routine clinical practice.

Marking/Incision Planning



Incision

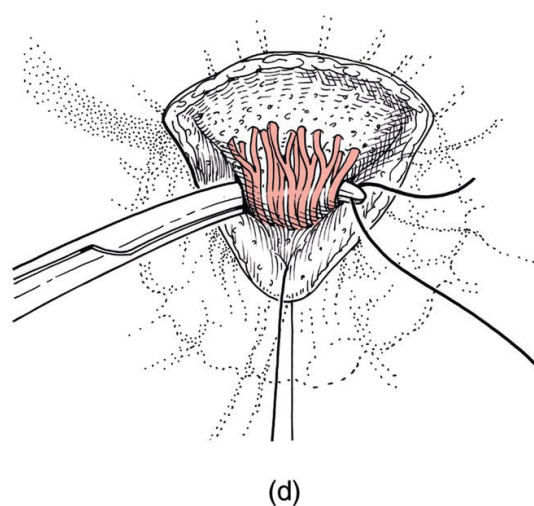
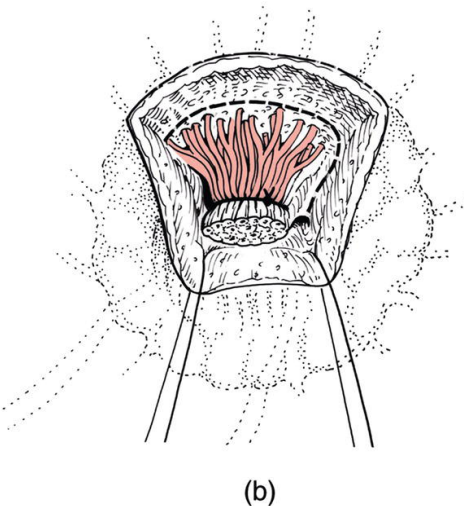
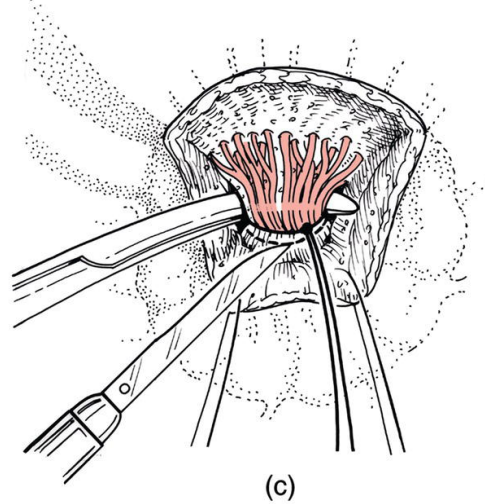
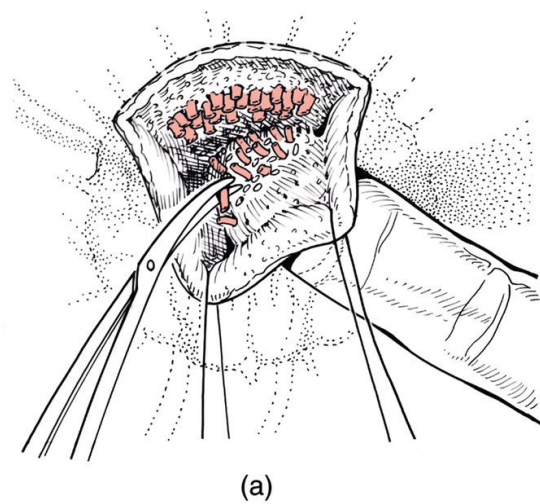


- The simplest and most aesthetic surgical access to the nipple–areola complex (NAC) is through a peri-areolar incision. The authors prefer the infra-NAC incision, given this is least visualised by the patient and theoretically is less damaging to the medial and lateral blood supplies to the nipple.
- If there is a biopsy-proven lesion/papilloma, then an appropriate localisation technique (wire/wireless) should be used, so the lesion can be included/removed separately.

Procedure

- Both procedures can be carried out with local anaesthetic and sedation, but given the sensation and nerve supply to the nipple, this is often poorly tolerated. So, general anaesthesia is preferred.
- A single dose of IV antibiotics should be administered at induction.

Total Duct Excision

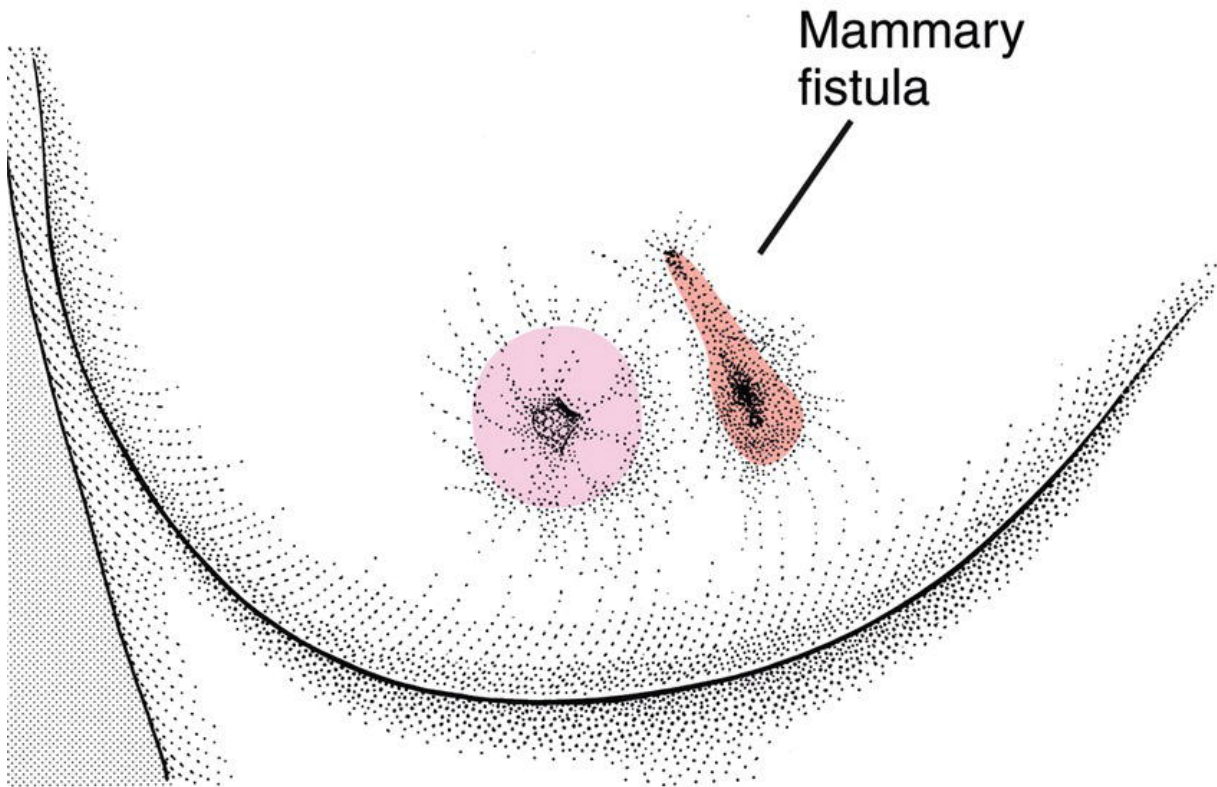


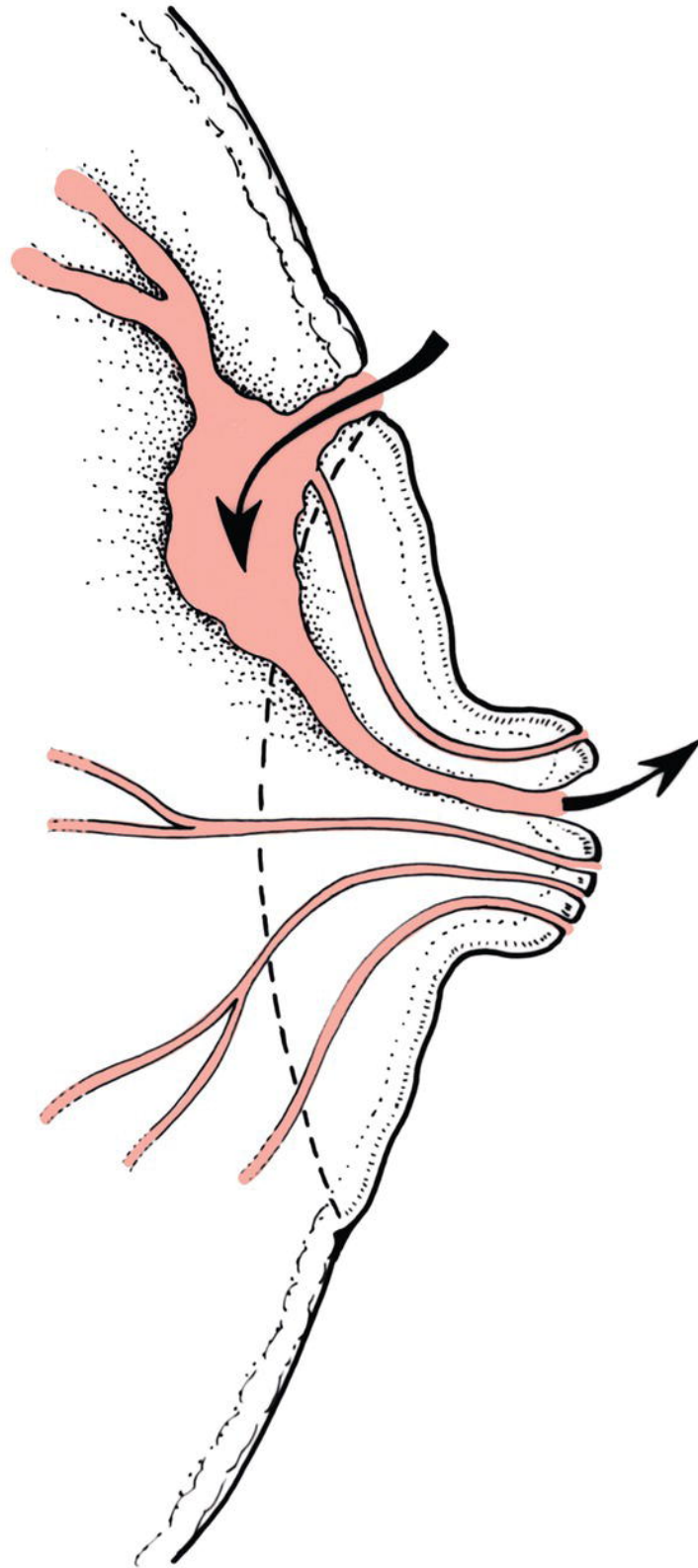
Total duct excision

- The inferior peri-areolar line should be marked with pen prior to cutting. This often requires cleaning with a saline-soaked swab to show the demarcation more clearly, moving the bright theatre lights away can also help.
- In general, make an incision at least 2–2.5 cm from the nipple.
- Standard cut down to mastectomy plane respecting that this is often quite close to the skin in the peri-areolar region.
- To this point, a blunt instrument such as a curved artery forceps can be slowly and carefully manipulated from both sides of the bunch of ducts behind the nipple until a tunnel has been created meeting from both sides and the bunch of ducts isolated.

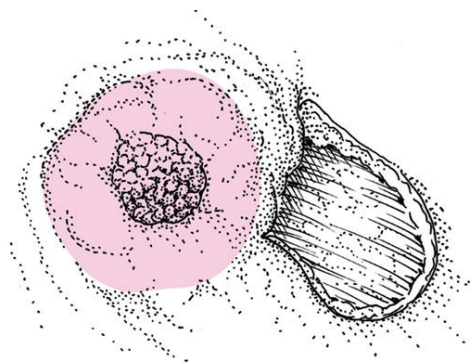
- This artery forceps can then be left in place, or a gauze pulled through to mark out the tunnelled tissue around the ductal tissue.
- The upper flap can then be created by having the assistant raise the skin with hooks/small cat's paws, and the underlying ductal tissue is dissected from the nipple above. The authors prefer sharp scalpel dissection to minimise thermal energy to the nipple, although bleeding can be an issue. This is completed once the artery/swab is reached.
- A Column of ductal tissue can now be resected in a circular fashion whilst grasping the centre with a Littlewoods or similar instrument. This should continue for at least 3 cm to ensure the maximal amount of ductal tissue is taken.
- If the lesion in question, such as a papilloma, has been clipped and localised, this should be confirmed with an X-ray.
- Thorough haemostasis and washout should occur along with palpation of the cavity to assess for further abnormal tissue.
- If the procedure is carried out for mammary fistula, then there are higher chances of wound infection. So along with post-op oral antibiotics, it helps to sprinkle antibiotics powder in the wound before closure (cefuroxime powder from the IV injection vial is the preferred antibiotic).
- The cavity can then be approximated with a 3-0 monofilament absorbable suture to obliterate the dead space to minimise collections as well as provide support for the overlying nipple to aid against post-operative retraction.
- The skin can be closed with a 4-0 absorbable monofilament suture, no knotting at either end of the suture line is required, this is a low-tension closure, and the knots can leave unsightly scars, be irritating to the patient or cause granulomas.
- Dressing should be surgeons' preference. But an adhesive dressing cut in the centre to expose nipple is sufficient. Some prefer skin glue around the NAC. Also, it helps to cut a small piece of scrub sponge and arrange it around the nipple under the adhesive dressing to keep the nipple erect.

- The excised tissue should, as always, be orientated in the event an unexpected cancer is found within the specimen.
- In case of mammary fistula, make a circular incision around the fistula and excise the fistula in continuity with the TDE specimen.

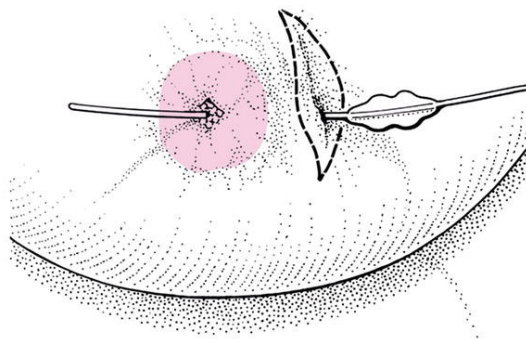




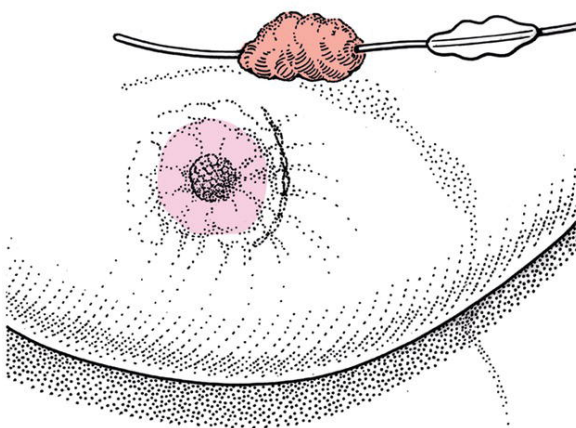
Mammary fistula



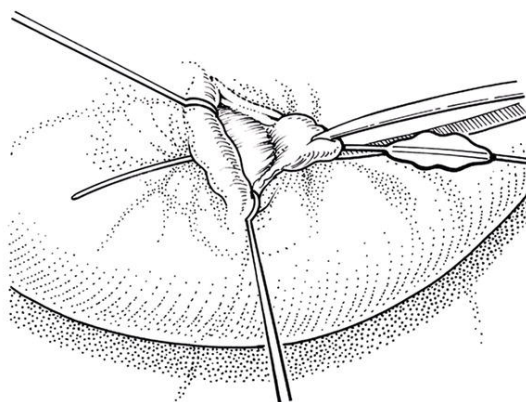
(a)



(c)



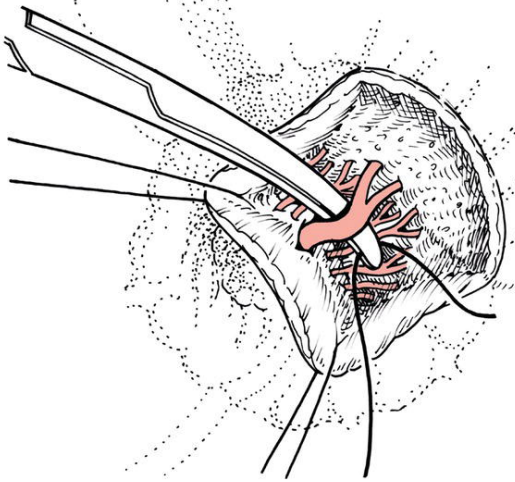
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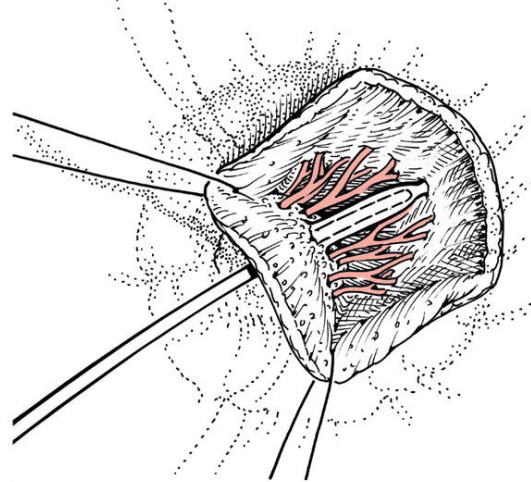
(d)

Mammary fistula excision

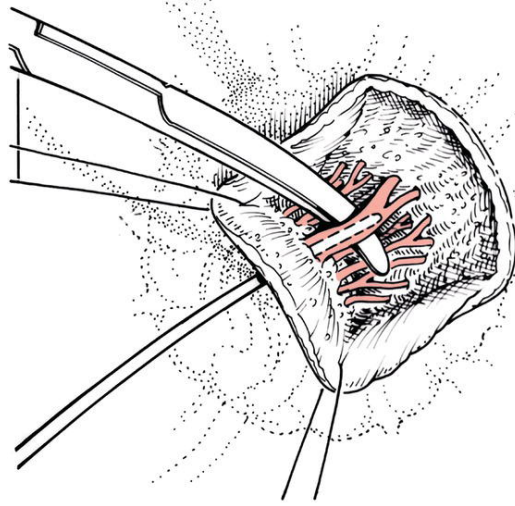
Microdochectomy



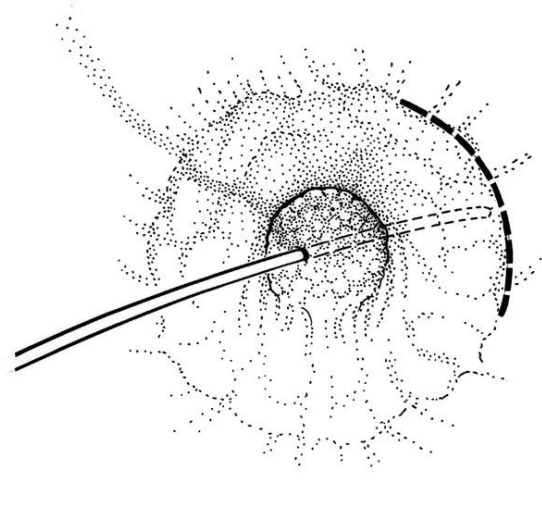
(a)



(c)



(b)



(d)

Microdocheotomy

- The single discharging duct can be isolated by insertion of a lacrimal probe or by cannulating and injecting patent blue dye into the duct.
- It is very important that the discharge is not encouraged prior to scrubbing as this can be the only discharge seen and the opportunity to insert a probe at the beginning of the operation is lost.

- Once the probe is inserted, the operation proceeds as above to gain access to the subareolar ductal tissue.
- Through manipulation of the probe against a finger, the minimal amount of tissue can be dissected and excised around the probe. Blue dye makes it easy to identify the discharging duct.
- This should be, where possible, excised as a long thin cylinder of tissue encompassing the duct from just behind the nipple at least 2–3 cm down into the deeper breast parenchyma.
- Thorough inspection and squeezing of the ducts should be carried out to ensure the correct duct has been taken and to ensure there are no others causing the symptomatic discharge.
- This operation should be carried out with minimal tissue dissection and diathermy to minimise post-operative scarring and maximise the chances of future breastfeeding.
- Post-operative management.
- A simple waterproof dressing such as a tailored Comfeel cut to fit around the nipple, but not across it for around a week suffices. Post-operative pain is uncommon, and most patients can be discharged with simple analgesia.
- Alternatively, simple dressing can be given over the wound around the nipple. Then put a piece of scrub sponge on the nipple with a hole in the centre to allow nipple to protrude. Then put another waterproof dressing on top of the sponge. This helps to keep the nipple projecting out and avoids flattening or inversion.
- Patients are reviewed in clinic around two weeks later for a wound check and to discuss resultant pathology.

Complications

- **Bleeding:** Rarely significant given the area of tissue excised and a small cavity left behind.
- **Infection:** Slightly higher than surgery in the rest of the breast. The ductal systems may harbour colonising bacteria, which only become problematic following surgery to the area. A single shot

of IV antibiotics should be given at induction and a low threshold for oral antibiotics post-operatively.

- **Nipple necrosis:** Rare given the rich blood supply of the nipple but of potential concern in smokers, diabetics and others with poor microvasculature. Can be the consequence of overzealous dissection and an initial incision around too much of the circumference of the NAC.
- **Poor scarring:** Usually avoided with good closure with a smaller suture such as 4-0 Monocryl. This should NOT be knotted at either end as these often become points of irritation to the patient and given the low-tension wound are simply not required.
- **Poor breastfeeding:** All patients should be aware that breastfeeding will not be possible following TDE. However, this may also be the case following microdochectomy where poor or no milk production may still occur due to post-operative scarring around the remaining ducts.
- **Poor sensation:** Can occur in up to 25% of patients to some extent. The nerve supply to the nipple may be disrupted, leading to partial or full aesthesia of the NAC. This can be of particular concern to some patients.
- **Nipple inversion:** The cavity left following the excision of the ducts can allow the nipple to 'fall back' and evert. This can be avoided through minimising the excision of surrounding nonductal breast tissue but closing the defect at the end of the procedure as per other procedures in the breast.
- **Symptom recurrence:** The duct causing the issue (most like a papilloma) may not be correctly excised in a microdochectomy, and the symptoms may persist.
- **Further surgery:** Although not necessarily a complication where invasive or in situ disease is expectantly encountered, margins are unlikely to be satisfactory, and further surgery would be indicated for oncological clearance.

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6

Sentinel Node Biopsy

Introduction

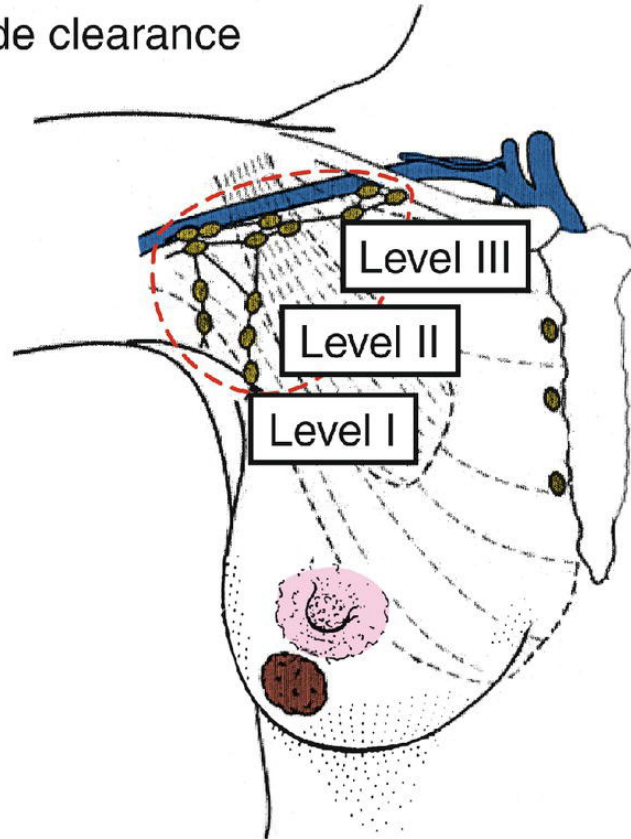
- The investigation and treatment of regional lymph nodes in breast cancer remain a topic of much research and debate.
- The Almanack trial, when published in 2006, demonstrated that SNB should be the treatment of choice in patients with early-stage breast cancer (ESBC) and clinically negative nodes.
- The status of the axillary lymph nodes remains the single best predictor of survival, with the number involved as well as the levels being independent predictors.
- The sentinel node is defined as the 1st draining or gateway node between the breast and lower axillary chain (hence sentinel/sentry/guard).
- This technique replaced 'blind' axillary node sampling where four nodes were taken from the low axilla.
- Traditionally, the sentinel node has been identified with an injection of patent blue dye and/or radioisotope into the subdermis at the upper outer margin of the NAC.
- Other methods in use for localisation are indocyanine green, microbubbles and superparamagnetic iron oxide (SPIO).

Indications

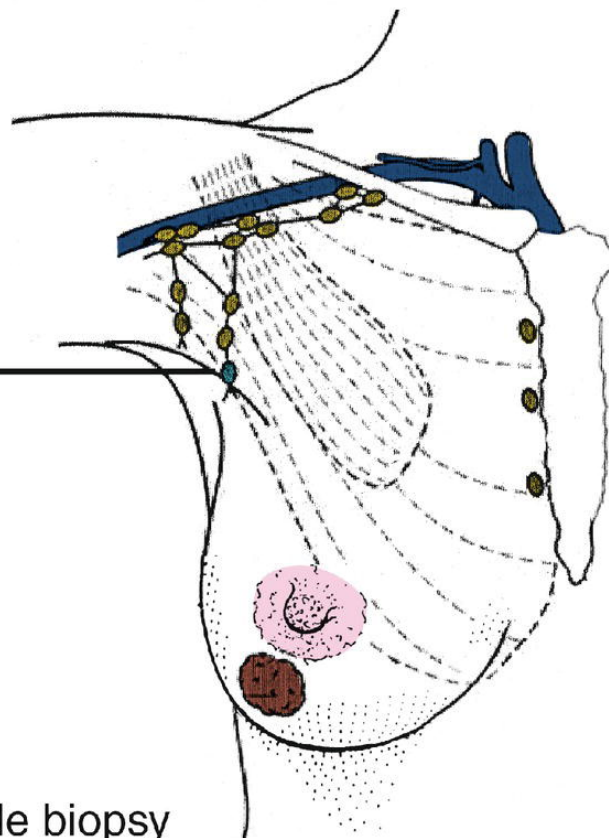
- ESBC with clinically and radiologically negative nodes
- Ductal carcinoma in situ (DCIS) requiring mastectomy and mass-forming DCIS
- Clinically and radiologically negative nodes following NACT

Anatomy

Axillary node clearance



Sentinel lymph node



Sentinel node biopsy

- Not one specific 'sentinel' node
- More than one lymphatic trunk in breast and other organs so more than one sentinel node most times
- Standard SNB number is close to 3, but sentinel node numbers do vary between surgeons.
- More sentinel nodes you remove, the greater accuracy of SNB.
- Lower the false-negative rate, the more likely patient is to get appropriate systemic therapy.

Preparation

- Ensure both dyes (in some hospitals, the radioactive technetium Tc99 dye is injected in the subareolar region in the nuclear medicine department. This injection is given either on the day of operation or the day before the operation) are readily available prior to the patients general anaesthesia (GA).
- As always check all notes and investigations.
- Anaphylaxis treatment should be on hand where blue dye is being used.
- The gamma probe should be in theatre and operational. This can be tested before any incisions are made to minimise any delays intraoperatively if there is an issue.

Operative Technique

- **Injection of dye:** This is the step that is most commonly carried out incorrectly. The dye must be injected into the subdermis at the upper outer edge of the NAC (or just distal to the tumour if there is a large/superficial tumour between the NAC and the axilla).
- The dyes should be injected to raise a pleb at the skin and then chased with copious saline and massaged for two to three minutes. The most common mistake is to rush this stage, and the dyes are injected into the subdermal fat or breast

parenchyma, thus taking far longer to be received by the breast lymphatics.

- In Edinburgh, we most commonly use Tc99 alone unless using dual tracer in post NACT patients. Tc99 may be injected at a higher dose the evening before surgery for logistical reasons.
- Generally, the breast surgery is carried out, allowing the dyes to make their way from the dermal lymphatics to the axillary nodes.
- The gamma probe is then used to identify the point of maximal signal and, therefore, proximity to the sentinel node. Most commonly, this is at the lower margin of the axillary hairline.
- One potential pitfall for the less experienced is the high signal often given off below the pectoralis major and would cause the incision to be made too high.
- To ensure aesthetically pleasing incision placement, the incision can be made by holding the knife at the distal end and allowing it to follow the natural axillary skin fold around the point of maximum signal. In the case of a mastectomy, no separate incision is required.
- The incision is then deepened until it may be held open with a self-retaining retractor. The upper edge can be held open with an assistant's Langenbeck retractor.
- The clavipectoral fascia has to be cut in order to reach the nodes.
- The gamma probe will then guide the surgeon to the sentinel node. Care should be taken to disrupt as little of the axilla as possible; aggressive dissection will simply lead to scarring, which may make a subsequent clearance very difficult.
- Although the target nodes should be low, 'clockwork' of the axilla should always be respected, particularly in the low body mass index (BMI) patient. Similar caution should be taken with respect to damage to the intercostobrachial (ICB) nerves.
- A minimum of three nodes should be taken to avoid false-negative results. (Multiple trials have demonstrated the importance.)

- This should be four nodes minimum where NACT has been the primary treatment. Where there has been node-positive disease treated with NACT, the clipped node must be excised for assessment; if this is not possible, a clearance should be carried out under the same GA. Hence, the importance of consenting such patients for a clearance prior to surgery in these situations.
- In more than 95% of cases, the sentinel nodes are very close to the lateral pectoral vessels. Care must be taken to preserve these vessels carefully, especially if perforator flap reconstruction is planned.
- Thorough haemostasis should be ensured, and the wound is closed in layers to minimise dead space and subsequent seroma formation.
- Use the gamma probe once again and look for any blue dye channels once the sentinel nodes have been removed. This is to rule out another chain/deeper sentinel nodes close to the chest wall.
- Close the wound in two layers and apply waterproof dressing.
- Inject local anaesthetic as per protocol.

Complications

- Haematoma
- Seroma
- Pain
- Infection
- Nerve damage
- Lymphoedema (although rare in SNB, this should still be consented for.)
- Cording of lymphatic channels

Internal Mammary Nodes

- Not a routine standard practice to remove IM sentinel nodes
- Drainage to IM nodes depends on where you inject.
- Degree of benefit of treating IM nodes is unclear.
- Some emerging evidence that radiotherapy to IM nodes may improve outcome.

Targeted Axillary Dissection

- This procedure is performed for patients with involved axillary nodes (biopsy-proven and clipped) following NACT if a complete radiology response is achieved.
- At least remove three or more nodes along with the sentinel nodes (use dual isotope + blue dye) and the clipped node (previously biopsy-proven involved node).

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7

Axillary Node Clearance

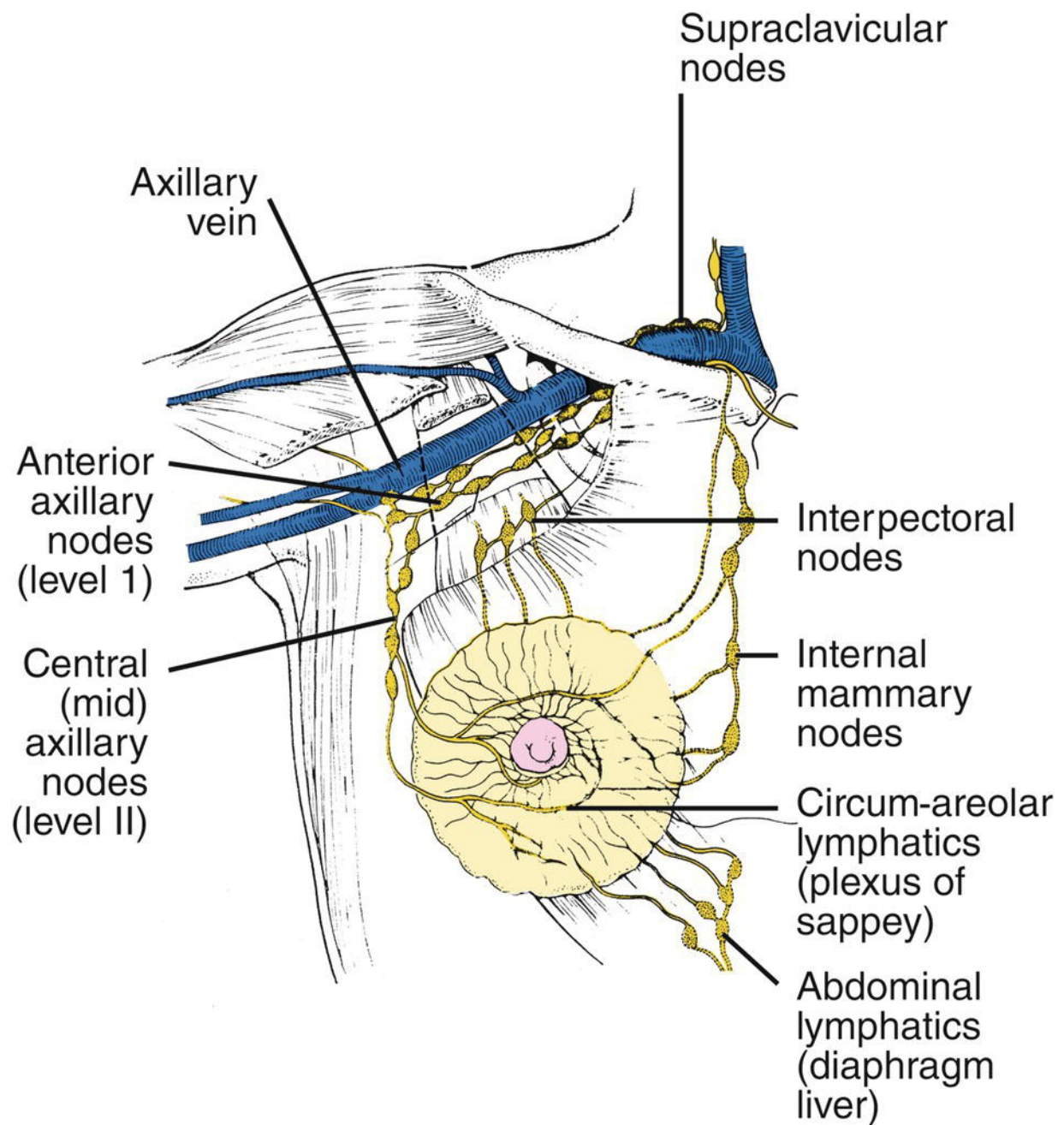
Introduction

- Treatment of the positive axilla has changed significantly over the past 10 years.
- There has been a reduction in the number of ANCs carried out mainly, due to research showing that aggressive nodal clearances do not always convey a survival benefit.

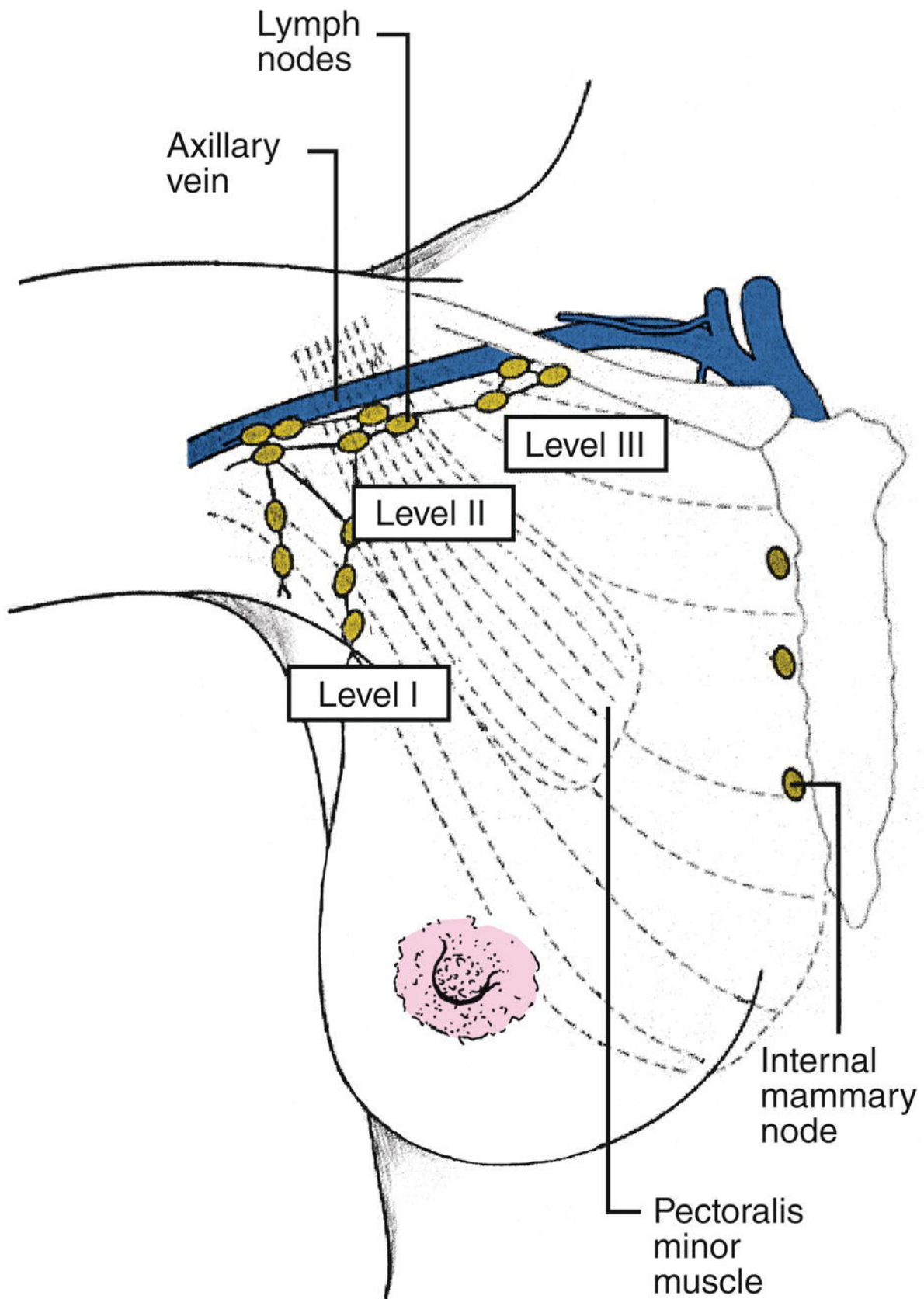
Indications

- Locally advanced (T4a, T4b, T4c) or inflammatory breast cancer with involved axillary nodes
- Tumours over 5 cm with any number of positive nodes on SNB
- Biopsy-proven metastatic disease in axillary lymph nodes
- Three or more nodes in patients with hormone receptor (HR)-positive disease less than 5 cm (T1/2)
- Less than three nodes in patients with HR-negative disease, HER2-positive or triple-negative breast cancer (TNBC) are subject to MDM and discussion with the patient regarding the risks and benefits of the procedure.
- If any node shows extra nodal disease on SNB pathology, an ANC will be discussed at MDM and with the patient.
- Nodes must have macroscopic disease, microscopic deposits, or isolated tumour cells (ITCs) that do not infer node positivity, and therefore, a clearance is not indicated.

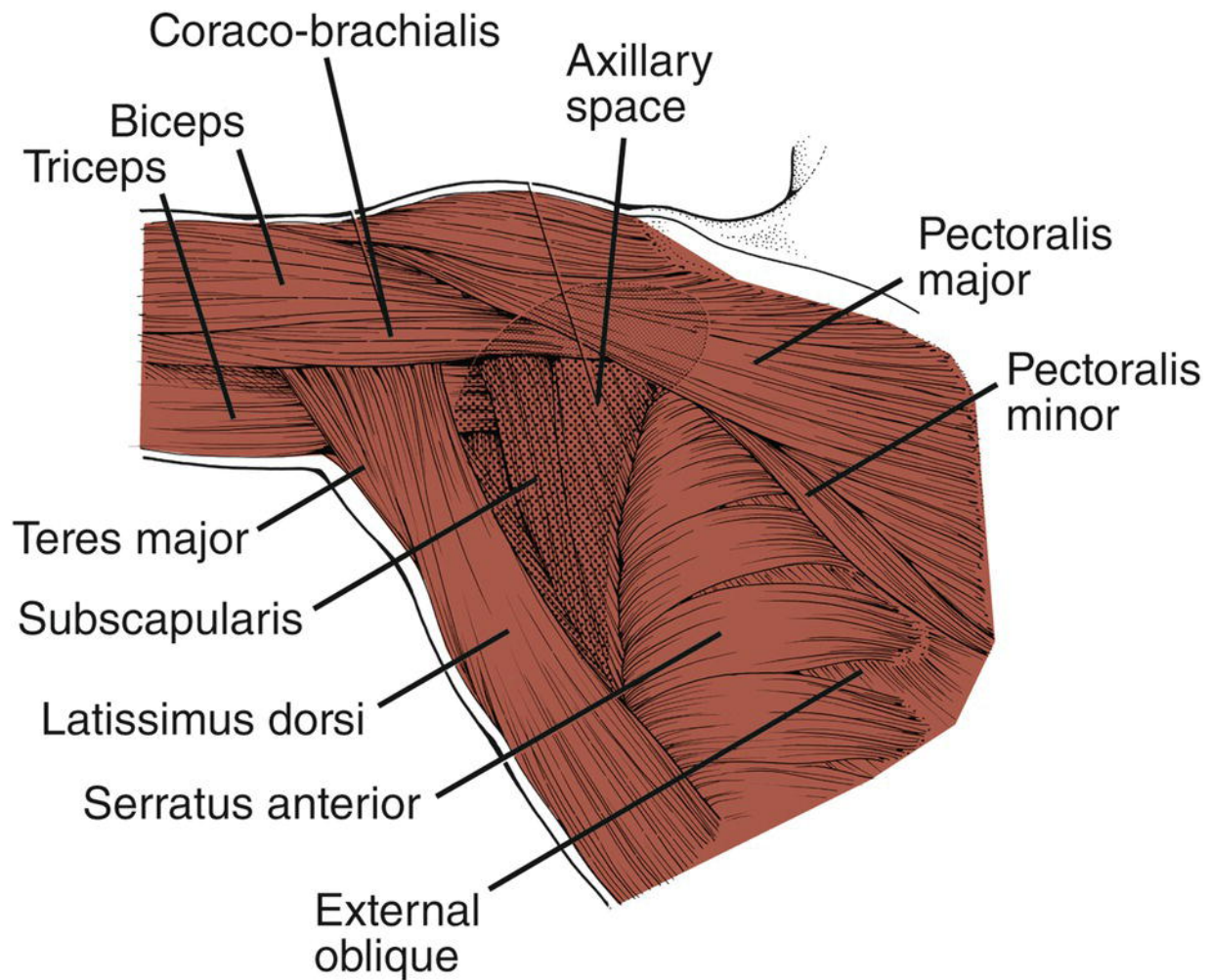
Anatomy



Anatomy of the breast and axillary nodes



Axillary lymph nodes



Anatomy of the breast and axilla

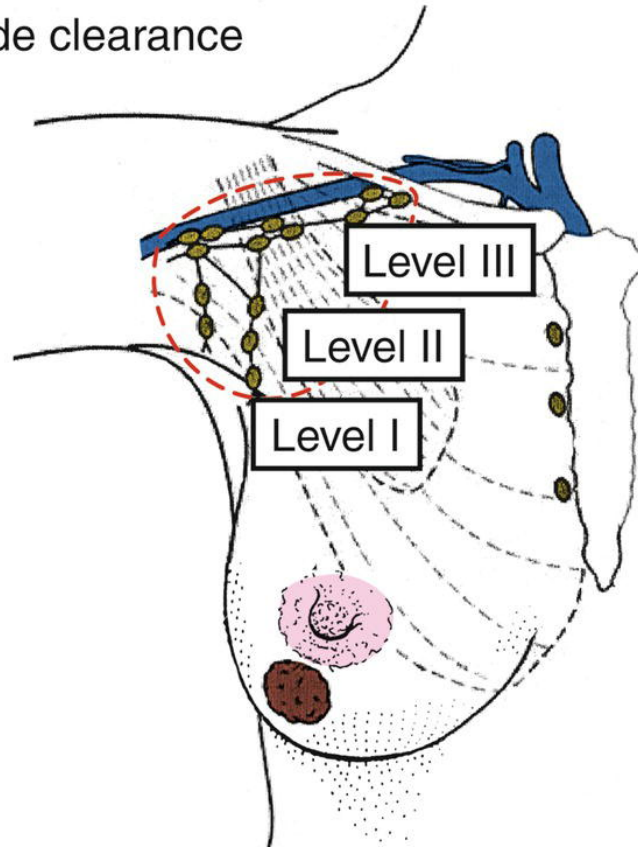
- **Apex:** The axillary inlet; first rib, scapula and clavicle
- **Lateral wall:** Intertubercular groove of humerus and tendons of brachialis
- **Medial wall:** Serratus anterior and chest wall
- **Anterior wall:** Pectoral muscles and clavipectoral fascia
- **Posterior wall:** Subscapularis, teres major and LD muscle
- **Base:** Skin and fascia

Operative Technique

There are many ways to approach the clearance of the axilla; although different, they all follow similar principles with respect to nearby important anatomy, slow careful dissection and early identification and protection of the important structures.

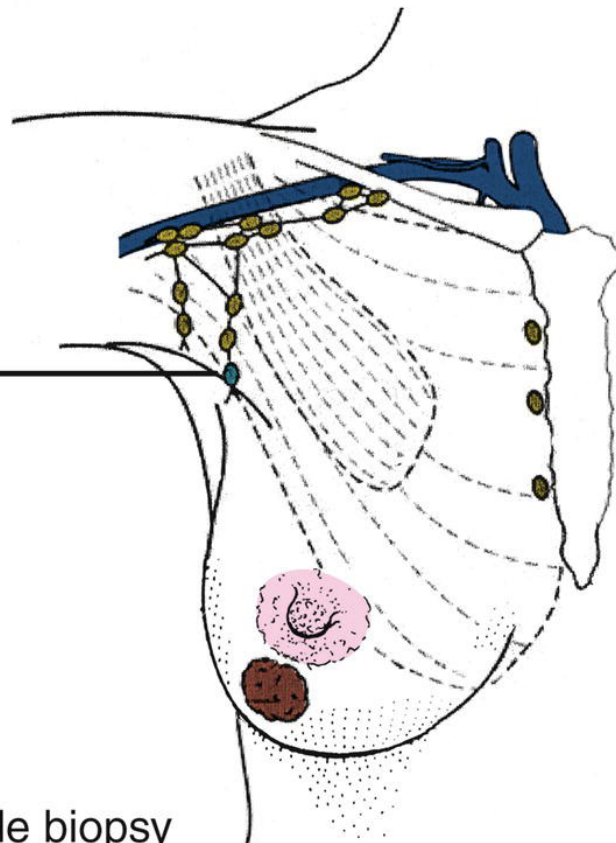
- These are the axillary vein, the long thoracic (LT) nerve (or the nerve of Bell, which innervates serratus anterior and damage will cause a winging of the scapula), the TD bundle and the ICB nerves. We describe here the authors preferred approach only.

Axillary node clearance

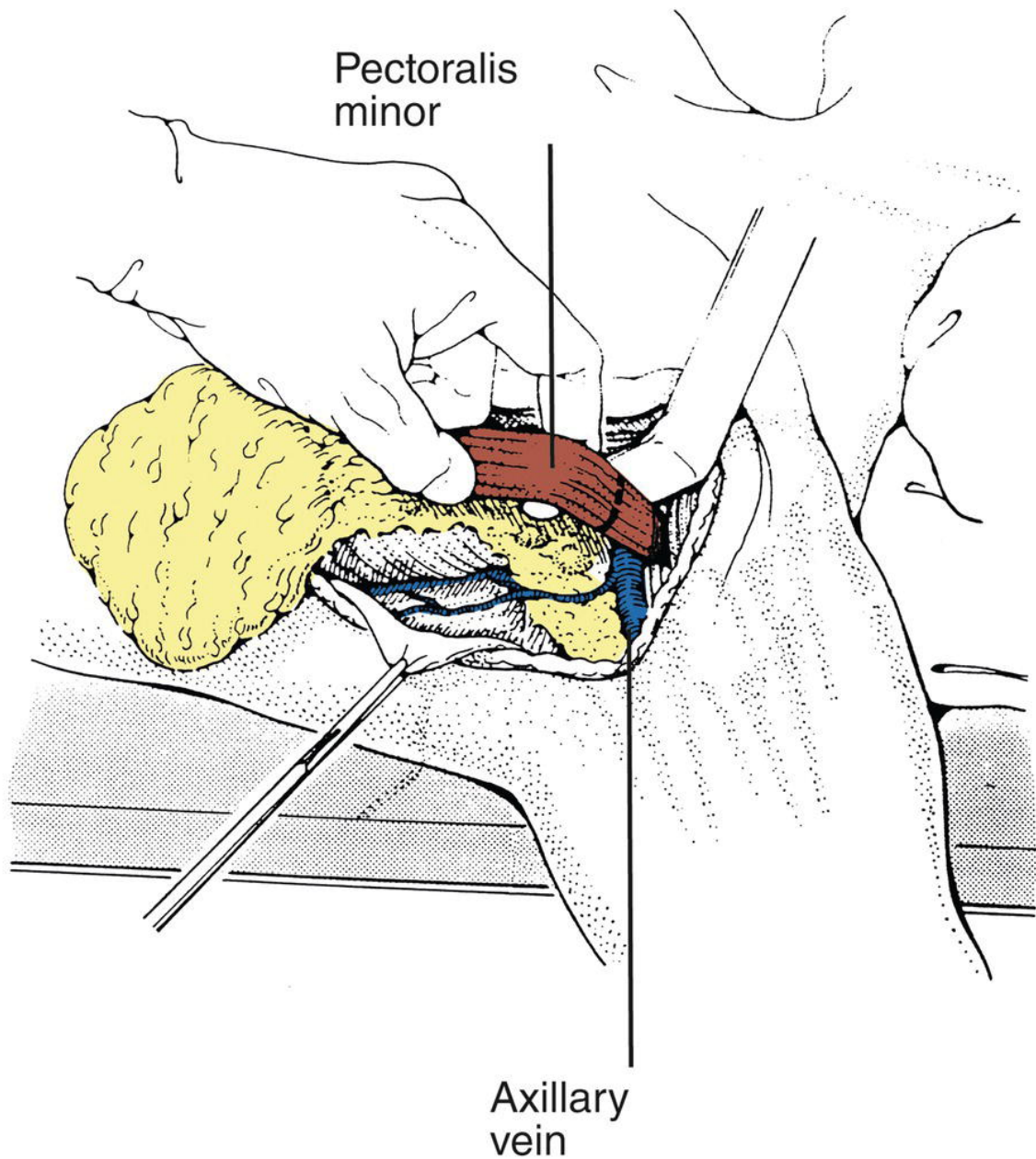


Sentinel lymph node

Sentinel node biopsy



- In cases of mastectomy, no further incision is required as the clearance can be carried out through the lateral margin of the incision.
- As part of breast cancer surgery (BCS), a new incision should be made; as in the case of SNB, this should be placed close to the inferior hairline of the axilla, but extended superiorly and inferiorly, this should curve at the margins in a lazy S incision, with the superior margin extending to the palpable border of the pectoralis major muscle.
- A good assistant is key as retraction allows for not only good access but also stretches the tissues along the lines of dissection. With regard to the superior aspect of the dissection, the assistant will be retracting the pectoralis major muscle with some force but must be careful not to damage the nearby axillary vein, given the position they are likely to be blind to this. The operating surgeon should regularly review the position and force of retraction by the assistant.
- The incision is slowly deepened through the clavipectoral fascia, showing the clear difference between the subcutaneous and the axillary fat. Haemostasis is important here as any bleeding from this superficial dissection will continue through the operation and compromise the surgical field.
- Palpate the lower lateral margin of the pectoralis major muscle and dissect just inferior in a deep direction. Once through the superficial layers, this can be continued bluntly with either finger dissection or pledgets.
- The pectoralis major is then retracted medially by the assistant to expose the pectoralis minor muscle. Care should be taken as the medial pectoral nerve and vessels pass through pectoralis minor (although this anatomy is variable, they may pass laterally around pectoralis minor); these innervate pectoralis minor as well as the lower third of pectoralis major.



Axillary node clearance

- Of paramount importance here is that **NO** vessels are ligated until further anatomy is delineated.
- This dissection should be slow and careful; the axillary vein can not only have a varied position but may also be bifid. It can come into the dissection plane suddenly. Visualising its path from the upper arm and into the axilla can help predict where it will lie.

- When encountered, its position should be respected for the entirety of the operation; the inferior aspect of the vein itself marks the superior margin of the dissection.
- The fat pad containing the level 1 nodes is now swept inferiorly and again bluntly with no damage to any vessels or nerves.
- Branches of the ICB nerves will cross this area transversely and can be teased off of the main specimen and preserved in the majority of cases.
- Most commonly, these leave the 2nd intercostal space but can be from the first. It often divides into a number of branches as it travels laterally across the axilla. If the ICB nerves cannot be preserved, these must be cut sharply.
- Continue this dissection until the view is compromised by tissue medially and laterally. There is often a large vein that is encountered early in the dissection, which may be confused for the TD vein. This should be preserved until the posterior dissection has been completed and the TD bundle positively identified.
- The TD bundle is easily identified as the only artery, vein, nerve bundle in this region; if there is any doubt, a small pinch of the nerve with non-tooth forceps in the non-paralysed patient will twitch the LD muscle. Most commonly, the nerve is the most medial structure within the bundle.
- Continue the dissection medially to tease the nodal tissue from the chest wall. Care must be taken here not to sweep the serratus fascia into the specimen. This can be done bluntly, and some small crossing vessels may need to be ligated.
- As the dissection continues deeper, the LT nerve will come into view; if this is difficult to find, it is worth bearing in mind that this forms an apex with the TD nerve in the apical region of the axilla. Once the nerve is identified, it can easily be protected and the remaining medial nodes and fat can be swept into the specimen.
- Switch to the lateral portion of the dissection, a finger can be swept between the specimen and the lower margin of the

axillary vein and the tissue between can be cut with diathermy; again some crossing vessels will be encountered and require proper ligation. This dissection should continue to the LD muscles.

- To complete the dissection, the specimen can now be held in the non-dominant hand and the remaining dissection continued posteriorly travelling in an inferior direction. Careful dissection of the specimen from the TD bundle is required here, small vessels off of the anterior portion of the TD vessels often require clipping. Where post-operative bleeding occurs, it is most commonly from these cut branches.
- Dissection can be considered complete when the TD bundle dives deep into the LD muscle.
- Once the specimen has been delivered, a careful inspection of the area is required, of importance is focussing on the 'interneural' area between the LT nerve and the TD nerve.
- Invariably, some apical tissue will remain; this should be inspected for nodes and, if easily taken, should be excised and sent as a separate pot to pathology.
- Once the apical nodes have been taken, the level 2 + 3 nodes should now be palpated and assessed. This will be covered later.
- Carefully palpate in the groove between the pectoralis major and the pectoralis minor for any interpectoral nodal tissue.
- Thorough washout of the cavity and ensure the patient has a blood pressure close to their baseline, this often requires a 'push' from the anaesthetic team but is well worth the pause in operation to minimise post-operative bleeding.
- **Quilting** is performed in multiple rows with a continuous barbed stitch with sutures placed loosely 2 cm apart. Five to seven rows are required to close the dissected axilla. When closing after axillary clearance, suturing starts at the apex and opposes the chest wall fascia medially to the soft tissue of the chest wall laterally. Multiple small bites are taken, and the suture kept loose.

- Place a number 10 drain in the axilla and keep it as long as required as per unit protocol. The local anaesthetic agent can be injected into the axillary cavity through this drain once it is in place and the wound is closed. Then keep the drain clamped for about 30 minutes and open it in the recovery.
- There is also the possibility that this reduces post-operative scarring and may reduce the incidence of lymphoedema by minimising the disruption to the remaining lymphatics in the area.
- The skin is then closed in the standard manner as well as dressing of surgeon's preference.
- In case of previous SNB from the same axilla, expect dense fibrosis, oedema and seroma cavity. In this case, the dissection is more difficult. It is fine to remove the axillary content in multiple pieces so long as all the fibro-fatty lymphatic tissue and the nodes are removed. This approach is better than damaging structures in the axilla.

Level 2 Dissection

- Level 2 nodes should routinely be taken as part of a standard clearance.
- The draped arm should be bent, and the hand placed behind the patient's head if possible. The brachial plexus can come under strain if this is carried out too vociferously.
- The pectoralis minor muscle is then dissected slowly down to the chest wall as care must be taken not to damage the medial pectoral nerve and vessels.
- A narrow Morris retractor then allows the assistant to retract both the pectoralis major and minor muscles medially.
- The nodes under the pectoralis minor can then be excised.

Level 3 Dissection

- A level 3 dissection should be carried out where gross lymphatic disease is palpable or when running a digit along the underside

of pectoralis minor in the direction of the clavicle.

- Significant comorbidity is associated with a level 3 clearance and should only be done for gross disease control.
- Where such dissection cannot be carried out safely, a surgical clip can be placed to guide post-operative salvage radiotherapy.

Complications

- **Haematoma:** Uncommon and when it occurs is most often a small anterior branch of the TD vessels, which had undergone vasospasm at the time of operation and, therefore, gone unnoticed.
- **Seroma:** In Edinburgh, as detailed, we quilt the axilla significantly reducing the seroma rate as well as allowing select patients to have a clearance carried out as a day-case procedure.
- **Pain:** Mainly around the site of incision and shoulder region and arm.
- **Infection:** Especially in obese, diabetic patients. Appropriate antibiotics should be prescribed.
- **Nerve damage:** Time should be spent with patients discussing the loss of function that would occur with TD and LT nerve damage, resulting in 'winging of scapula' deformity.
- **Lymphoedema:** This is often the complication patients are most concerned about. It is unpredictable, but usually obese patients are more likely to get it. Most patients will need regular exercise, physiotherapy, fitted sleeve compression and occasional antibiotics to cope with this permanent change. There are now several procedures described including lymphovenous shunts and implanting lymph nodes to prevent and treat lymphoedema.
- **Paraesthesia** to upper/inner arm, due to damage to ICB nerves

Post-operative Care

- In Edinburgh, an increasing number of these patients are going home the same day, given that drains are not required with good quilting sutures to the axilla.
- If drains have been placed, these can be removed when less than 50 ml is collected over a 24-hour period.
- Patient must be counselled into the importance of the prescribed exercises and physiotherapy to avoid potentially severe shoulder stiffness; adequate discharge analgesia will be required.
- If significant bleeding has occurred during surgery, a post-op haemoglobin check should be carried out in the evening of surgery.
- Most patients can receive thromboprophylaxis on the evening following surgery at the surgeon's discretion.
- All patients should be seen before discharge by a physiotherapist trained specifically in post-axillary surgery exercises.

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8

Wide Local Excision of Breast Cancer

Introduction

- Wide local excision (WLE) or breast conservation surgery (BCS) is the mainstay of surgical intervention for breast cancer. Its technique, however, has changed significantly over the past decade to allow for larger areas of disease and multisite disease to be removed whilst conserving the breast.
- Traditional teaching dictated that only up to 20% of the breast could be removed by WLE and only a minimal volume excised from the medial aspect of the breast.
- This has now been challenged by several oncoplastic techniques described in this book, including simple glandular manipulation, therapeutic mammoplasty, lipofilling and perforator flaps.
- As such, the mastectomy rates have fallen significantly in the past decade with benefit to the health and wellbeing of women who have had a breast cancer diagnosis.
- This chapter discusses the approach to the ‘simple’ WLE, which is an excision of cancer without level 2 oncoplastic techniques. These techniques will be described in other chapters.

Indications

- As with all breast surgery, this is tailored to each individual patient’s needs and wishes.
- Obviously, certain large or multifocal cancers still require mastectomy, but the overriding rule should be that all patients are at least considered for breast conservation should there be no detriment foreseeable to their oncological outcome.

- This will most likely be discussed amongst health professionals in the MDM setting and then options presented to the patient in clinic.
- Many patients, particularly early on in their treatment process, may be very adamant for a mastectomy, and sometimes bilateral, given the fear surrounding the cancer diagnosis.
- With a slow patient approach with family members and a Breast Cancer Nurse (BCN) present, the majority of patients will often come to an understanding of why conservation is a safe and effective treatment.
- This is, however, sometimes not possible, and where this is the case, the support of a clinical psychologist can be very helpful in ensuring the patients understanding and motivations are sound prior to such a major decision on surgery.

Localisation

- Where a cancer is not palpable, localisation is required to guide the excision of disease. There are a multitude of techniques for this from simple carbon tracking or hook needle to more advanced technology of magnetic seeds or radar tracers.
- Whatever method is used, however, it is imperative that localisation is accurate and user friendly, and this requires close communication between the radiology and surgical teams.

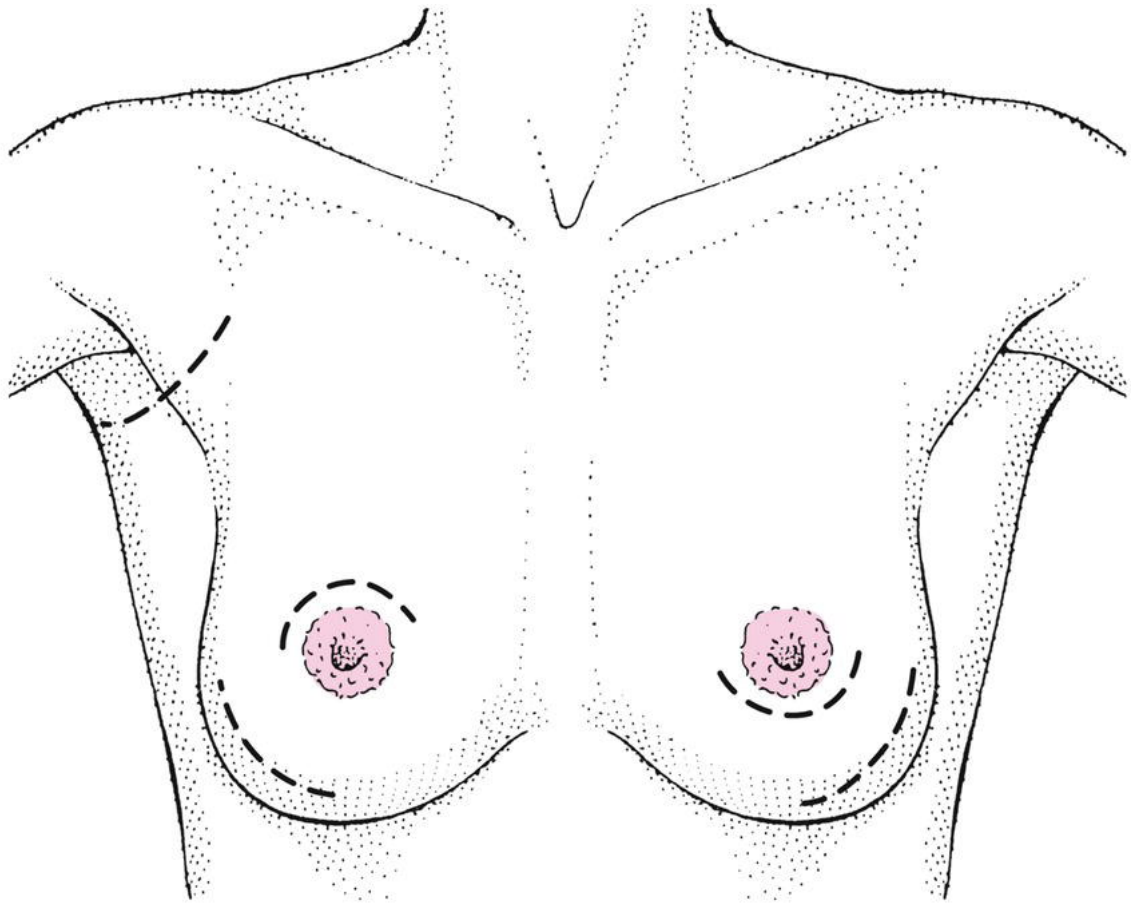
Preparation

- It cannot be overstated the importance of planning.
- This includes detailed discussion with radiological and pathology colleagues as well as time spent with the patient understanding what is most important to them regarding their treatment and managing their expectations accordingly.
- There can be situations where, particularly older, patients have no interest in aesthetic outcome.

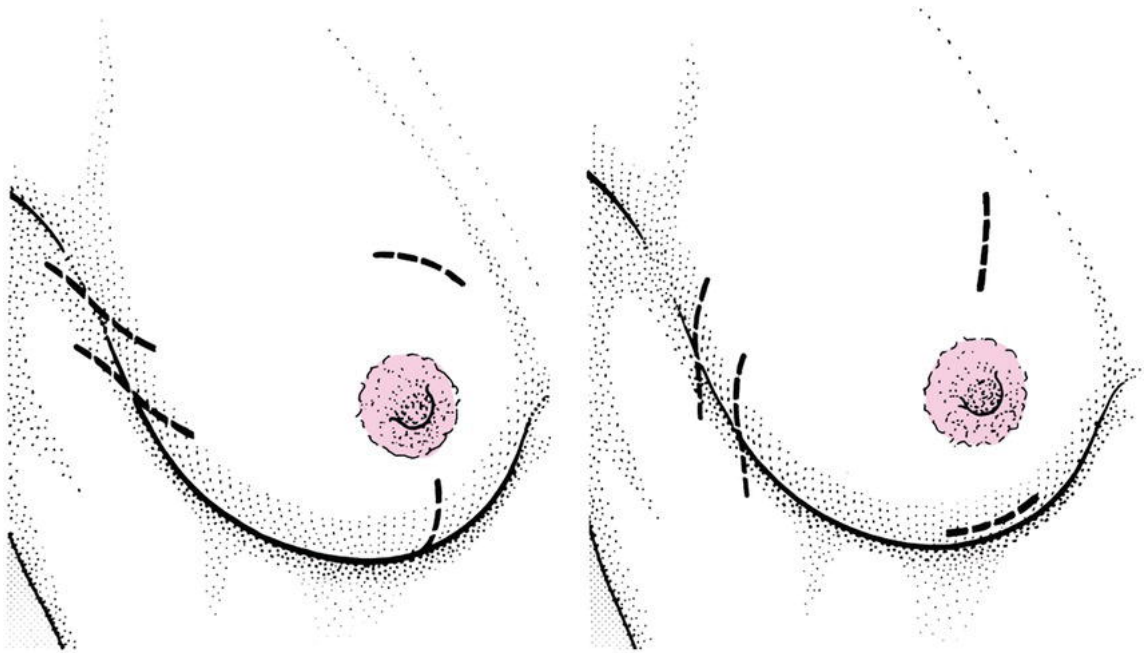
- Always explain the patients that there is a possibility of second operation if one of the margin or margins of WLE are found to be involved on pathology. These patients will need further re-excision of margin(s).
- Prior to scrubbing in theatre, all images as well as pathology should be reviewed.
- A quick visit to the radiology department to discuss the approach with a colleague can pay dividends.
- The operative approach and rationale were agreed between all members of the theatre team and the WHO safety briefing completed.
- Images should be displayed in theatre within view of the operating surgeons.
- A headlight may be very useful, allowing deep dissection but minimal traumatic retraction of skin edges by the assistant.
- If hydro-dissection is planned, the preparation of the tumescence should be done prior to scrubbing and overseen by the surgeon.

Operative Technique

- **Choice of incision:** This is absolutely key to a good aesthetic outcome, and again still done poorly in a lot of cases. Most lesions can be removed with one of three incisions as follows:



Various incisions for wide local excision



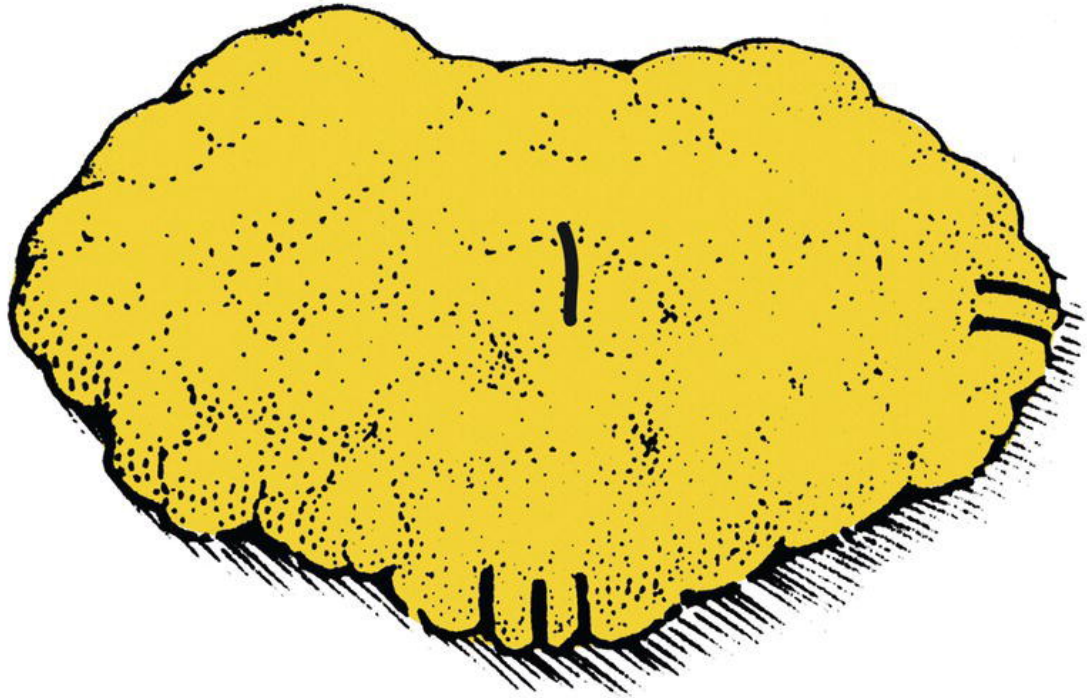
Various incisions for wide local excision of breast cancer

1. **Peri-areolar:** An excellent approach for central and even peripheral cancers within a smaller breast. Accurate marking of the areolar margin should be done prior to scalpel and is best seen when any skin prep is washed off the skin and theatre lights taken off full strength.
2. **IMF:** An excellent choice of incision for any cancer of the lower pole, general approach is like as already described, however, in this case, carrying out a dissection in the posterior mastectomy plane first and palpating the lesion from behind is a simple and easy approach. Should this approach be used, then make the incision about 1 cm above the IMF on the breast. This will avoid the resulting scar sticking to the chest wall muscles and also prevent poking in the bra strap and cause discomfort.
3. **Axillary skin crease:** There are multiple and differing creases within the skin around the tail of the breast and the axilla; they may not exist at all in the very thin patient. Where a lesion is within the tail of the breast, this incision

can be utilised for both the index lesion and the SNB where required.

- The last choice of incision should be over the breast itself, but where necessary, this should follow the lines of Langer or Kraissl's lines. Except for cases of skin involvement, incisions should never be made in the upper inner quadrant of the breast.
- The incision should be made under tension and deepened with cutting diathermy.
- This should be deepened to the breast parenchyma.
- Flaps can then be raised in the standard manner with either hydro-dissection or diathermy.
- A common mistake is overzealous skin retraction, here causing trauma to skin edges that may delay healing.
- The maximal tension needs to be between the breast tissue and the subdermal fat to open the plane of dissection, and this can usually be done adequately with minimal trauma with the operating surgeon's digits and no instrumentation at all.
- All bleeding should be dealt with as encountered to ensure as clean an operating field as possible.
- In cases where the lesion becomes palpable intraoperatively, this allows for accurate dissection with margins around the lesion by constantly palpating the mass behind the fingertips of the non-dominant hand.
- The surgeon retracts the lesion as the assistant draws the surrounding tissues away with Langenbeck retractor; this tension should always be kept, ensuring the diathermy is working with maximal efficiency.
- In cases where the lesion remains impalpable, it is the author's preference to pen mark the point of maximal signal (if using magnetic seed/radar technology) and work around this.
- Regular review of the position of the lesion and the dissection planes being formed is very important.

- In a large fatty breast, it can be very easy to digress from what is the correct dissection.
- Traditional teaching suggests all excisions should be full thickness, and although this remains generally true, in small superficial lesions in a large breast, this would result in excision of too much healthy tissue.
- Where full-thickness excisions are deemed necessary for adequate margins; the pectoral fascia and indeed its overlying thin layer of fat do NOT require routine excision.
- In cases where there is breach of this fascia with disease, this can be dealt with by removing a fillet of muscle en bloc with the posterior aspect of the lesion.
- Prior to actual removal, the specimen should be orientated in situ where possible (our standard practice is to put a single Liga clip to mark the anterior border, two clips for the medial and three clips to mark the inferior border).



Wide local excision of breast lump orientation

1. Clip anterior
2. Clips medial
3. Clips inferior

- There is always the possibility that it is dropped from or spins in the instrumentation on removal, rendering the specimen unoriented with potential serious consequences should any margins be deemed positive on pathology.
- For large cancers requiring large-volume excision, raising adequate flaps is key to the operation.
- This may be more easily facilitated with hydro-dissection of the flaps and scissor dissection.
- The planes can be identified, and it may minimise flap trauma secondary to diathermy.
- The specimen now orientated should now be examined visually by the surgeon looking for any obvious breach of the margin of

the lesion and then inspected by intraoperative X-ray where available.

- Time taken to arrange the specimen on the X-ray plate is key here, ensuring all margins are aligned perpendicular to each other with the inferior margin aligned to the inferior portion of the plate.
- A second view should then be taken with the specimen turned 90° on its axis, allowing an examination of the anterior and posterior margins; this allows a second look at the other margins in a different orientation.
- The specimen should then be weighed and fixed in formalin (document the specimen weight in the operative notes).
- Where there is doubt regarding an adequate margin, a shave of the cavity must be taken. These shaved margins should be orientated for pathology. Our standard practice is to put one Liga clip on the 'cavity side' to mark the specimen.
- Cavity shavings should be X-rayed as well to check for residual microcalcification etc.
- The cavity of WLE can be marked as per local protocol. Application of 4 Liga clips to mark the cavity will help in planning and delivery of post-operative radiotherapy to the correct site.
- Also, in case re-excision of margins is required, then the cavity can be correctly identified if it is marked.
- Apply waterproof dressing after wound closure and inject local anaesthetic as per protocol.

Cavity Margins

- Margins should be taken where deemed appropriate from physical inspection or on examination of the X-ray image.
- This is often done poorly with inadequate information given to the pathology team.

- Any margin taken must include the entirety of that margin, i.e. an inferior margin must encompass all tissue to the junction of the inferior to lateral and medial margins.
- It must be of adequate thickness and have no breaks within the tissue.
- It must take all tissue from the anterior to posterior margins.
- Where a large margin is taken, it can often be helpful to fully orientate this in the standard manner.

Closure

- Simple deep to superficial closure of the cavity
- Manipulation of columns of breast tissue between the anterior and posterior skin flaps and approximation to close the defect can be done (glandular flaps)
- Haemostasis is usually undertaken prior to packing the cavity with a swab before the SNB is carried out.
- Small cavities can be closed from deep to superficial with no dent to the skin on final closure.
- Most cavities do, however, require some manipulation of tissue to ensure minimal denting to the skin in the long term. Lipofilling of the surrounding breast tissue around WLE cavity can be done to replace volume in excisions of more than 20% volume.
- Simple manipulation of breast tissue can support the skin overlying the cavity and, for larger excisions, single or multiple episodes of lipofilling can eliminate extremely large defects.

Complications

- **Haematoma:** Uncommon and will usually present soon after surgery. In delayed cases, these can often be managed conservatively (depending on size and symptoms).

- **Seroma:** With elimination of the cavity as detailed in this chapter, the risk of this can often be missed.
- **Pain:** Minimal post WLE
- **Infection:** Usually, can be treated with simple oral antibiotics
- **Skin denting:** This may be avoided, at least to some extent, using the techniques detailed above. It is, however, important to understand that this will almost always be worsened by radiotherapy and managing patient expectations around this is paramount.
- **Nipple:** Areola distortion due to loss of volume

Post-operatively

- The pathology request form should be filled in by the primary surgeon in theatre. This should summarise the biopsy results as well as the surgery itself.
- A diagram can be extremely helpful in assisting the reporting pathologist and informing future discussion of the results of the MDM.
- The post-operative note should be equally detailed and again include an annotated diagram showing the approach and excision as well as details of any margins taken.
- It is good practice to write this note considering you yourself may not be present in the MDM discussion so detail it so the discussion may be adequately informed in your absence.
- Specimen weights, blood loss and sutures used should be documented.
- Post-operative instructions should include medications and thromboprophylaxis.
- Most of these patients go home the same day and should be discharged with wound care advice and simple analgesia.
- Unplanned overnight stays are usually secondary to anaesthetic complications or unexpected social reasons.

How to Perform Operative Procedures in Breast Surgery, First Edition. Dhananjay Kulkarni, Kenneth Elder, Cameron Raine and J. Michael Dixon.

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9

Marking and Procedure of Mastectomy, Skin-Sparing Mastectomy, Goldilocks Mastectomy

Surgical Anatomy

- 15–20 mammary ducts start at each nipple, leading to terminal duct lobular unit at the periphery.
- Fibro-fatty tissue with lymphatics and blood vessels forms the supporting tissue around mammary ducts and ducto-lobular units.
- 15–40 nodes in axilla
- Base of the breast tissue lies between the 2nd and 6th ribs, from the sternal edge up to mid-axillary line.
- Breast tissue lies on pectoralis major, serratus anterior and rectus abdominis muscles.
- Size and weight of breast tissue varies, ranging from <100 to >2000 g each.
- Breast lymphatics: 85% to axillary nodes, 15% to IM nodes

Blood Supply

1. Arterial supply:

Medially: from perforating branches of the IM artery that arise from the lateral margin of the sternum penetrating through the deep surface of pectoralis major. These branches are often encountered at the medial most dissection in a mastectomy.

Laterally: The lateral thoracic artery, which is usually the second branch of the axillary artery; it follows the lower border of pectoralis minor before supplying the

superolateral aspect of the breast, these branches are often encountered when dissecting the axillary tail of the breast. These arteries are complimented (particularly in the lower pole of the breast) by perforating branches of the intercostal arteries (often encountered in the posterior dissection plane of a mastectomy).

2. **Venous drainage:** Superficially starts with subcutaneous plexus richest around the nipple areolar complex, draining medially to the IM vein. Laterally and deep the veins drain into the azygos and vertebral veins and subsequently into the IVC.

Indications

Indications for mastectomy have lessened considerably in the past decade.

With the introduction of NACT and hormonal treatment, oncoplastic procedures and in particular therapeutic mammoplasties, perforator flaps and immediate lipofilling techniques increased volumes of diseased tissue can be excised, leaving acceptable aesthetic results, thus negating the need for full mastectomies.

The old adage that only 20% of breast volume can be removed at WLE no longer applies. There are, however, a number of true indications that still exist for a mastectomy.

- Disease occupying a significant volume of the breast where no oncoplastic procedure could fill the defect and leave a satisfactory aesthetic result
- Recurrent disease that would require adjuvant radiotherapy (the caveat being a patient may accept the increased risk of further recurrence with no radiotherapy in order to undergo a repeat WLE only. This is especially true in non-aggressive disease)
- **Inflammatory breast cancer:** A significant portion of skin is usually required for oncological clearance of disease. Of note, there are a few select cases where dermal extent of disease is limited and a WLE can be considered.

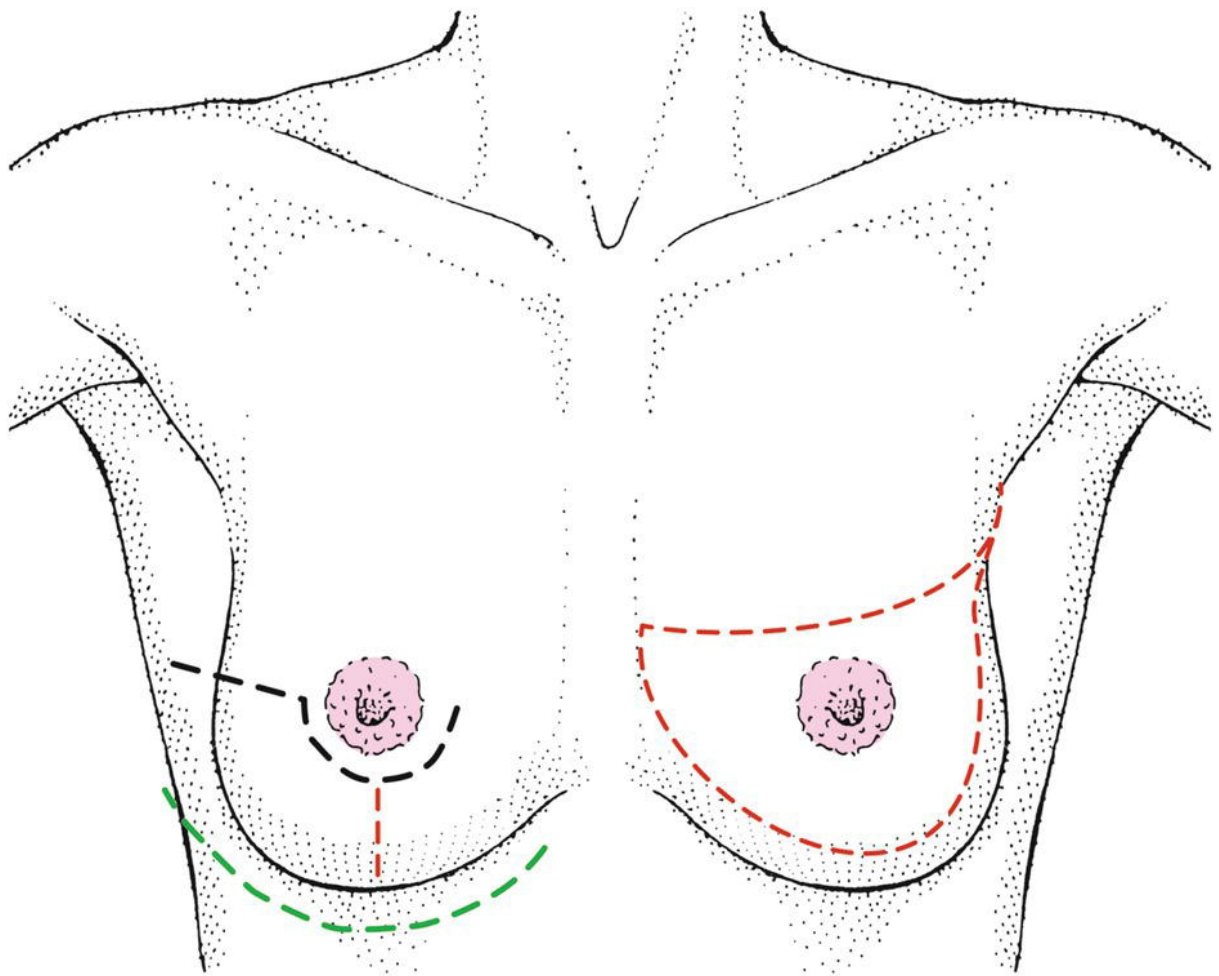
- Inability to achieve negative margins with multiple attempts (generally less than 4) following WLE
- Multifocal disease that cannot be taken out en bloc or as multiple WLEs and leave an acceptable volume of breast tissue. In these cases, there is also concern that radiologically these are distinct and isolated areas of disease, they often represent contiguous disease.
- **Patient choice:** This is very often encountered in the clinical setting, the patient who wishes a mastectomy where breast conservation will suffice either due to a fear of recurrence or a wish to not undergo future surveillance. They may wish for a unilateral or bilateral mastectomy. Where this is not clinically indicated, most patients may be counselled with a long consultation to discuss the benefits and downsides of such an approach, and most opt for conservation once the shock of diagnosis subsides and the safety of conservation is patiently explained. In some cases, however, patients may be adamant they still wish a mastectomy and indeed this may be appropriate to maintain a quality-of-life post-treatment. In these situations, it is of the utmost importance that a clinical psychologist's input is sought by the surgeon prior to progressing to surgery.
- Prophylaxis for those carrying high-risk genes for developing breast cancer

Pre-Op Workup and Consent

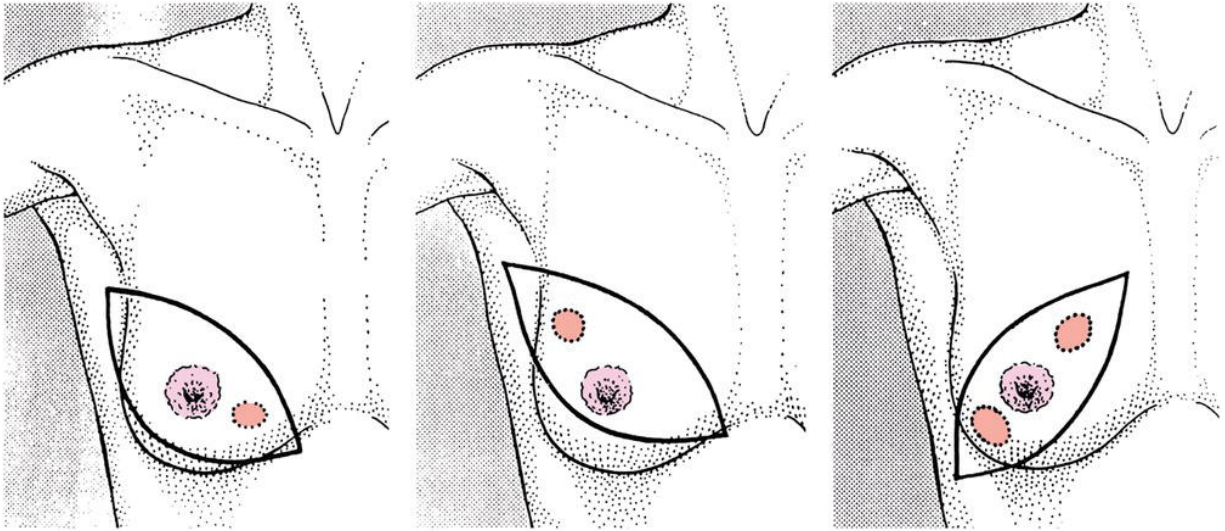
- It should not be underestimated how shocking a mastectomy can be to patient's psychology. The breast plays a very significant and important role in body image.
- Its loss is felt greatly by most, and counselling prior to surgery, most often done best with BCNs, may prepare a patient for the post-operative period.
- Whilst it remains a common and seemingly simple procedure to breast surgeons, this is definitely not the case for the patient. Discussion and timing of reconstruction is discussed elsewhere in this book.

- General workup is as for other breast procedures; the mastectomy itself is not a particularly morbid operation, and patients fit for GA are generally fit for mastectomy.
- While consenting, always explain patients about potential complications like bleeding, infection, scar, seroma, wound edge necrosis, nipple necrosis, numbness around the scar, chronic chest wall pain, loss of implant reconstruction in case of infection/necrosis and even lymphoedema of the arm.

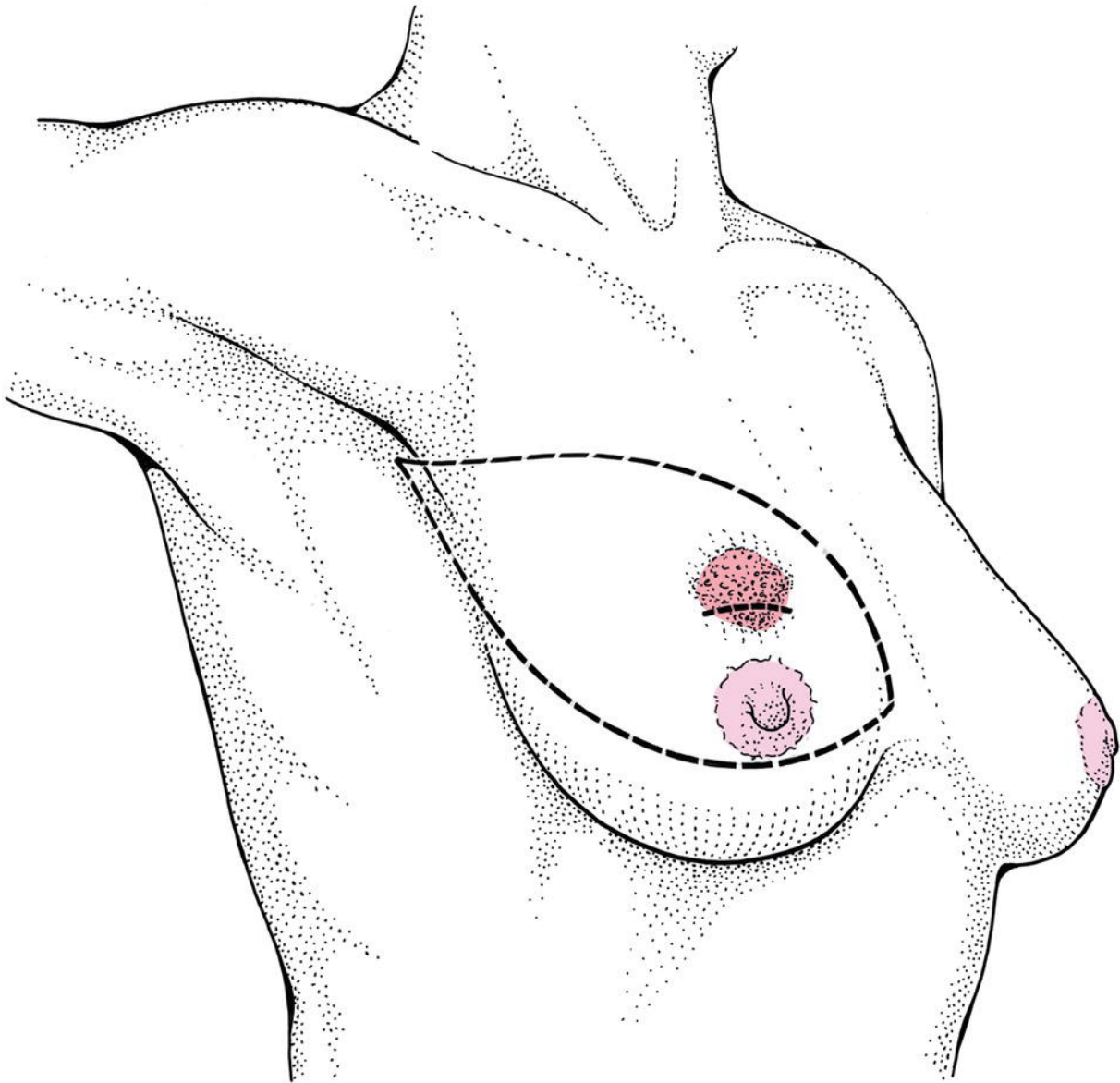
Marking/Incision Planning



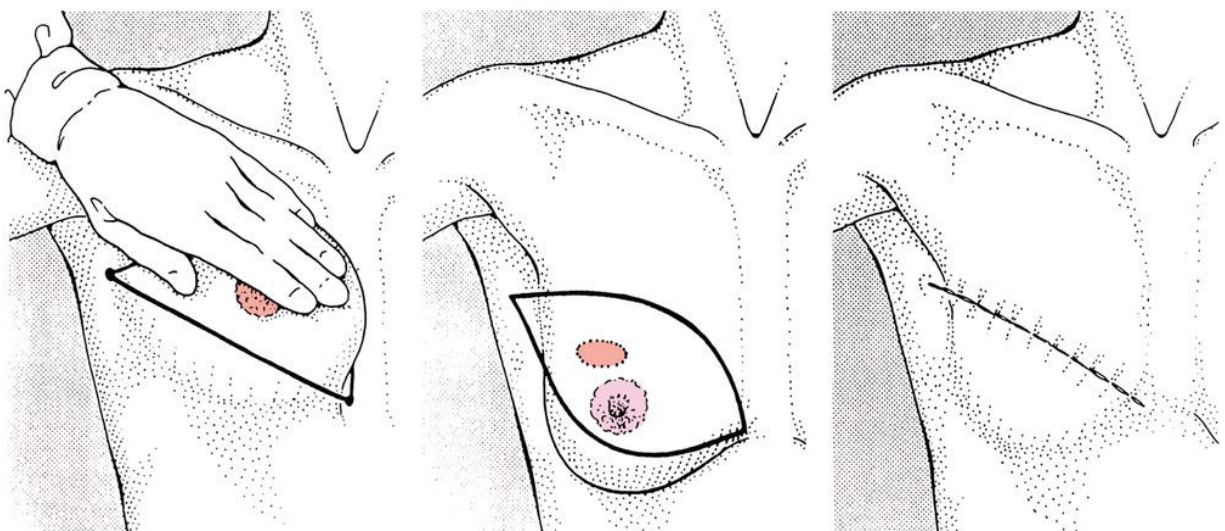
Various incisions for mastectomy procedure



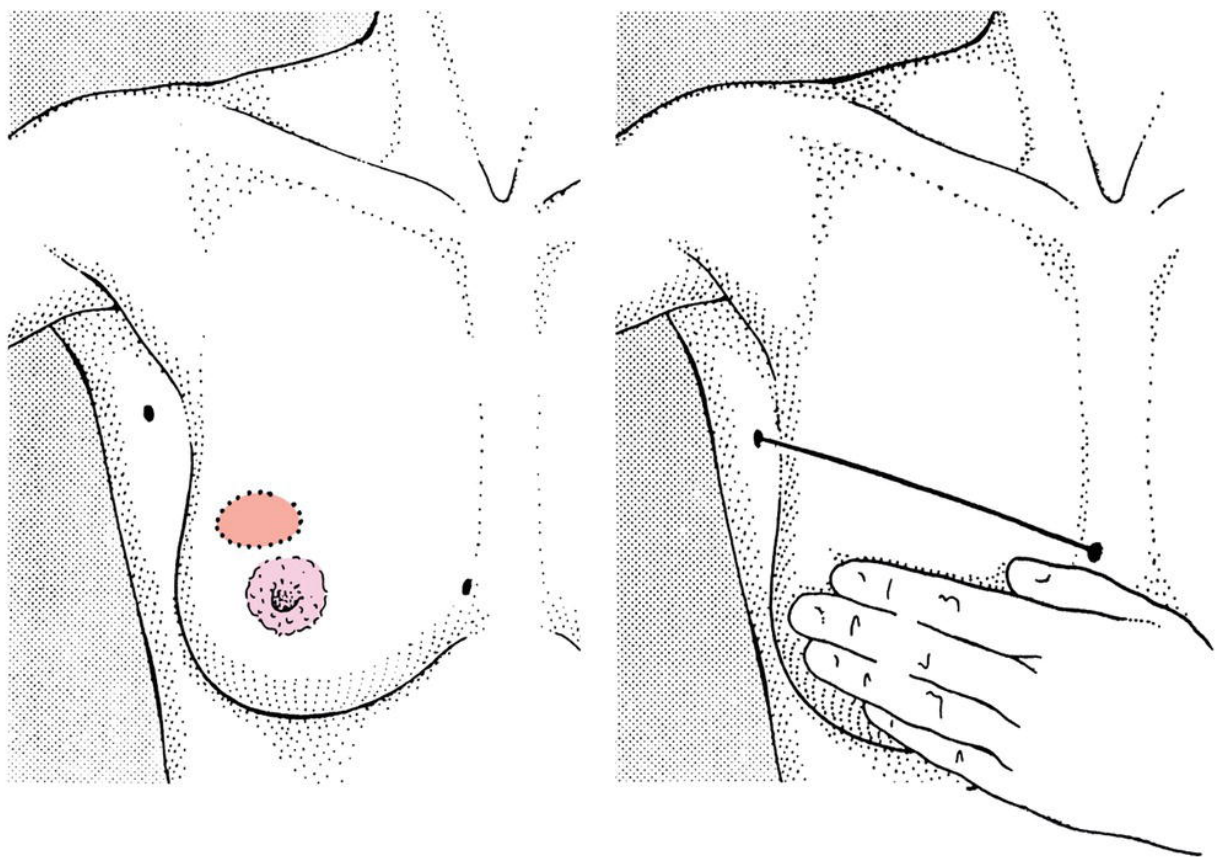
Incision for mastectomy



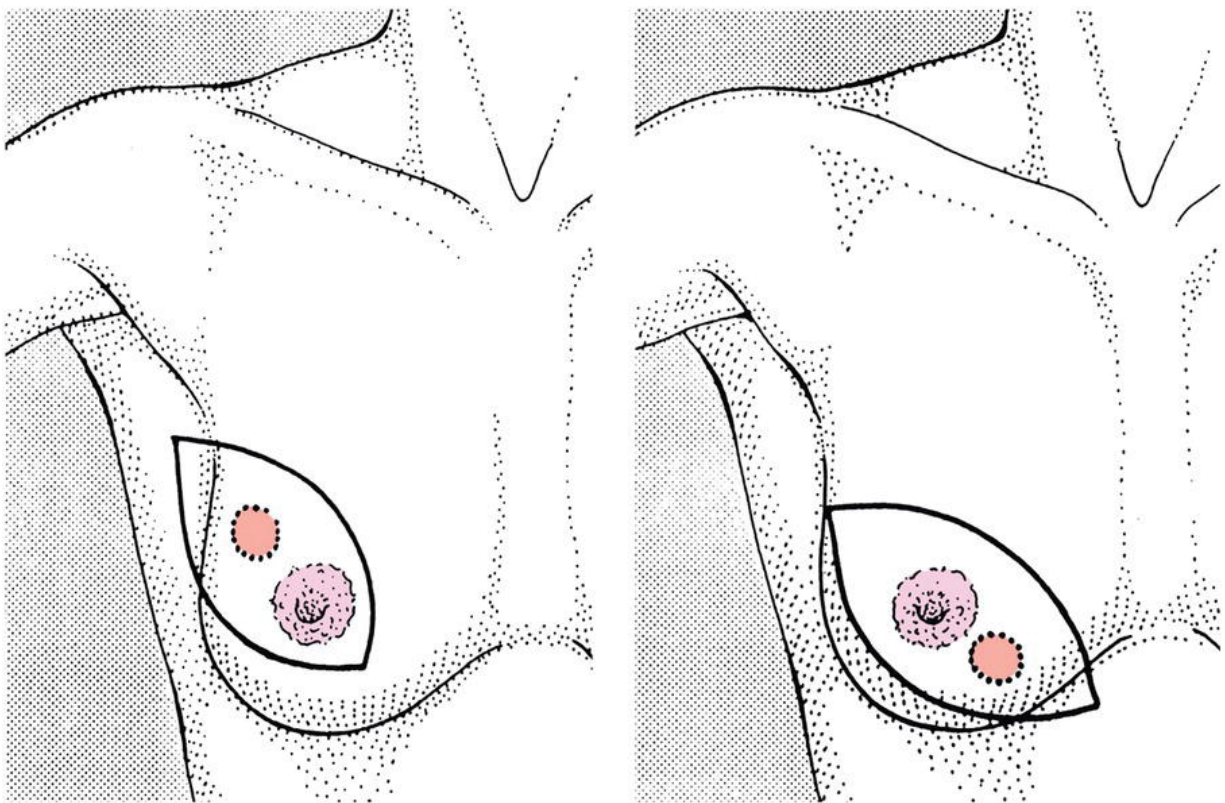
Mastectomy incision



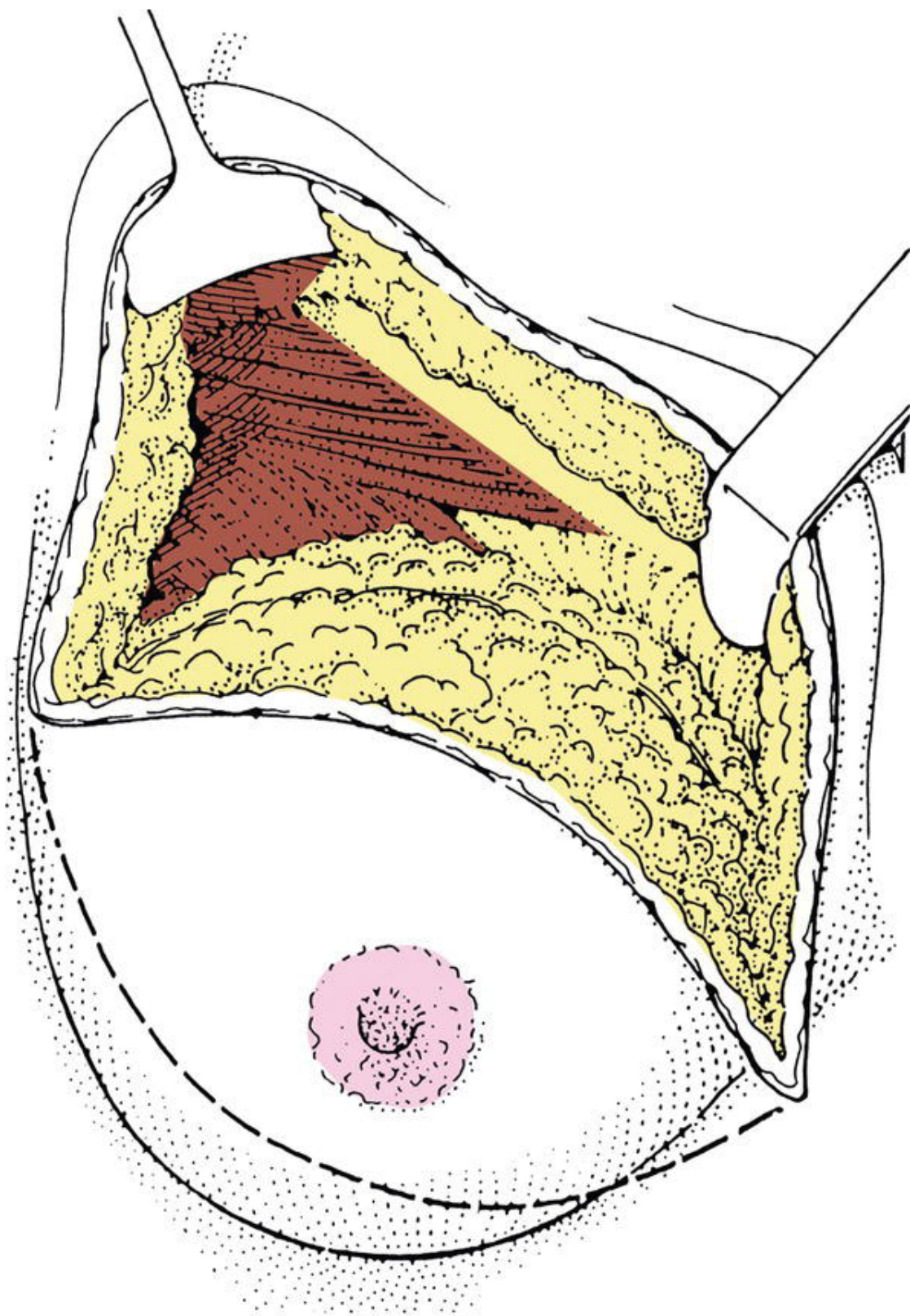
Mastectomy



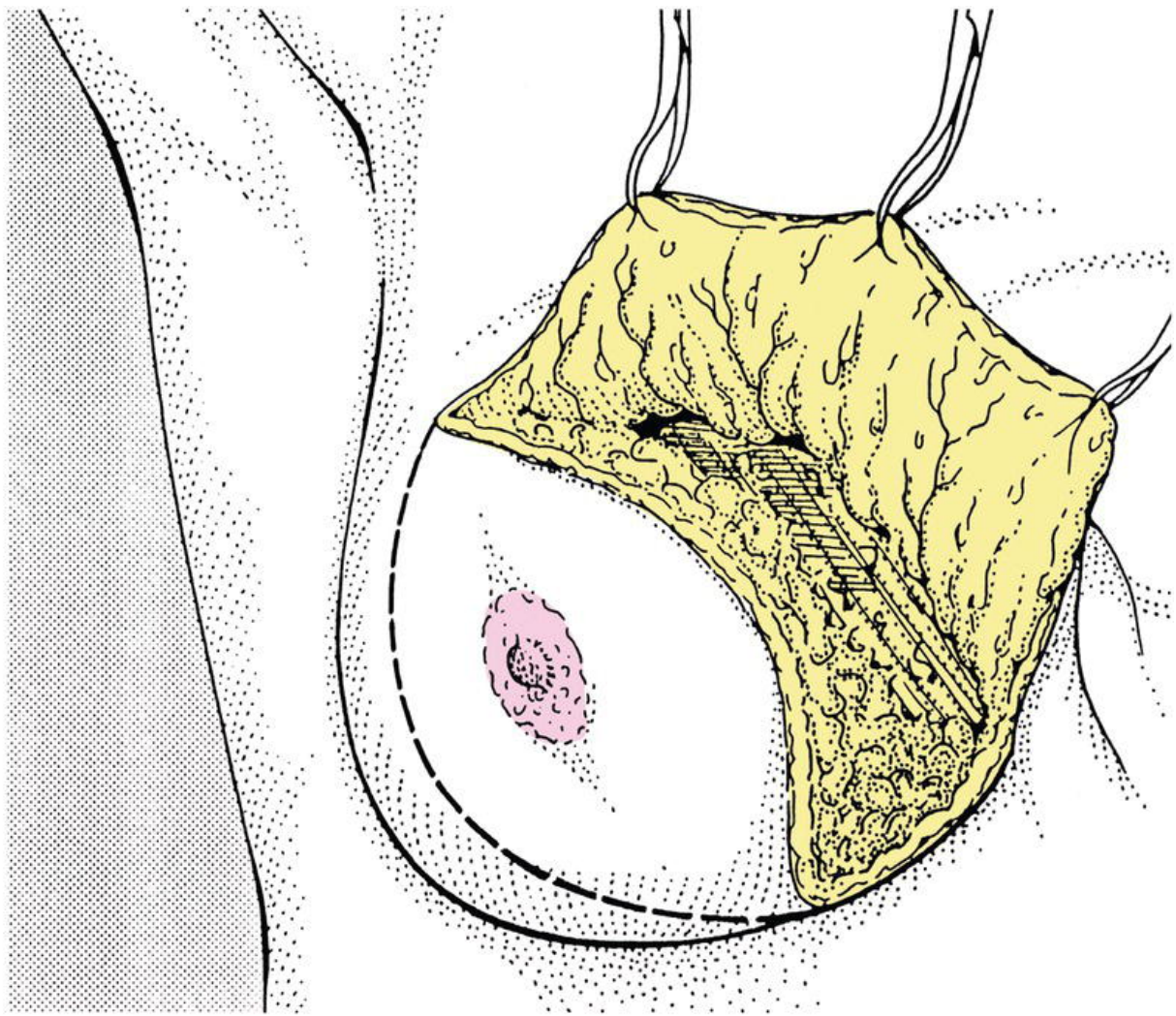
Incision marking for mastectomy



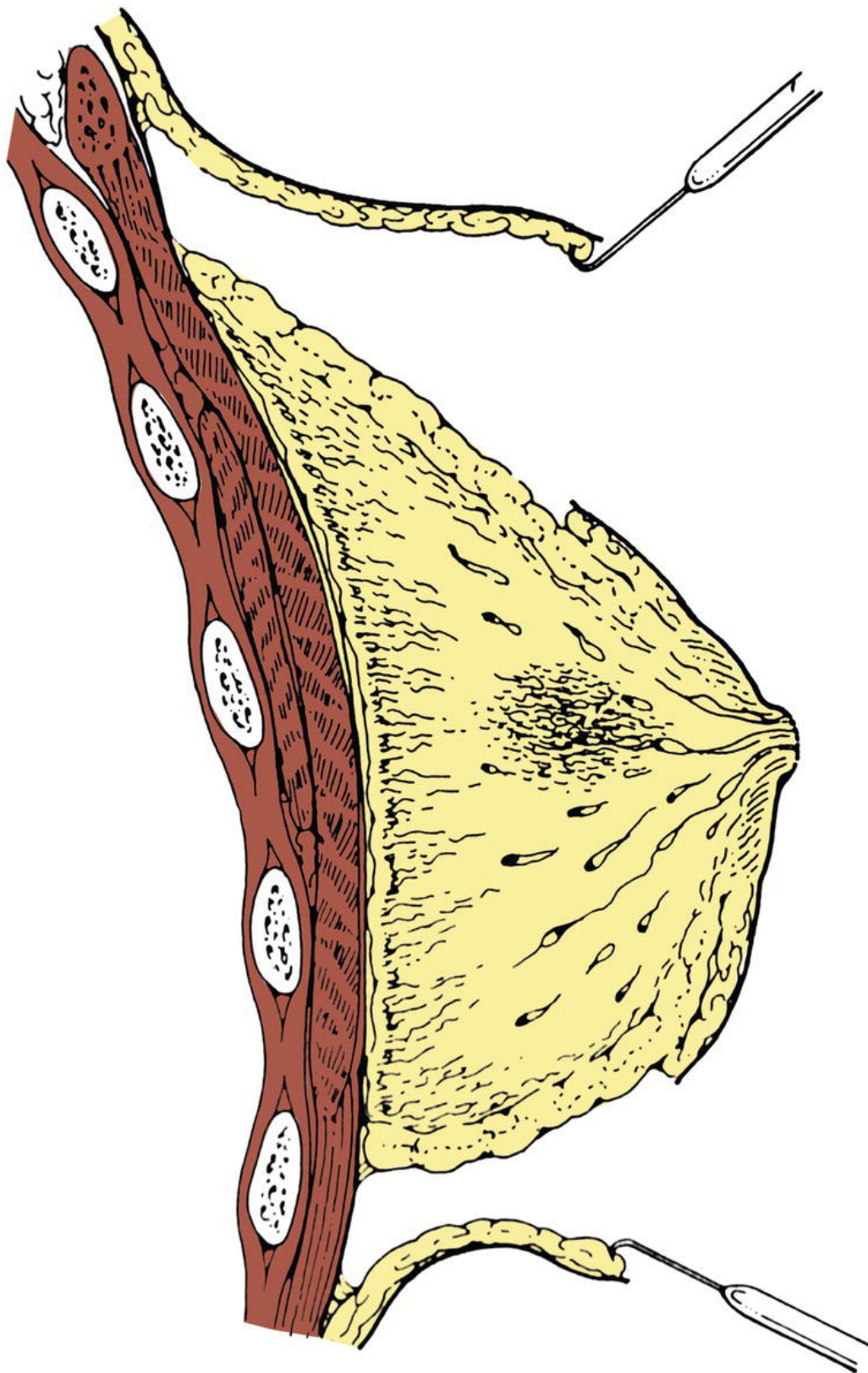
Mastectomy incision to include nipple, areola and the cancer



Mastectomy plane



Mastectomy plane



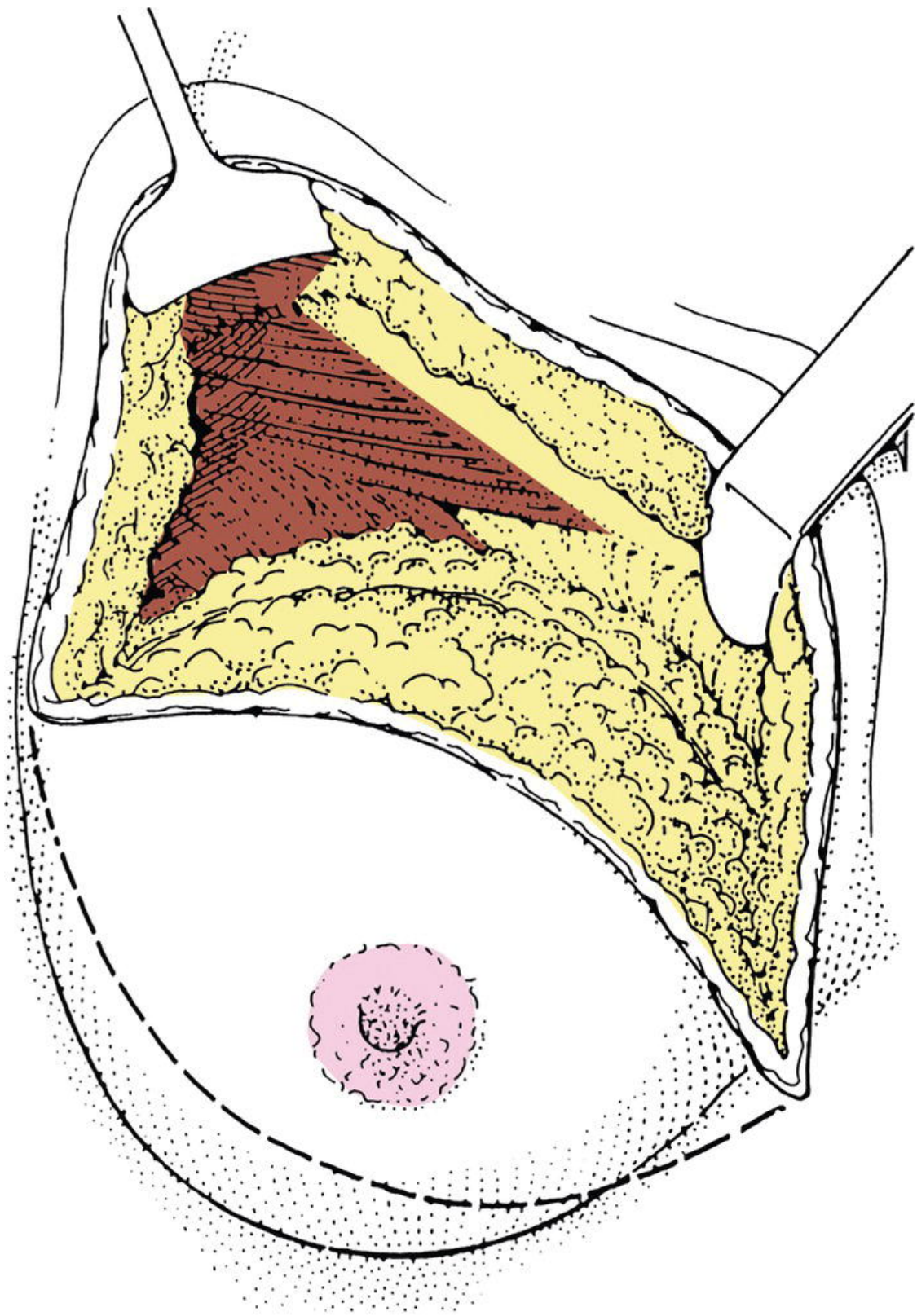
Mastectomy plane

- **Simple/transverse:** Transverse mastectomy incisions have been the norm. Widely used because it gives good access. The aim is to leave chest wall flat, BUT many are 'caved in' due to the shape of the chest. Most cause dog ears or angels' wings.
- Should only be used now in select cases where a proportion of skin above the NAC is required for oncological margins. Leaves a poor aesthetic result and is more difficult to achieve good cosmesis where delayed reconstruction is considered.
- **IMF incision:** Should be the incision of choice, it leaves an aesthetically pleasing scar following a simple mastectomy and, in cases where delayed reconstruction may be considered, maintains an important anatomical landmark.
- **Skin-sparing mastectomy:** The NAC is excised and forms the entry point for dissection of the breast (diagram showing ellipse/circle around NAC). The skin envelope left forms the pocket for subsequent reconstruction.
- **Nipple-sparing mastectomy:** In cases where the disease is considered distant enough to the NAC, this may be preserved; this is achieved with either an IMF approach or peri-areolar with lateral extension.
- **Goldilocks mastectomy:** Transverse incision that goes around NAC (to be removed with the mastectomy specimen). Then de-epithelise the lower flap and bury it under the superior flap with 'double breasting'. The lower flap could be anchored onto the chest wall with few loose absorbable sutures. This technique gives a cushion of tissue over the chest wall and helps the prosthesis fit better later on. It also helps to add volume if reconstruction is planned in the future.

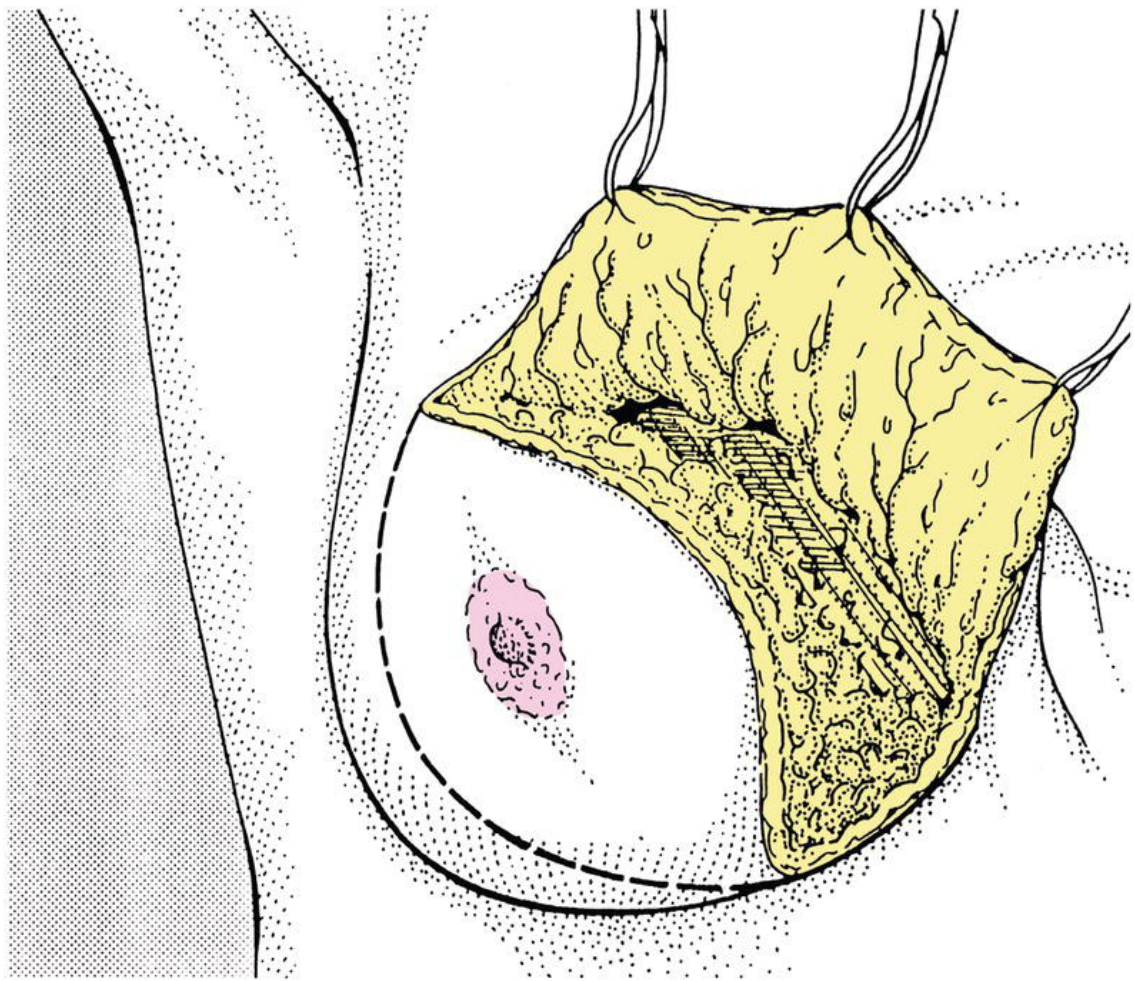
Procedure

- Despite a mastectomy being considered a common and simple procedure, it is commonly done incorrectly. The most common mistake is poor adherence to the embryological plane between the breast parenchyma and the subcutaneous fat.

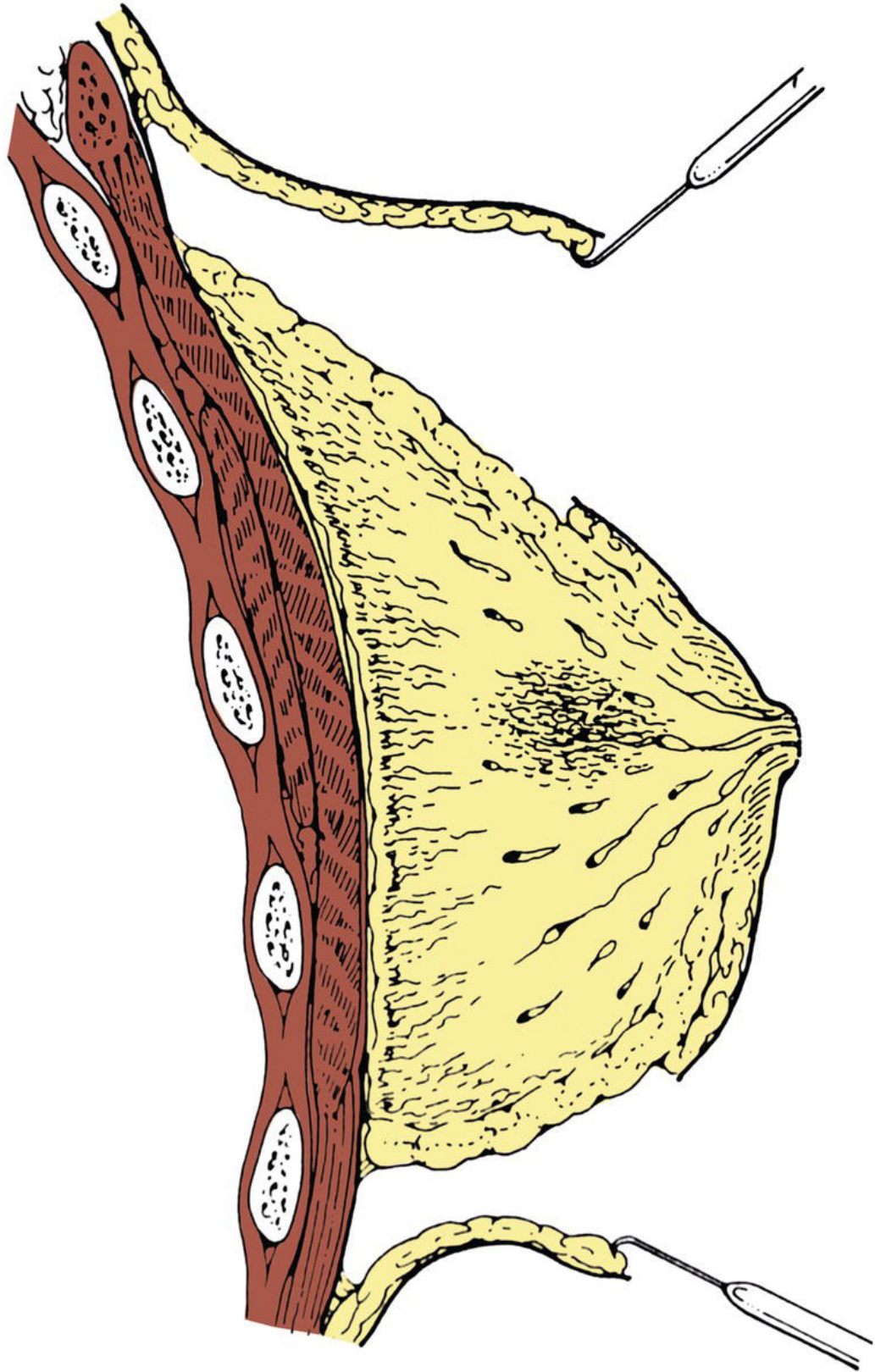
- It is absolutely vital to mark the boundaries of the breast tissue while consenting on the day of surgery. The boundaries should be marked with patient in standing position. It is important not to cross the marked lines during surgical dissection.
- Under dissection leaves behind breast tissue and is obviously a potential source of recurrence. This is easier done in a fatty non-dense breast where the plane between fat and parenchyma can be difficult to follow.
- More commonly, it is over-dissected and the subcutaneous fat is excised overlaying the breast parenchyma. There are a number of issues with this; most importantly, it carries vasculature essential to maintain flat and nipple perfusion. It also provides natural coverage (both in feeling and warmth) to any reconstruction, which is particularly important where an implant is used.
- A mammogram should always be referred to prior to any mastectomy as the degree and volume of subcutaneous fat can often be accurately estimated from this.
- The anterior mastectomy plane may be followed by diathermy alone, but it is an adequate retraction, both on the breast by the operator and the flap by the assistant, that opens up the appropriate plane.



Mastectomy plane



Mastectomy plane



Mastectomy plane

- The most likely cause of loss of plane is inadequate retraction. However, it must be understood that overzealous retraction of the flap can cause trauma.
- Another method is hydro-dissection of the anterior mastectomy plane. A mixture of saline/adrenaline/local anaesthetic is infiltrated either through the initial dissection plane or into the breast around the NAC. The solution is pushed through a large-bore needle and 'blows up' the appropriate plane. This then allows the operator access to this plane with large (Mayo Harrington's) scissors to dissect through the plane with minimal trauma and bleeding.
- The scissors should be passed with bevel down (contradictory to what feels natural) and pushed down onto the breast tissue.
- This allows then to follow the plane without digging outside of where they naturally wish to glide.
- In cases where an IMF incision is used for access, this is extremely useful, and the use of diathermy in the upper pole far from the excision can be extremely difficult.
- Another pitfall is overdissection of tissue medially, laterally and superiorly. This can easily be avoided where the breast contours are pre-marked with the patient sitting upright prior to anaesthetic.
- Medial overdissection can be a particular issue where reconstruction is planned as it deforms the resultant cleavage.
- Posterior dissection should follow a plane between the breast and the pectoral fascia. Unless there is macroscopic evidence of posterior disease, the pectoralis fascia DOES NOT require excision. There is no oncological benefit, and its excision most likely results in excess seroma formation and post-operative pain.
- Posterior dissection can be done with diathermy or with scalpel and clipping of perforating vessels.
- Lateral dissection needs to respect the axillary tail of the breast, but not over-dissect into the subaxillary fat or into the axilla

itself.

- Encountering lymph nodes does not necessarily mean the axilla has been entered as this is the most common location of intramammary nodes.
- The breast should then be orientated (stitch to axillary tail suffices) and weighed.
- It should also be palpated for 'scalloping' that is where there are obvious indentations into the breast parenchyma where the plane has been lost.
- This would represent areas where breast tissue has been left on the flap, and since the specimen has been orientated, this should guide the operator as to where on the flap these may be.
- The flaps themselves should also be palpated for potential islands of remaining breast tissue.
- At this point, there should be a check for haemostasis. Particular attention should be made to inspect for spasmed small arteries, which, although not currently bleeding, will do once the spasm subsides (most commonly in the small hours of the night!). Where no reconstruction is planned, a drain should be placed usually along the lower border of the cavity and taken out laterally through the skin.
- Always inspect for bleeding at the perforation site of the drain.
- At this point, quilting of the anterior flap to the pectoralis fascia should be done (described elsewhere in the book).
- When bringing the skin edges together, it is not uncommon that too much/not enough skin has been excised. In the case where too much skin has been taken, dissection may be continued down to the rectus fascia below and above the pectoralis major superolaterally, and this will usually allow for closure.
- Where skin edges require significant forces to pull the sutures together, this is very likely to result in wound breakdown.
- Excess skin should always be excised where encountered at the end of a mastectomy.

- **Quilting** is performed in multiple rows with a continuous barbed stitch with sutures placed loosely 2 cm apart. Five to seven rows are required to close a mastectomy or dissected axilla. When closing after axillary clearance, suturing starts at the apex and opposes the chest wall fascia medially to the soft tissue of the chest wall laterally. Multiple small bites are taken, and the suture kept loose. When closing a mastectomy, start at the upper limit of the mastectomy flap and take small stitches opposing fascia of the chest wall muscles to the subcutaneous fat or fascia in the mastectomy flaps anterior. If dimpling of the mastectomy flap is evident, the sutures are too tight and should be loosened. To avoid a dog ear laterally, the mastectomy skin and subcutaneous are pulled medially and sutured in place to medicalise this tissue and to obliterate the space. This helps avoid excessive skin and bulk laterally, but if there remains excess bulk laterally, this should be reduced by simple liposuction using wall suction and a 315 Mercedes cannula after infiltration of 1 in 500,000 adrenaline (epinephrine) solution.
- Standard skin closure with monofilament absorbable sutures in layers suffices with simple waterproof dressing.

Post-operative Management

- **Thromboprophylaxis:** Should be given unless there is a haematological contraindication. Although they almost definitely play some role in post-mastectomy haematomas, it should always be given.
- **Physiotherapy:** All patients should be seen by a breast surgery-specific physiotherapist the day following a mastectomy.
- **Antibiotics:** Very rarely required post-operative. Given at induction and then none after unless the mastectomy was prior to the insertion of an implant and drains are in place.
- **Analgesia:** Simple analgesia of paracetamol and NSAIDs suffices in the majority of cases.
- **Drain management:** Drain output in terms of volume and type of fluid should be regularly assessed by nursing and

surgical teams. Initial output is almost always blood-stained, but this should make way for more hemo-serous output within 24 hours. Different surgeons advocate for different 24-hour drain volumes prior to removal, but in cases of well patients returning home, less than 150 ml/24 hr is acceptable. For those returning home alone or back to nursing homes, it may be pertinent to have less. In some patients, returning home with a drain in situ with prior discussion is very acceptable and can expedite the discharge of patients back to their home environment.

- Soft bra and prostheses should be offered to all patients. Once the wound has healed in about six weeks, patients can then be referred to a prosthesis clinic for measurement and shaped prosthesis fitting.
- Complications
- **Haematoma:** The potential space behind a mastectomy scar can accommodate a very significant blood volume. Low drain outputs should not reassure; these are often blocked with clot or lying outside the main pocket of blood. Any patient with abnormal observations or significant pain requires immediate examination by the surgical team. Beware of the low-habitus patient. In case of haematoma, patient needs to return to theatre for evacuation of haematoma.
- **Seroma:** Very common and almost a sequela rather than the true complication. Most will be reabsorbed by the body, and patients reassured. They may be minimised with quilting of the mastectomy flap to the chest wall. If significant volume, seroma can be aspirated in the outpatient clinic.
- **Nipple necrosis and wound edge necrosis:** In the case of nipple-sparing mastectomy, this is of particular concern in smokers, diabetics and others with poor microvasculature. Can be the consequence of dissection of the subcutaneous fat of the breast.
- **Skin/flap necrosis:** As above, will need debridement and refashioning of the flap with suturing

- **Wound infection:** Uncommon but can usually be adequately treated with oral antibiotics in the community
- **Dog ear:** Considered of minimal importance by a lot of surgeons, but this is certainly not the attitude of the patient. It is unsightly, even painful and can be a constant reminder of cancer and surgery to the patient. This is particularly the case where it is of sufficient size to cause irritation of skin caused by the arm swing in walking or lying on it when sleeping. Caused by poor marking and under excision of skin in the lateral aspect of the mastectomy. Bringing narrow flaps to a point is the most likely cause. It may, however, be entirely unavoidable in patients with increased body habitus as the lower axillary fat should not be excised with a mastectomy and this fold will persist. In these cases, post-mastectomy liposuction in this area can minimise this issue or sometimes formal excision is required.
- **Pain:** Post-operative pain is seldom an issue and can generally be controlled with simple analgesia. The procedure of a pectoral block prior to closure of the wound for immediate analgesia can be considered.
- **Excess skin:** A common and underestimated issue. The inexperienced surgeon is often concerned with the inability to close the mastectomy wound at the end of the operation. As a result, excess skin is encountered when closing. Again, this is unsightly and easily avoided. If there is obvious excess skin at the end of the operation, an extra 10 minutes taken to excise this prior to closure will give a good result. A good scar is important for the fitting of the prostheses.

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10

Extended Latissimus Dorsi Myocutaneous Flap

Introduction

- The pedicled LD myocutaneous flap remains one of the most versatile and viable flaps available to the oncoplastic breast surgeon.
- It fell out of favour against abdominal flaps due to the limited flap volume that could be achieved.
- Its use as a pedicled flap is now primarily for breast reconstruction following mastectomy and can be done with or without an implant.
- In Edinburgh, we prefer an extended LD flap, which became popular in the 1990s. This technique achieves greater volume with the inclusion of de-epithelialised skin paddles and additional subcutaneous fat.
- Even with this technique, symmetry with a larger contralateral breast may not be achievable, and we advocate the use of immediate lipofilling to the flap and surrounding soft tissues, which we have shown to be effective and safe and is our preferred approach.

Indications

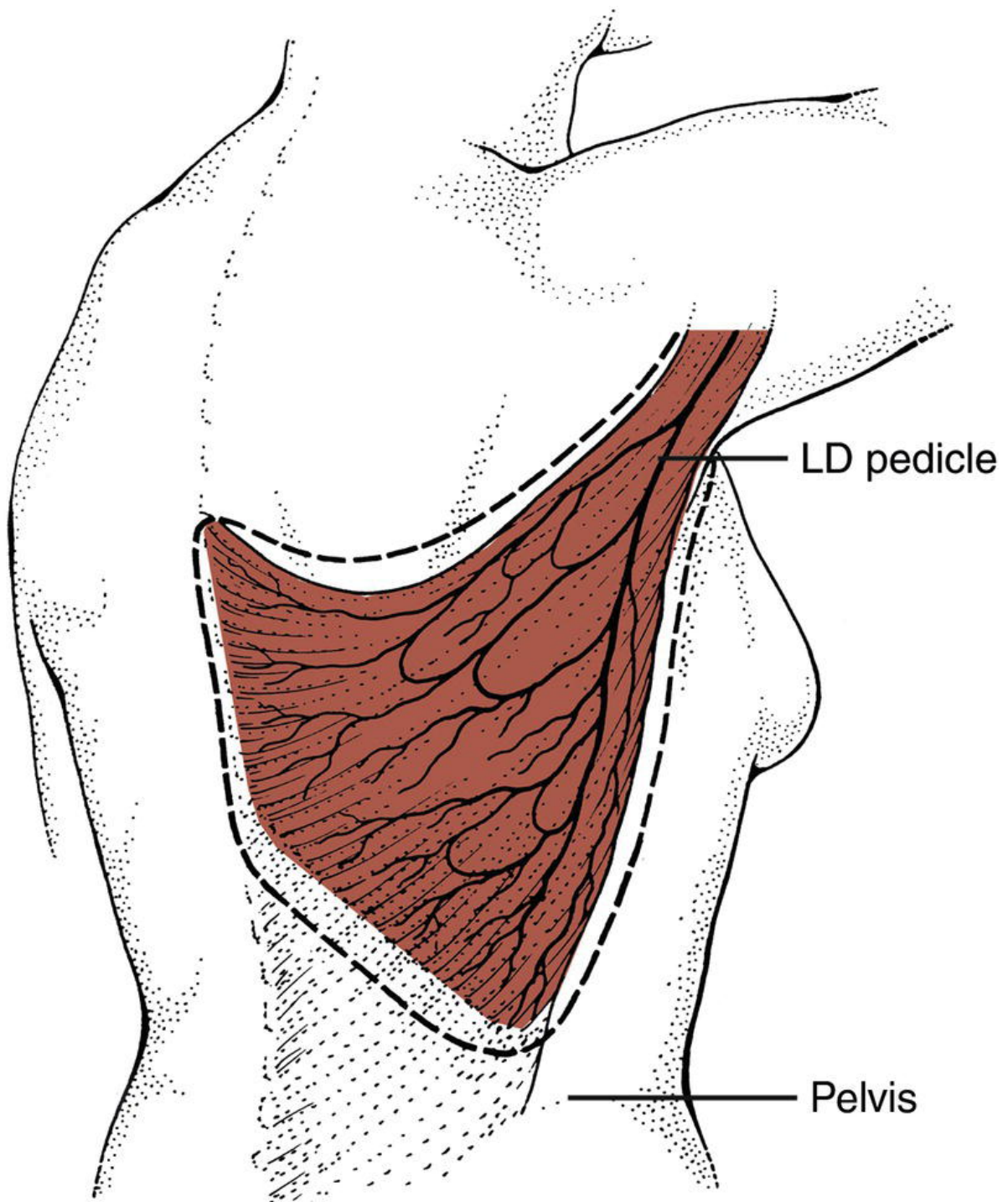
- Breast reconstruction following mastectomy, either as an immediate or delayed procedure
- Muscle alone to create a pocket for implant reconstruction. This is described, but in clinical practice, such indication is rarely encountered (usually better to use fat graft as the first step and then use implant if that was the plan).

- Provide skin coverage following extensive resection or radio necrosis of skin
- For patients with large defects following large-volume WLE (mini-LD)

Contraindications

- Primarily in patients for whom reduced strength across the shoulder joint would impinge on activities, including, but not limited to, racquet sports, climbing and golf. Although it can be done without any issues, a discussion needs to be had to alert them to the potential for some shoulder weakness.
- Those with preexisting shoulder conditions affecting mobility
- Insufficient tissue and skin at the donor site. Only the latter is a true contraindication, which is rare.
- The presence of a thoracotomy at the donor site

Anatomy



Latissimus dorsi muscle flap blood supply and extent of dissection

The LD muscle itself is the largest muscle of the upper body whose primary functions are shoulder extension, adduction and internal rotation.

Origins: Spinous processes of thoracic and lumbar vertebrae T7-L5, iliac crest, lower 3rd or 4th ribs and thoracolumbar fascia

Insertion: Bottom of the intertubercular groove of humerus

The muscle is immediately subcutaneous apart from the insertion and a small triangle, which is deep to the trapezius muscle at the upper medial aspect. Deep to the muscle lie the ribs and serratus posterior muscles inferomedially.

The external oblique lying inferolaterally

Superolaterally lies serratus anterior with which the LD shares fascial attachments, which will require division

Along the underside of the superior aspect of the muscle (from medially to laterally) lie the rhomboids and teres major muscles at the inferior tip of the scapula

Blood Supply

TD artery; branch of the subscapular artery from the 3rd part of the axillary artery

The pedicle itself enters the muscle on the underside and generally consists of a single artery, the TD nerve and two veins

The artery itself generally has two branches: one to the LD and the other to serratus anterior.

On entering the LD muscle, the artery continues as a main intramuscular branch around 3 cm from the lateral edge, giving a rich plexus to the muscle and overlying skin.

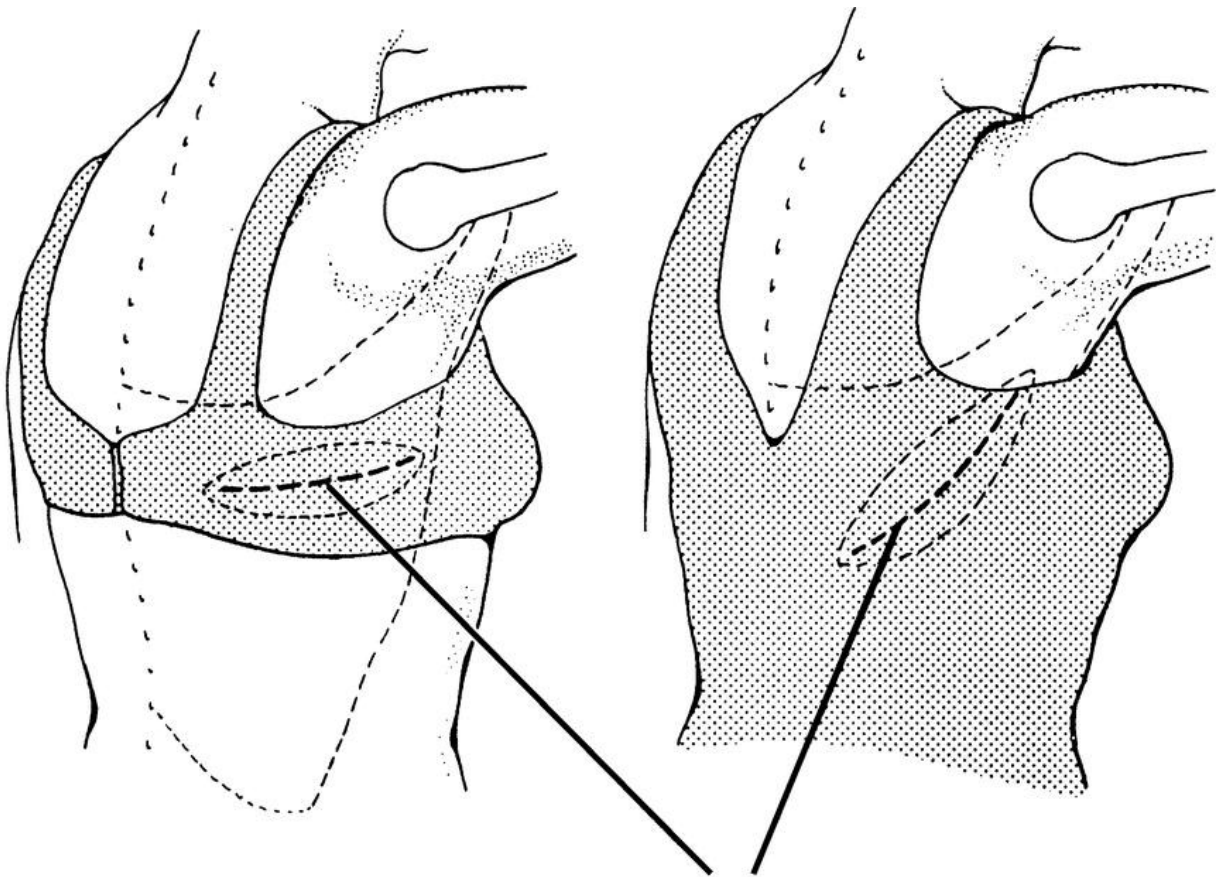
This vascular anatomy needs consideration if the flap is to undergo immediate lipofilling.

Operative Technique

Preoperative Investigations

Consider CT angiography for the LD pedicle patency in case of delayed reconstruction if patient has had previous axillary clearance or radiotherapy.

Preoperative Marking



Latissimus dorsi muscle flap marking (within the bra strap area)

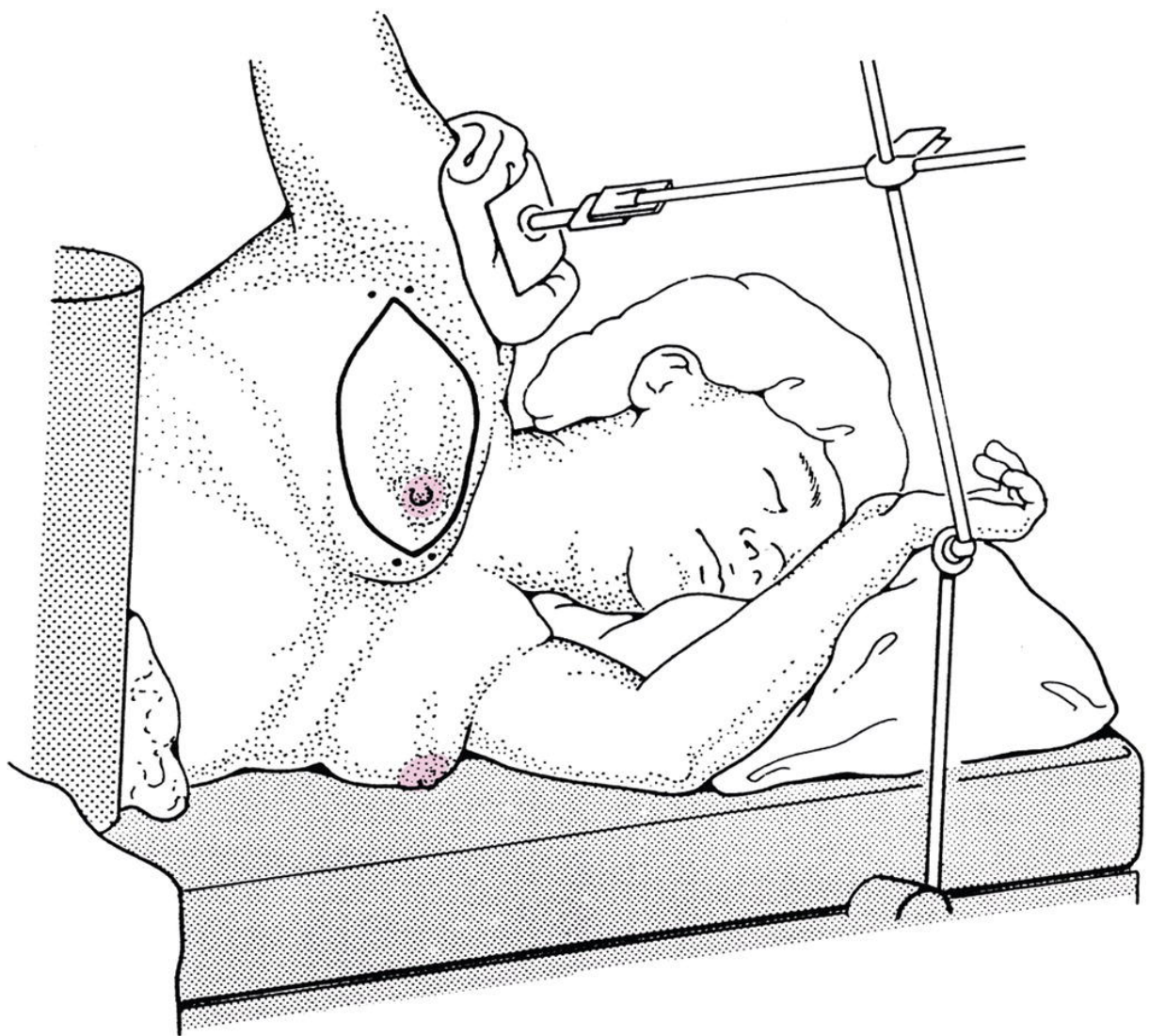
Mark the position of the ipsilateral IMF if immediate reconstruction, or a mirror image of the contralateral IMF if delayed reconstruction.

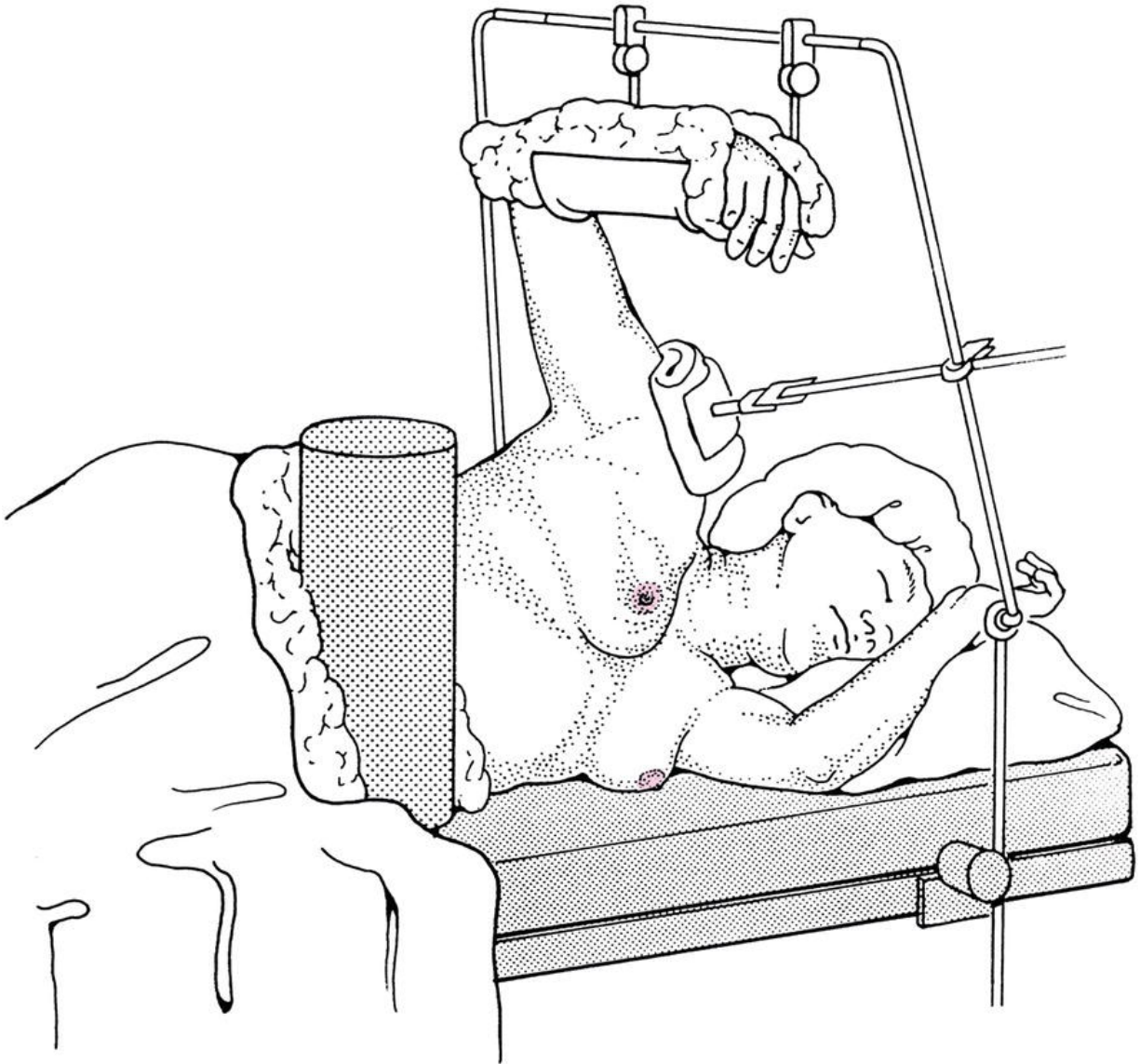
- Mark patient's bra line on the back.
- Mark the preferred position of the back scar to lie beneath the patient's bra strap.

- Hold marker pen over the preferred scar position on the back centrally, and displace the skin up and down, marking the extremities as the limit of the planned elliptical skin island.
- Double-check the skin can close easily, allowing 5–10 mm margin for safety.
- Ensure the edges of the marked island are less than 30° to minimise the risk of a ‘dog ear’.

Theatre Preparation

- This requires an experienced and well-trained theatre team and anaesthetist.
- Patient should be catheterised under GA.
- The mastectomy with/without axillary dissection procedure can be carried out first in the supine position as per surgeon’s preference and then turn the patient to the lateral position.
- Our preferred approach is two surgical teams with the patient placed in the lateral decubitus position, the pelvis fixed, and the ipsilateral arm placed into a padded frame to allow maximal access for both teams.





Latissimus dorsi muscle flap lateral position for the procedure

- Once the mastectomy and flap harvest have been completed, the patient is placed supine for fat harvest and inseting of the flap.
- We prefer the use of operating headlights. Both teams of surgeons should have access to high-quality headlights (optional).

- A pneumatic retractor can be used for the LD flap dissection to help with flap harvest. This makes the retraction of the skin flaps sustained and in the required direction and aids in complex dissection at the lower and especially upper end of dissection.

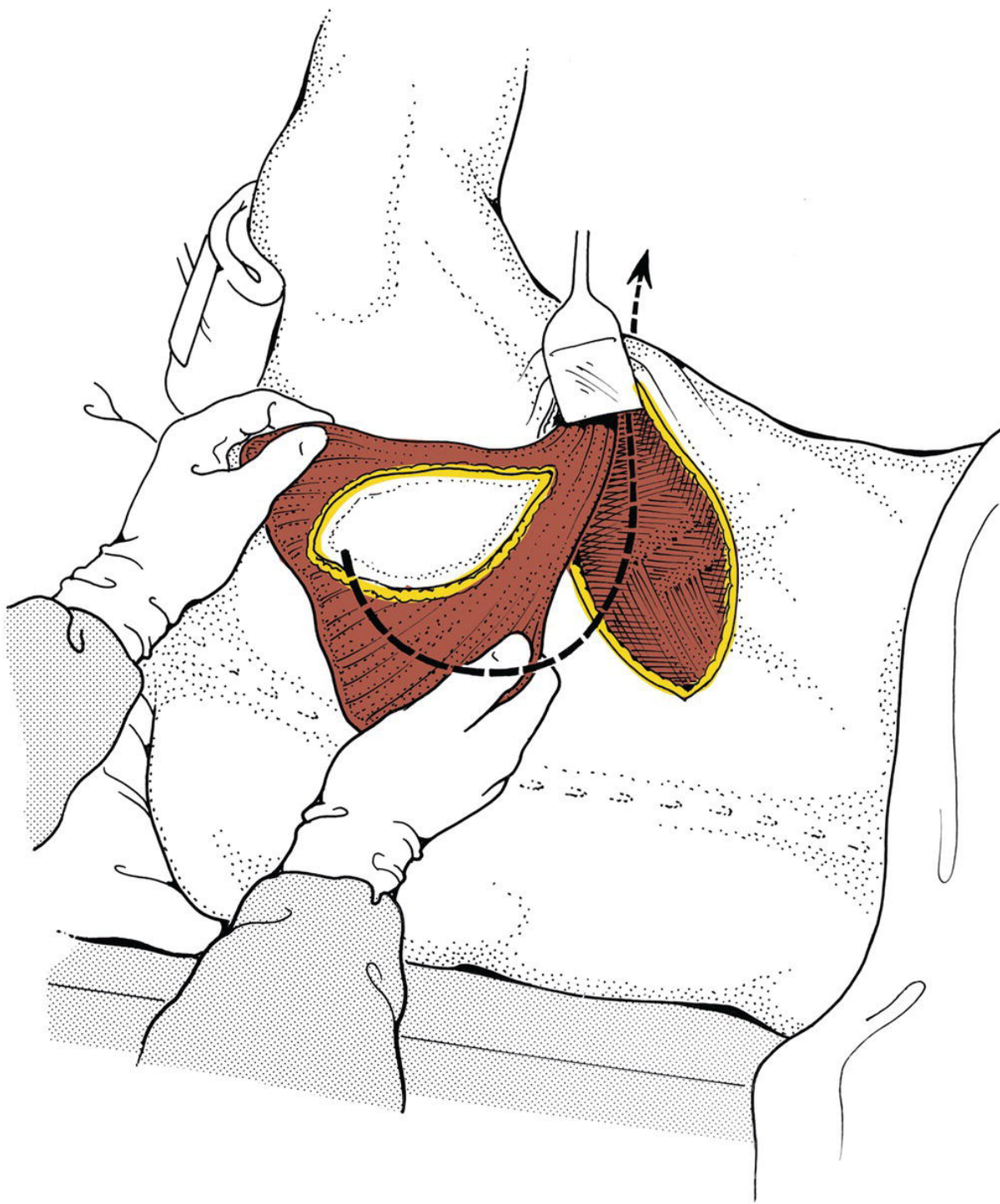
Dissection

- Our preferred technique for skin-sparing mastectomy is to use hydro-dissection with a local anaesthetic/adrenaline mixture of 500 ml NaCl/200 mg levobupivacaine/1 mg of adrenaline separating the breast surface from the subcutaneous fat with large, curved scissors via a circumareolar incision.
- Care must be taken particularly when raising the medial flap as there are a number of branches of the IM artery, which are best preserved. Otherwise, the mastectomy is a standard dissection.
- Flap harvest starts with scalpel incision through skin and coagulation diathermy down through Camper's fascia to expose Scarpa's fascia.
- We prefer subfascial dissection. Identify Scarpa's fascia (if muscle is encountered then 'Camper's was in fact a Scarpa's and Camper's was overlooked).
- Dissect full length of incision superior and inferior (Scarpa's often fades away as you head away from the midline).
- At midline inferiorly, divide Scarpa's fascia along the full length of the incision and develop a plane of dissection immediately deep to the fascia whilst leaving the sub-scarpal fat attached to the underlying LD muscle.
- Attempt to avoid seeing any muscle at this stage.
- Laterally, the dissection should continue beyond the edge of the LD over the external oblique and serratus anterior muscles.
- The fat overlying these muscle groups, where present, may be harvested with the flap by placing traction on the fatty layer and lifting it off the serratus and oblique muscles whilst maintaining its attachment to the lateral free border of the LD muscle. (In

some patients, an additional 2 cm strip of fat may be harvested with the flap in this way.)

- Continue the dissection in the same plane as far as the view and instrumentation allows. Do not go into the fat around the hip; this will be obvious as it is generally comprises larger lobules and is a brighter yellow in colour.
- Once the inferior dissection is complete, the inferior border of the LD muscle is identified by incising the fatty layer to expose the muscle, which can then be divided with monopolar diathermy.
- Continue dissection medially approximately two finger breadths lateral to the spine. As the dissection progresses superiorly in this plane, the tip of the trapezius muscle will come into view, dissected in between the LD and trapezius, taking care not to damage its fibres. The LD muscle is detached from the spinous processes.
- Lift the free border of LD and commence submuscular dissection moving superiorly and laterally. Care must be taken to not dissect beneath serratus anterior.
- Continue superiorly past edge of the LD to 'steal' the so-called turnover flap.
- At the superior extent, cut down onto the spinatous and rhomboid muscles and continue behind LD muscle 'peeling' in from the thoracolumbar fascia and ribs.
- Holding the muscle up, dissect slowly superiorly towards the serratus and TD vessels. The serratus vessels should come into view first and necessitate slowing of the dissection and use of slow blunt dissection.
- Once the TD vessels have been isolated and confirmed to be entering the LD muscle belly, careful dissection should encounter medially the TD nerve, which should be skeletonised with a right angle and a section dissected out; care should be taken that this has not already bifurcated superiorly and that this is only one branch of two.

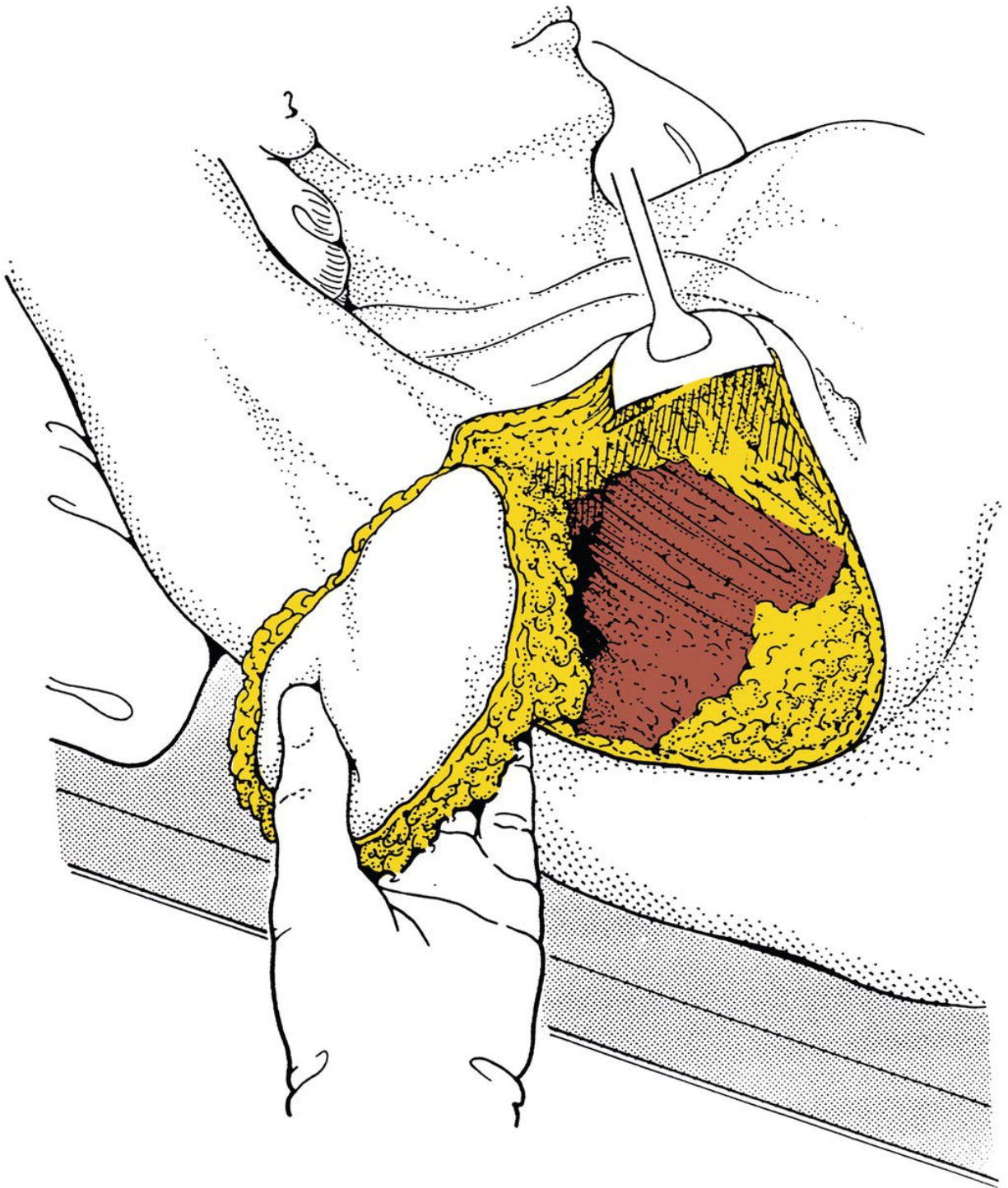
- The nerve can be cut (optional) to prevent 'twitching of muscle and the reconstruction' later on.
- Holding the muscle in one hand, the harvest can now be completed superior and anterior towards axilla.



Latissimus dorsi muscle flap

- At the superior–posterior margin of the LD, the muscle fibres themselves can be cut to allow more free rotation of the flap through the axilla.

- Incomplete dissection here can cause the muscle to run low in the axilla and cause a bulging of tissue in the underarm region, which is highly undesirable.
- The final mobilisation of the LD up to its tendinous insertion will be completed by the mastectomy team. Dissection of a conduit through the axilla should now be made, remembering that the lateral thoracic vessels may be running close.
- Flap can now be rotated through the axilla (ensuring no twist or tension on pedicle) and covered with Tegaderm while the back is closed.



Latissimus dorsi muscle flap

- Indo-cyanine green perfusion scan can be performed to confirm adequate perfusion of the flap, although not routinely required as the flap has robust blood supply.

Variation

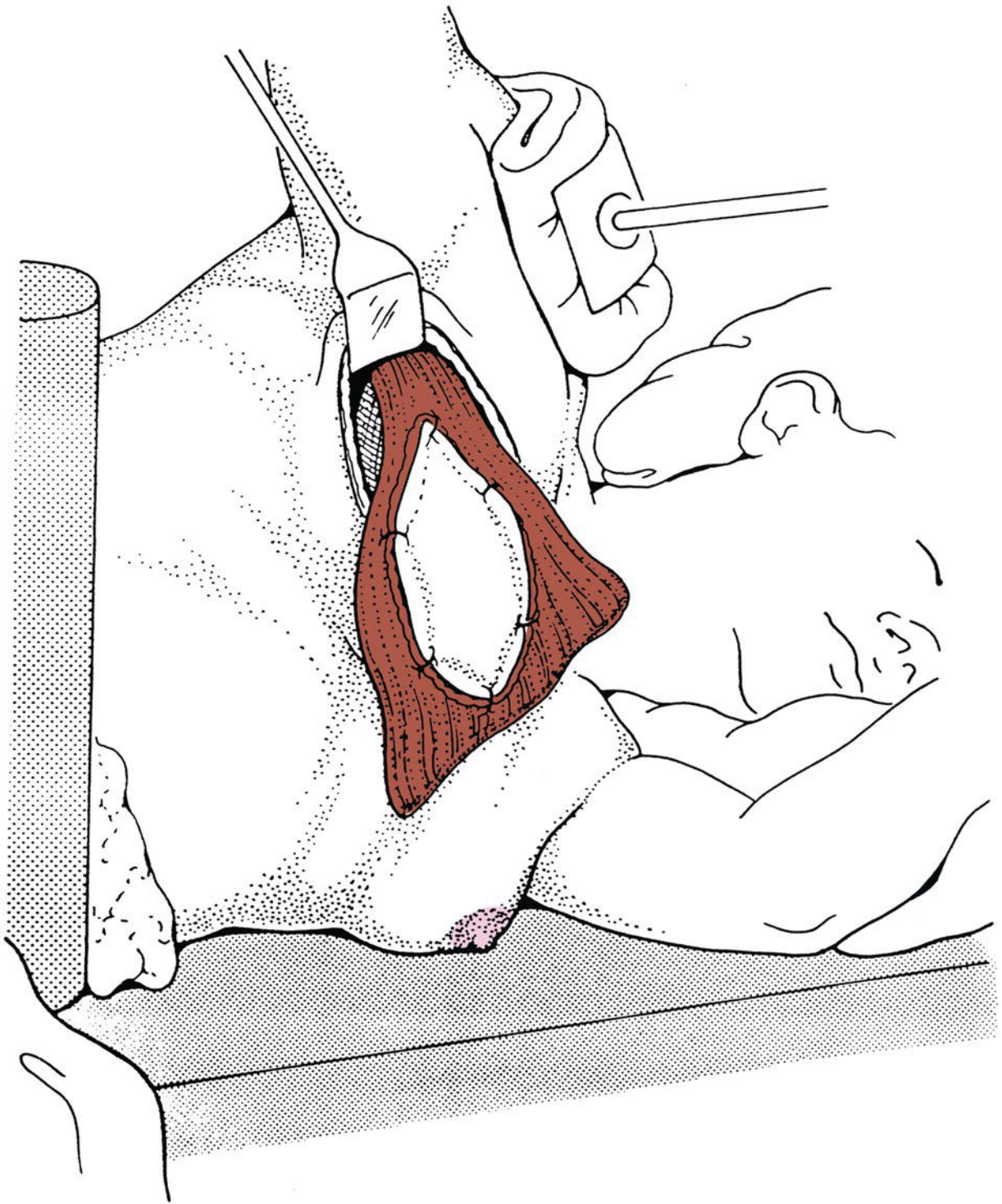
- **Myofascial LD flap:** Only LD muscle can be used in reconstruction (skin and nipple-areola-sparing mastectomy).
- LD flap can be used as a 'skin cover' after mastectomy for locally advanced breast cancer with skin involvement.
- **Mini-LD flap:** Part of the LD muscle is used after a large wide excision/ excision of quadrant for large primary cancer (rarely used for this indication now).

Closure of the Harvest Site

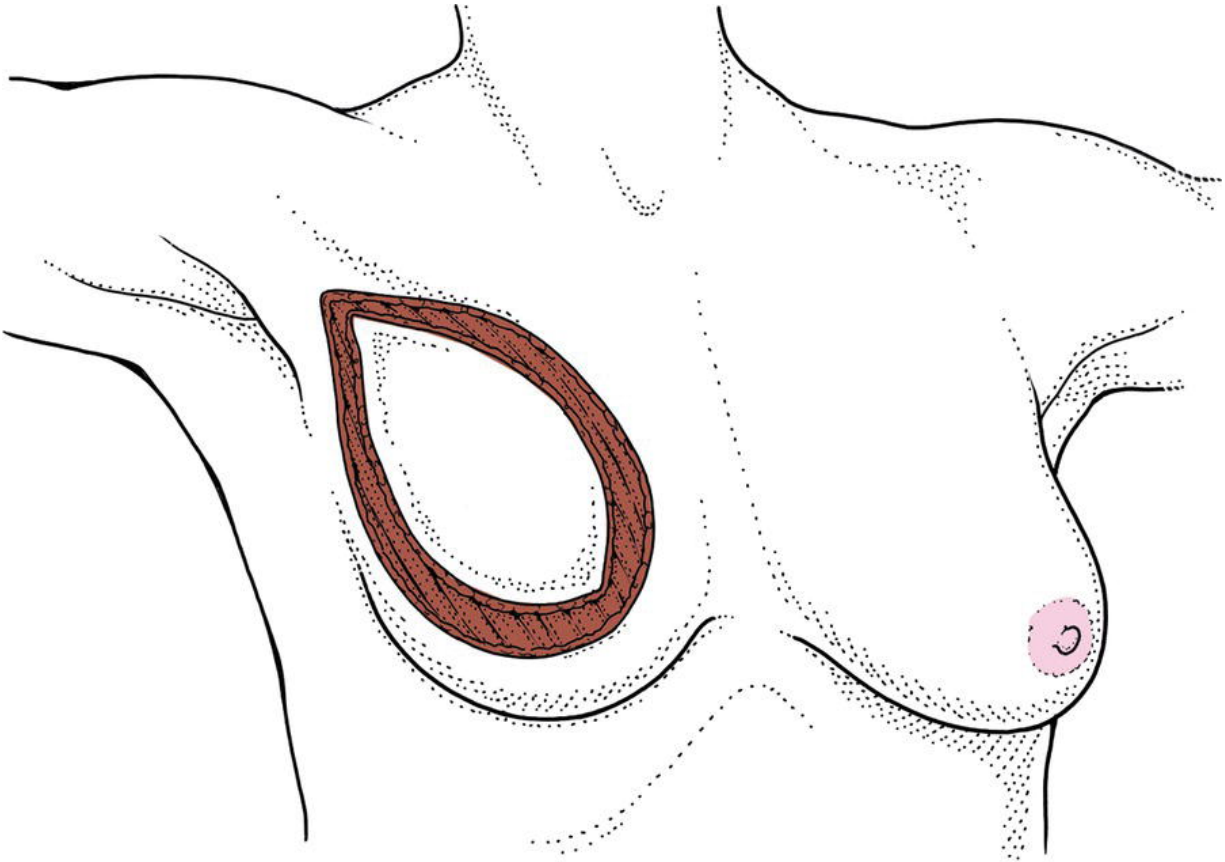
- Double diathermy over all charred areas to ensure haemostasis whilst ensuring blood pressure is at least at patients baseline
- Drain should be placed into the inferior portion of the dissected area and passed anteriorly (otherwise patient will have to lie on drain).
- Both flaps should now be quilted down with 2-0 barbed suture with triclosan coating (knotless spiral suture material), ensuring the flaps are constantly migrated towards each other to allow for minimal tension at dermal layer of the wound.
- Scarpas is approximated with running same 2-0 barbed suture.
- 4-0 monofilament synthetic absorbable suture should be used to close skin.
- Apply skin glue and waterproof dressing.

Patients is now turned as surgery team take a break.

Stitching in the LD Flap Into Mastectomy Defect



Latissimus dorsi muscle flap deliver the flap through axillary tunnel into the mastectomy wound



Latissimus dorsi muscle flap position and suture the flap

- Ensuring tension-free mobility of the flap is imperative and can be done by resting the flap against the chest wall and ensuring the medial edge of the skin island falls easily across the midline. The tendon of the muscle requires division at this point if mobility is not satisfactory.
- Place inferior drain first.
- Lipofilling can be performed now if required. Lay the LD flap on the chest wall and place the fat injections parallel to the muscle fibres. (injection across muscle fibres can cause damage.)
- Use 10 ml syringes with fine bore (18 French) blunt-tipped Coleman fat grafting cannulas.

- Distribute the fat grafts to the widest areas possible to include the LD muscle belly (avoiding the flap insertion where the TD vessels enter), the skin paddle, the mastectomy flaps where possible and the pec major muscle.
- Average volume of fat is around 159–200 cc, but more if the tissues and donor sites allow.
- An implant can also be inserted to add volume to the reconstruction to match the opposite side (but try sizer to make sure adequate closure of skin can be achieved).
- Approximate the size of skin island required with a pen and de-epithelialise the remaining skin.
- Chamfer the edges to avoid step in skin contour on completion.
- X3 sutures to posterolateral edge of flap to anchor flap in place and avoid migration back towards axilla.
- The bulk of the muscle will naturally now sit in a superior position to the skin paddle, they should be rotated 90° and sutured in place medially. (Care should be taken here to ensure sutures are not overtightened as medial vessels here are vital for flap integrity.)
- Tack the inferomedial edge of flap in behind what will be the new nipple position (to achieve maximal projection).
- Tack lower lateral to pectoralis.
- Work circumferentially around flap, now tacking where the tissue wants to lie to ensure smooth contour of breast mound.
- Nipple marker onto the remaining skin island and de-epithelialise skin.
- Cut a groove around the 'areolar' to ensure it will lie flush with skin.
- Stitch areolar in.
- Free nipple graft if required

Post-operatively

- Patient to sit up as much as possible
- Soft supportive medical bra (without any cups or wires) for the first 6 weeks 24/7
- Remove urinary catheter 24 hours after procedure once patient is confident of walking up to the toilet
- Antibiotics to be maintained until all drains have been removed (depending on local policy)
- Drains out when less than 50 ml
- Patient must be counselled on the importance of the prescribed physiotherapy/exercises to avoid potentially severe shoulder stiffness
- Adequate analgesia
- Low-molecular-weight heparin injections while in the hospital (as per local protocol)
- Wound check and removal of dressings usually in a week or 10 days

Complications

- **Non-healing of wound:** May need dressings, wound debridement, secondary suturing
- **Slipping of the muscle under the arm due to tension and sutures near sternum giving way:** Flap revision surgery to re-position the flap may be necessary (difficult to achieve once the flap has contracted in to axilla).
- Partial or total flap necrosis (rare)
- **Asymmetry:** Contralateral reduction mammoplasty is required at the same time or later on. Also, further fat grafting can be done on the side of LD reconstruction later on to add more volume.
- **Twitching of the muscle due to intact nerve or one of its branches:** Nerve can be cut later on (very difficult), or injection

of Botox into the LD muscle in the axilla can give relief up to six to eight months. Injection may have to be repeated.

Mini-LD Flap

Indications

- Alternative to mastectomy (it allows very large wide excision), especially when post-mastectomy radiotherapy is planned
- It is an alternative to volume replacement in small breasts.
- BCS when the WLE >20% of the total breast volume
- Small breast with large WLE, slim patient
- Now with the advances in perforator flaps, mini-LD is rarely indicated

Technique

- Myocutaneous or myofascial/myosubcutaneous (de-epithelialise the skin or do not take the skin with the flap)
- Single or two stage

Marking

- Mark tumour site and extent of excision.
- Mark up tunnel in the axilla for dissection and delivery of the flap.
- Free border of LD, midline of the back
- TD and its serratus branch vessels with the help of Doppler should be identified and marked.

Procedure

- Use headlights for especially tunnel from upper outer quadrant under the axilla and back

- **Positioning:** Lateral position (remember axillary vein will be collapsed in the lateral position)
- ANC or SNB if required is better done in the supine position
- Use U-drapes and infiltration
- Lazy-S incision
- Lift skin UOQ and tunnel, lift skin on the back
- Dissect the muscle with/without overlying skin pedicle, keeping vascular pedicle intact
- Deliver and suture the flap in place
- **Drain:** Number 10 Blake drain preferable
- Quilting of the back to avoid seroma as usual

Post-operative

- Physiotherapy
- VAC dressing (optional)
- **Antibiotics:** As per local policy

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11

Free Tissue Transfer in Reconstructive Breast Surgery

Introduction

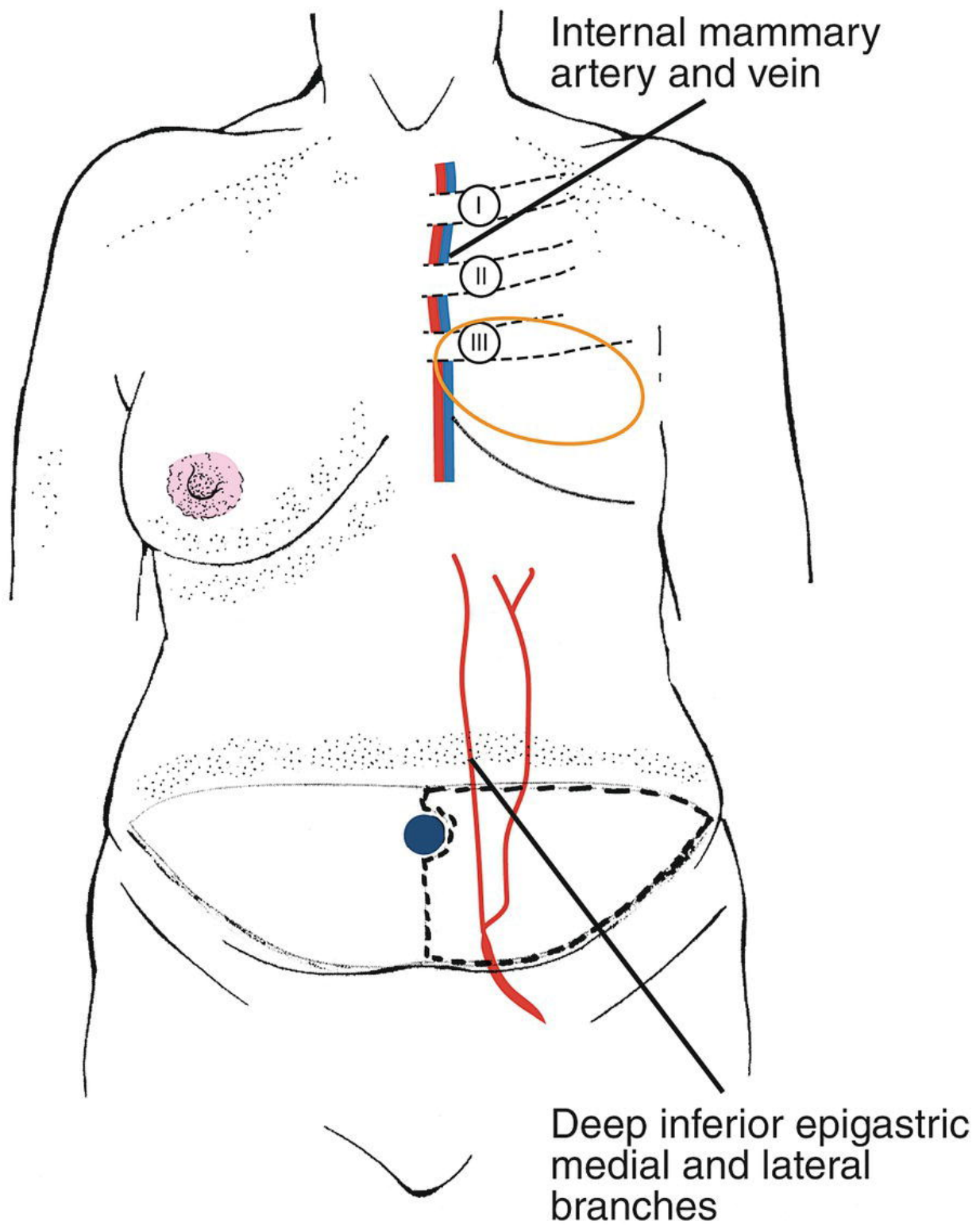
- Advances in microvascular free tissue transfer techniques have resulted in improved patient outcomes from a variety of donor sites, combined with reduced operative times.
- The lower abdomen remains the most popular choice for free flap breast reconstruction due to the tissue volume available, the reliability of the perforator supply, the ease of access to the donor site to allow a two-team approach to flap harvest and acceptable donor site morbidity.
- Alternative donor sites include the buttock and thigh.
- Advances in preoperative imaging (improved localisation of suitable perforator vessels), intraoperative imaging (real-time assessment of flap circulation) and the use of anastomotic coupling devices have all contributed to reduced operative time and improved outcome.

Indications/Contraindications

- Immediate or delayed breast reconstruction
- Access to suitable donor sites
- Patient general status suitable for free flap surgery

Operative Technique

Donor Sites



Free flap DIEP reconstruction

- Lower abdomen most common donor site
- Alternatives include upper buttock (superior gluteal artery perforator), lower buttock (inferior gluteal artery), inner thigh (transverse upper gracilis and profunda artery perforator), amongst others

Imaging

- Magnetic resonance angiography (MRA) to identify and localise the most suitable perforators for flap harvest pre-op
- Computed tomography angiography (CTA) is an alternative.
- Intraoperative indo-cyanine green angiography (e.g. 'SPY' fluorescence imaging system) can be helpful to evaluate flap perfusion and identify poorly perfused regions that should not be included with the transfer.
- SPY imaging can also allow assessment of mastectomy skin flap perfusion.

Markings

- The planned recipient and donor sites should be marked preoperatively.
- The planned footprint of the breast reconstruction is marked with reference to the contralateral side based on the position of contralateral inframammary crease.
- Skin-sparing mastectomy is preferred.
- For smaller breasts, a circumareolar incision is recommended.
- In larger breasts, a skin reduction pattern similar to that of breast reduction is preferred; however, to minimise the risks of skin necrosis at the T-junction, the redundant skin should be de-epithelialised and invaginated rather than excised.
- Perforator location identified with preoperative MRI and position confirmed with handheld Doppler device

Theatre Preparation

- Expose recipient and donor sites
- Ensure adequate warming
- Calf compression advised
- Prophylactic antibiotics at induction

Equipment

- Surgical loupes
- Surgical microscope
- Microvascular instrumentation and sutures

Anatomy – DIEP Flap

- The deep inferior epigastric artery is typically around 3 mm in diameter, with the veins slightly larger.
- These axial vessels provide two rows of perforating vessels, which penetrate the rectus muscle and provide the blood supply to the overlying fat and skin.
- The contralateral vessels are preferred for flap harvest when anastomosis to the IM vessels is planned.

Surgical Technique – DIEP Flap

- A two-team approach is recommended, allowing synchronous preparation of the recipient vessels and flap elevation.
- The IM vessels are exposed by performing bipolar dissection of the intercostal muscles at the 2nd interspace.
- A section of the 3rd costal cartilage is removed to increase exposure as it joins the sternum.
- The perichondrium is first elevated to expose the cartilage, which can then be removed either using a small Rongeur or en bloc, with the help of an Obwegeser curved periosteal elevator.

- The posterior perichondrium is then removed, taking care to preserve the IM vessels.
- Microvascular clamps are placed proximally, and the distal vessels are clipped and divided.
- The arterial flow is tested by briefly removing the arterial microvascular clamp.
- The upper and lower abdominal incisions are made, ensuring closure will not be excessively tight.
- The superficial inferior epigastric vessels are approached first, and if present and of suitable size, a SIEA flap may be elevated (minority of cases).
- The superficial inferior epigastric vein may be preserved during DIEP flap harvest as a backup.
- The abdominal flap is elevated from lateral to medial, and the previously marked perforator is identified.
- Loupe magnification is recommended.
- A second perforator may be included in the flap if required.
- The anterior rectus sheath is opened at the base of each perforator to be retained, and the vessels are carefully mobilised through the rectus muscle, which is split along the length of its fibres to expose the deep inferior epigastric vessels.
- Intercostal nerves encountered are preserved.
- Dissection continues caudally to mobilise the deep inferior epigastric vessels until sufficient length and appropriate vessel calibre are achieved.
- Having confirmed the recipient vessels are available, and completed dissection of the flap on the contralateral side, the deep inferior epigastric vessels of the flap pedicle are clipped at a suitable location and the vessels divided to free the flap.
- The flap is then transferred to the recipient site and prepared for anastomosis.

- Ensure the vessels are well aligned and not twisted and the vessels ends present themselves well for anastomosis.
- Conservative trimming of the arterial adventitia to allow for precise suture placement is often helpful.
- The venous anastomosis is best completed using a venous coupling device, whilst the arterial anastomosis is undertaken using 8/0 or 9/0 nylon interrupted sutures.
- On the completion of the anastomoses, the venous clamp is released first, followed by the arterial clamp.
- Any leaks are closed with additional 9/0 sutures.
- Perfusion of the flap is checked by assessing capillary refill and dermal bleeding.

Flap Inset

- Anchor the lateral flap to the pectoral fascia superolaterally.
- Assess volume requirements and undertake conservative flap tailoring, aiming to leave the breast reconstruction slightly larger than the contralateral side to allow for shrinkage.
- Discard Zone 4 (distal extent of flap).
- Secure the upper flap border to the pectoral fascia at the upper limit of the mastectomy defect if an immediate reconstruction or at the desired upper breast position to match the contralateral side in a delayed reconstruction.
- Further tailoring of the flap volume may be required as the inset proceeds.
- The lower flap is secured to the planned IMF.
- A 10F suction drain is placed with the end positioned in the axilla, away from anastomosis.
- Excess skin is de-epithelialised, leaving a skin paddle at the areola or as an ellipse during delayed reconstruction.

Donor Site Closure

- Rectus fascia closure with 'o' PDS running suture
- Upper abdominal flap elevated with undermining at the level of the rectus fascia centrally
- Table flexed
- Umbilicus exteriorised
- Quilted closure using a 2/0 barbed suture (Stratafix, Ethicon Inc.) with repair of Scarpas fascia for added strength
- No drainage tubes required
- Layered subcuticular skin closure with absorbable interrupted sutures around umbilicus, which may be inverted by suturing skin to deep fascia at the 3 o'clock, 6 o'clock and 9 o'clock positions
- Tissue glue dressings are preferred.

Post-operative Care

- The patient is monitored in the surgical high dependency unit overnight with 30 min flap observations initially (flap temperature/colour/capillary refill time/Doppler signal).
- The surgical team is notified immediately if any sign of circulatory compromise is identified.
- The patient returns to the ward and begins mobilisation on day one with discharger often possible by day five.

Complications

- Infection
- Bleeding
- Numbness
- Seroma
- Abdominal hernia or bulging
- Delayed healing

- Flap failure (partial or complete)
- Fat necrosis
- Wound dehiscence
- Need for further surgery
- DVT/PE

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12

Autologous Fat Transfer in Breast Surgery

Introduction

- The continued development of fat grafting techniques has proved a valuable adjunct in reconstructive breast surgery.
- Modern approaches to fat transfer permit the successful use of larger graft volumes with wider indications.
- A number of techniques are reported with no agreement on the ideal approach.
- Optimal techniques will reduce operative time without compromising the results of surgery.

Indications

- **Volume deficiency:** Cancer treatment (immediate or delayed), breast reconstruction, congenital breast asymmetry or deformity
- As an adjunct to breast reconstruction
- Improve skin quality at sites of radiotherapy
- Localising pain

Operative Technique

Donor Sites

- Agree preferred donor sites with patient pre-op
- Typical donor sites include the abdomen, hips and thighs; however, fat may be harvested from any site where excess fat is identified.

- For repeat procedures or in slim individuals, consider the lower back.
- Rotation of donor sites should be considered when planning repeat procedures.
- The impact of liposuction from the donor areas on absorption of subcutaneous injection of drugs like insulin, Herceptin, GLP-1, GNRH analogue etc. is unclear and the evidence in literature is sketchy. The resulting changes in donor site perfusion, scarring and lipodystrophy etc can alter the absorption of these drugs and make it erratic and unpredictable at least for the first few weeks and months. If patients are on any of these drugs, then the options other donor sites or even other form of reconstruction should be explored. Prone liposuction from the Lower back, lumbar and the flanks is possible.
- The weight loss injections GLP-1 result in a lot of loose skin and any fat harvesting is difficult.
- Always be aware when planning multiple episodes of lipofilling to take from one region such as anterior thigh first so next time you can take fat from somewhere else such the lateral thigh. It's something easily forgotten in patients who need multiple episodes of fat grafting and that is minimising donor site morbidity.
- Try and leave the lower abdominal fat if there is a chance they may need a DIEP free flap reconstruction at some time.

Markings

- The planned recipient and donor sites should be marked preoperatively in the standing position.

Theatre Preparation

- Expose recipient and donor sites
- Ensure adequate warming
- Calf compression advised

- Prophylactic antibiotics at induction

Equipment

- Liposuction machine and tubing
- Tumescant infiltration cannula (2–3 mm)
- 50cc Leuer lock syringe or fluid pump
- 50cc catheter tip syringes to inject the fat
- 4 mm liposuction cannula – expanded tip cannula my preference
- Fat separation canister – sedimentation or centrifugal

Surgical Technique

- Surgical prep recipient and donor sites
- Donor site infiltration with tumescant solution (500–1000 ml saline, 1 mg adrenaline, 200 mg chirocaine) using 50cc syringe and liposuction cannula. Mechanical pump may be used.
- Small groin crease and umbilical incisions for access
- Fat harvest using liposuction technique
- If using traditional liposuction, it can be helpful to introduce a gentle bend on the liposuction cannula to more easily follow the curves of the donor sites and avoid end hots to the skin.
- Pre-tunnelling to loosen fat initially before application of suction
- Care to avoid surface irregularity and deep structural injury
- In patients identified as having a distended abdomen when supine, both the subcutaneous fat layer and the muscular abdominal wall itself may be thin. Extreme caution is advised when harvesting fat from the abdomen in these patients as intra-abdominal injury is reported.
- It is preferable to harvest small volumes from a wide area to limit the risk of irregular skin depressions that can follow excessive harvest from a single site.

- If such depressions are identified intraoperatively, fat redistribution using the expanded tip cannula can be helpful to address the problem, combined with immediate fat grafting to the area if required.
- Further infiltration of the donor sites with remaining tumescent solution can help with post-op analgesia.

Fat Preparation

- Follow instructions provided with fat separation device.
- Numerous devices are available, with or without fat filters, based on the sedimentation technique or centrifugal technique.
- Goal is to efficiently prepare the required volumes of fat for transfer, with impurities removed.
- The purified fat is then transferred to appropriate infiltration system.

Fat Transfer

- Approach will vary depending on requirements.
- When injecting the fat, inject through the inframammary fold globally initially with more injected deep in the breast and chest wall under the defect.
- We believe that to reverse the effects of radiotherapy on the whole breast means you need to inject some fat throughout the breast to improve breast elasticity.
- Some local injections at the site of scar or indentation in addition to the global ones are required.
- Use an orange venflon needle to make holes in the skin through which insert the blunt lipofilling needle. The needle holes are closed with steristrips or glue.
- The same venflon needle can be used for scar release. Also, you can use the V-dissector/ Rigotomy needle to release the scar that causes dimpling before lipofilling the local area. It works well especially thick bands of scar tissue stuck to the chest wall and

the overlying skin/ scar. This does not cause any issues with neuropathic pain, it's meant for scar release. But any accidental injury to chest wall muscle could cause pain. It's quite sharp, so careful while using in axillary scars.

- Delicate targets, such as mastectomy flaps or ELD muscle flaps, are best treated with small calibre fat grafting cannulae attached to 10 ml syringes.
- Larger target areas, such as breast contour irregularities or breast asymmetry where the whole breast may be targeted, are best treated using the 4 mm liposuction cannula attached to a 50cc catheter tip syringe using a section of liposuction tubing.
- In these circumstances, remote access through the umbilicus is recommended.
- Fat placement is within vascularised tissue in a grid-like manner avoiding fat pooling in a single location.
- Volume requirements will vary depending on the target; however, over-correction is advised to allow for the expected 50% graft loss.
- After WLE of breast cancer, immediate lipofilling can be performed to replace the lost volume. This is achieved by injecting fat into parenchyma globally as well as into breast tissue adjacent to the wide excision site. Also inject fat into chest wall muscle and subcutaneous fat in area around wide excision site. Wash out at the end of lipofilling to remove any loose fat. Some mobilisation of breast parenchyma may be required to close the defect, but do this after lipofilling as the fat injection reduces the size of the defect and so reduces the extent of any mobilisation required. Close defect with a continuous barbed suture because this allows even fatty breast defects or fat-infused tissue to be closed in layers and stops sutures from tearing out. The art of closing such defects is to use loose layers of a barbed suture that slowly close the defect. The resultant closure resembles a darn, with no suture being under tension that might result in that suture cutting out.

- After wide excision, inject at least twice the volume of fat compared with the volume of breast tissue resected to compensate for up to 50% reabsorption of fat and breast shrinkage after radiotherapy. Lipofilling seems to reduce the impact of radiotherapy on the breast so there is little or no scarring at the wide excision site post-radiotherapy. This is also seen on mammography where there is little or no deformity or scarring at the wide excision site.

Post-operative Care

- Continuous use of well-fitted support garment such as a sports bra for six weeks to minimise movement at the recipient site and encourage graft survival.
- Advise a firm cotton and Lycra bra to support the breast and the injected fat, worn 24 hours a day for 6 weeks. A firm bra also limits fat leakage through the injection holes. A loose bra can let gravity pull the edges of the Venflon holes apart; if fat leaks out, then bacteria can get in.
- Some surgeons tape the breast with skin-coloured, inch-wide Mepore put on in lengths to provide a shell to promote the shape you are trying to obtain. This is left on for about 10 days.
- Use a single dose of antibiotics to cover the procedure.
- Some units use fat bank if multiple fat grafting procedures are expected. So patients need only one liposuction procedure; then, the fat is stored in freezer for future use.

Complications

- Infection
- Unpredictable fat graft survival
- Oil cysts
- Fat necrosis
- Microcalcification within the breast
- Surface irregularity and skin laxity at the donor sites

- Need for further surgery
- DVT/PE

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13

Local Perforator Flaps in Reconstructive Breast Surgery

Introduction

- Local perforator flaps are a useful adjunct in the planning of BCS where volume replacement is desirable.
- Anatomical and clinical studies have confirmed the location and suitability of chest wall perforators arising from a number of feeding vessels.
- Anterior, medial and lateral branches of intercostal arteries and branches of axillary artery such as lateral thoracic artery and TD artery are the preferred vessels for flaps.
- **The flaps are named after the perforator vessel used:** LICAP, AICAP, MICAP, TDAP and LTAP.
- LICAP flap is the most versatile and will form 80–90% of the practice.
- Good candidates for local perforator flap surgery include patients with small- to moderate-sized breasts with good Doppler flow signals in a suitably located perforating vessel.
- Perforator flaps have relatively low morbidity and better aesthetic outcome than mastectomy +/- reconstruction.
- Financially viable compared to mastectomy + reconstruction
- Combination of perforator flaps can be used (LICAP + MICAP) for reconstruction and even for whole-breast reconstruction in some cases.

Indications

- Immediate or delayed partial breast reconstruction
- If WLE is <20% of total breast volume, then level 1 oncoplastic BCS is possible. Anything more than 20% will need an oncoplastic reconstruction.
- Choose patients who are unlikely to get NACT.
- Low-risk cases such as DCIS or luminal A are ideal for perforator flaps.
- It is difficult if not impossible to do SNB/ANC after LTAP. So ideally avoidable in these scenarios.
- LICAP + LTAP or TDAP alone can generate enough volume for whole-breast reconstruction in suitable slim patients with B/C cup breast.
- 'Random flaps' are not random; there is always an LICAP vessel supplying these flaps.
- **Perforator flaps suitable for:** Grade 1 ptosis; however, it is possible to do perforator flaps for large ptotic breast as well.
- Smoking is not an absolute contraindication for perforator flaps.
- Two-stage procedure is useful where margin status of WLE can be doubtful, e.g. DCIS and lobular cancer. Also, high suspicion of positive nodes based on tumour features.
- **Choice of flaps:** Lateral tumours: LICAP (laterally placed tumours get the best results), central tumours: TDAP or Mini-LD, upper inner quadrant tumours: LTAP, medial tumours: TDAP, LD-mini flap
- **One-stage procedure (wide excision and perforator flap done in the same setting):** Single procedure, quicker recovery and no delay in adjuvant treatment; also avoids capsulectomy that is required for two-stage procedure. Unifocal lesion (less chances of re-excision) is in favour of one-stage procedure. But the disadvantages with this approach are positive margins/SNB requiring further procedures. If TDAP is done as a one-stage procedure, then the option of LD flap is wasted if extensive disease is found on pathology.

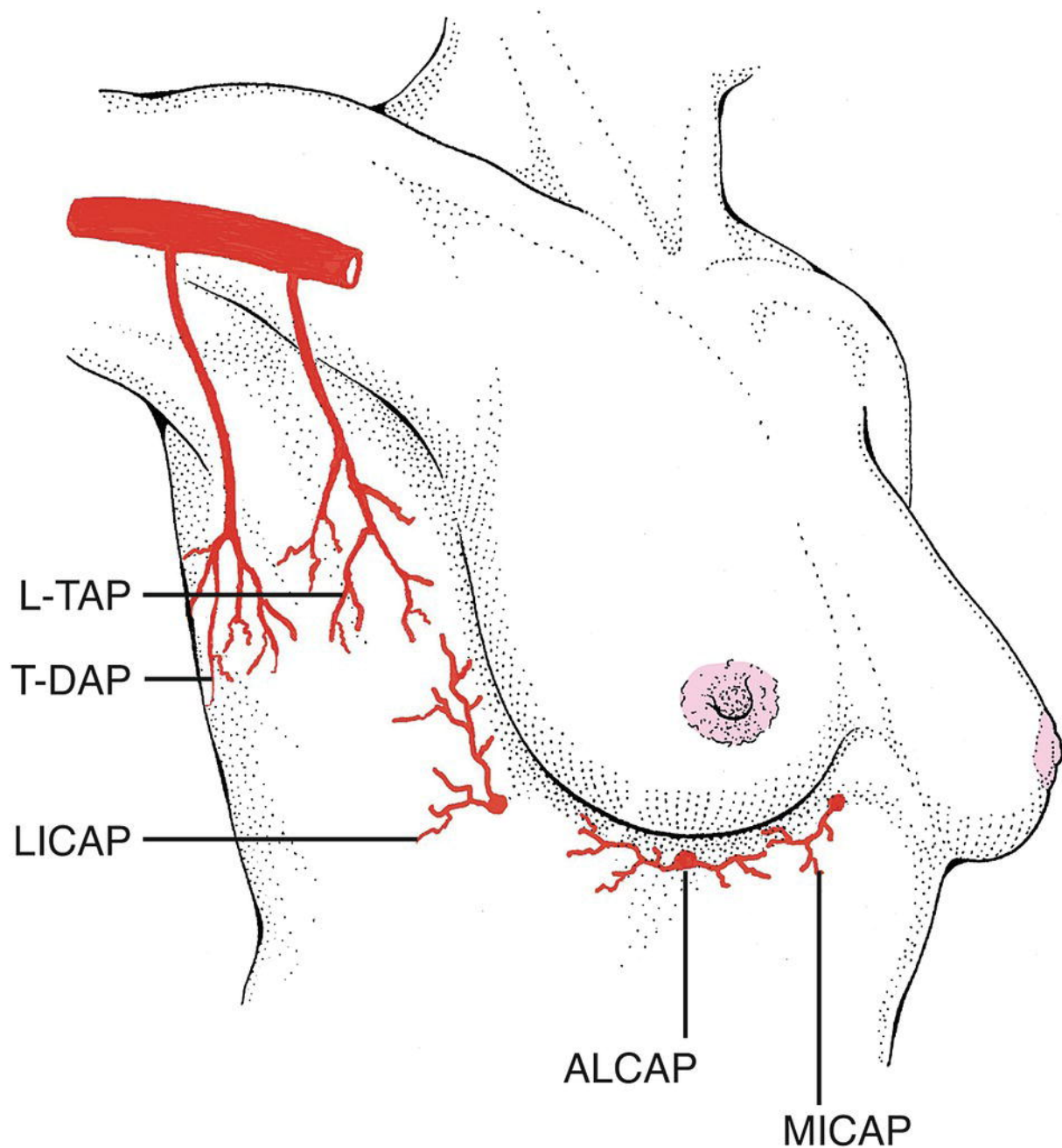
- **Two-stage approach:** (Wide excision +/- sentinel node as first stage and then perforator flap reconstruction in three to four weeks as second-stage procedure. Close the skin for WLE cavity and inject saline to keep cavity patent for the perforator flap at the second stage) allows change of plan (e.g. mastectomy if disease is extensive), ensures negative margins and SNB, extends indications for BCS. Also, if extensive disease is found on pathology, the option of mastectomy + LD flap or implant still open. The disadvantages of two-stage approach include the need for two operations, potential delay in adjuvant treatment and extra incision if peri-areolar at the start.
- Two-stage approach is better when high tumour to breast size ratio, multifocal DCIS, ILC, or post NACT. Good autologous LD option if disease is more extensive than expected! So two-stage approach better in these cases.
- Preserve carefully lateral thoracic vessels while doing SNB, 90% times the SNB is on these vessels. If axillary clearance is required, avoid LTAP flap.
- **If skin is not required:** Propellor flap can be done and if skin is required: LTAP is better option.

Preoperative Tips

- Patients should be assessed in the outpatient clinic before decision of perforator flap is made.
- Doppler should be performed as there could be anatomical variation in the location of perforators.
- Colour Doppler can be used to trace perforator vessels. Small handheld Dopplers that can be connected to the smartphone screen are now available.
- Duplex ultrasound is an alternative.
- Always better to have a buddy surgeon (or plastic surgeon) for the first few cases

- It is better to do wide excision + SNB in the supine position and then flaps in the lateral position. (It can be disorientating to do SNB in the lateral position and the perforator vessels could get damaged.)
- **One- or two-stage approach:** At least in the beginning, it is better to do two-stage procedures. Start with a two-stage approach in the beginning and then slowly increase the numbers of one stage procedure.

Donor Sites



- Local flaps may be designed on the perforating vessels originating from:

Branches of intercostal arteries (MICAP, AICAP or LICAP) – lateral and lower medial defects

Branches of axillary artery: LTAP and TDAP – lateral and higher volume defects

Anatomy of LICAP

- **LICAP:** 5th–7th intercostal perforator branch just lateral edge of breast
- LICAP vessels may be located between 4th and 8th intercostal spaces, with the highest concentration in the 6th and 7th intercostal spaces.
- The dominant perforators are typically located around 3.5 cm from the anterior border of the LD muscle.
- Short pedicle length limits application to lateral breast defects unless dissection is deepened to expose and mobilise the intercostal artery itself. This dissection is difficult, and care must be taken to avoid pneumothorax.

Markings

Always mark the IMF, lateral mammary fold and posterior axillary fold in standing or sitting position first.

- Protect your preoperative markings with a clear transparent dressing.
- Assess for adequacy of donor site before starting to plan for perforator flap.
- ‘Lazy-S’ or elliptical skin excision incorporating perforating vessel
- Flap width designed using skin displacement technique to allow direct closure of donor site
- **Preoperative marking is empirical:** Mark all possible vessels and potential flaps, to avoid injury to vessels.
- **LICAP:** The perforators are typically located about 1–2 cm posterior to the lateral mammary fold and about 2–3 cm anterior to the posterior axillary fold from 3rd to 7th intercostal spaces (LICAP: 4th–6th intercostal spaces).
- **LTAP:** Mid-axillary line, 3th–5th intercostal spaces

- **MICAP:** Medial perforators 2–3 cm lateral to sternal edge and 1–2 cm inferior to the IMF
- **AICAP:** Perforator located at 6 o'clock 1–2 cm inferior to the IMF
- Hold the Doppler probe at 45° angle and not 90° for better results.

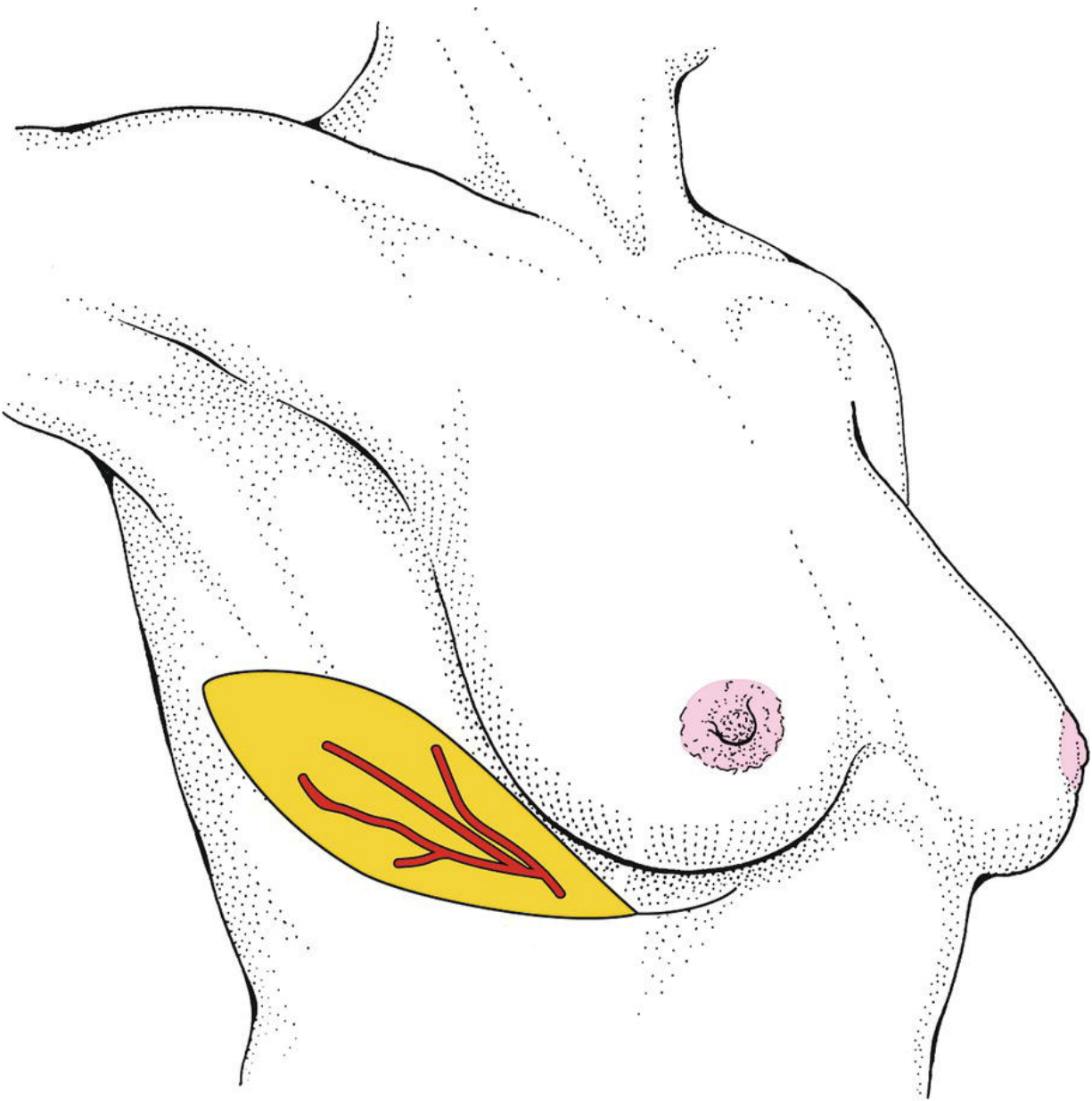
Theatre Preparation

- Expose recipient and donor sites
- Ensure adequate warming
- Calf compression advised
- Prophylactic antibiotics at induction

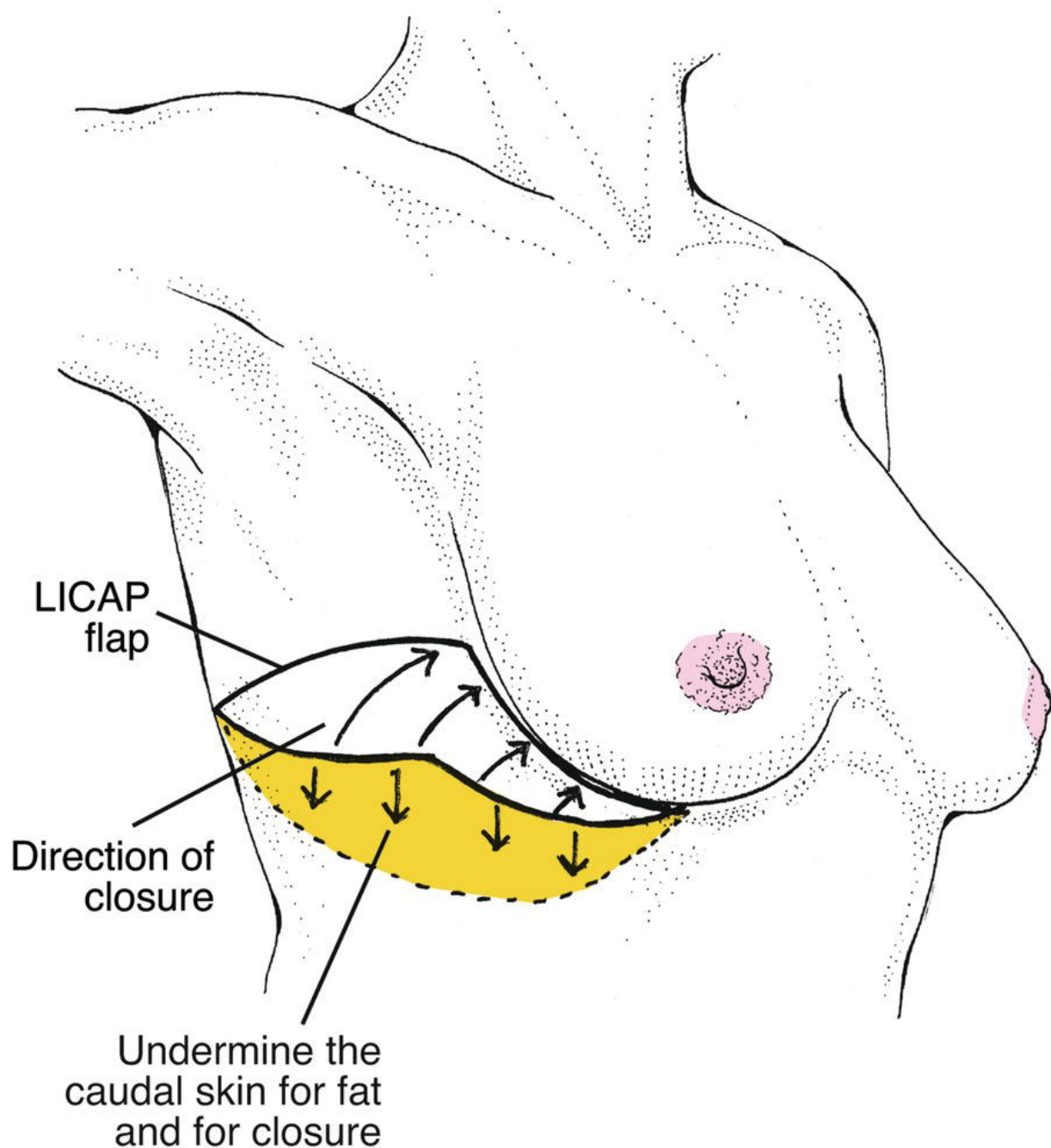
Equipment

- Operating surgical loupes 2.5× (optional)
- Microvascular instrumentation, Fine tip scissors, forceps and fine tip bipolar
- Intraoperative Doppler device or handheld Doppler 8 MHz
- Laparoscopic sleeve for intraoperative use
- Good light
- Indo-cyanine green perfusion scanner (optional) to confirm perfusion of the flap

Surgical Technique – Modified LICAP Flap



LICAP flap



- The patient is positioned supine, ensuring adequate exposure of the flap donor site.
- Where the perforating vessels are located more posteriorly, a lateral decubitus position is preferred.
- **Incision:** Peri-areolar/lateral. Prefer lateral incision for wide excision and sentinel node. Axillary clearance: skin crease

incision in the axilla. Lazy-S incision better than tight closure that can lead to chronic chest wall pain

- Try to extend the same incision for SNB in case of LICAP. This can be difficult; blue dye helps in better identification.
- Keep the flap as horizontal as possible to avoid lateralisation of nipple–areola.
- 90% of the time the SNB is sitting on lateral thoracic vessel, preserve it for future use as LTAP option.
- Blue dye helps in SNB if perforator flap is planned. With the visual signal, easy to avoid injury to the vessels.
- Use bipolar cautery or low setting unipolar cautery, but scissors dissection is the best around vessels.
- Aim for wider margins to avoid re-excision of margins.
- Intraoperative specimen X-ray to confirm complete excision
- If axillary clearance is required, do it in the supine position (easier), flap can be done in semi-reclined/lateral position.
- Perform wide excision first before raising the flap (do not compromise oncology!).
- **Decide perforator preference:** LICAP/LTAP.
- Dissect two perforators.
- **Direction of dissection:** From tip towards breast supra-fascial
- The dominant LICAPs are localised with a handheld Doppler device or duplex ultrasound.
- **Modified LICAP:** It fills lateral defects nicely, though cannot reach central defects like an LTAP can. It is based on parallel lazy-S incisions, creating S-skin paddle from lateral IMF to lateral chest wall up to axilla and the pivot point is inferior (where the LICAP vessels are). De-epithelialise then raise off fascia and rotate 90° into the wide excision cavity.
- Local verapamil (calcium channel blocker) can be used if the vessels are in spasm.

- Loupe magnification is recommended for the pedicle dissection (optional).
- Dissection of the flap proceeds carefully in a superficial plane from posterior to anterior. (Do not harvest fascia while harvesting the flap, just the fatty tissue or else patients could get chronic chest wall pain.)
- Length of the flap should be as long as possible and viable. This will compensate for the 'thicknesses of the breast tissue.
- The perforating vessels are maintained in a mesentery of tissue to minimise the risk of injury. Only skeletonise vessels, if necessary, always leave some connective tissue around the vessels for support and avoid shearing or twisting and injury.
- Once the pedicle vessels have been identified, flap dissection continues until the flap is fully islanded.
- Extend the dissection in caudal direction to mobilise skin for closure and also harvest more fatty tissue with the flap.
- The flap is de-epithelialised (usually do it in the end, secure the flap with surrounding skin with the help of skin staplers to avoid shear injury to vessels).
- The islanded flap is rotated or turned over into the defect, with careful attention to flap circulation during flap repositioning.
- The donor site is closed with layered absorbable sutures.
- Drains are not typically required.
- Negative-pressure dressing can reduce seroma and non-healing of wounds.
- **Delayed reconstruction with perforator flap:** This is a good option for patients who develop defects over years due to changes in shape of breast/weight fluctuation/post-radiotherapy changes. Lipofilling may or may not take up with history of radiotherapy, so better to do a perforator flap and bring in a fresh tissue and lipofilling the perforator flap later on if required.

Flap Inset

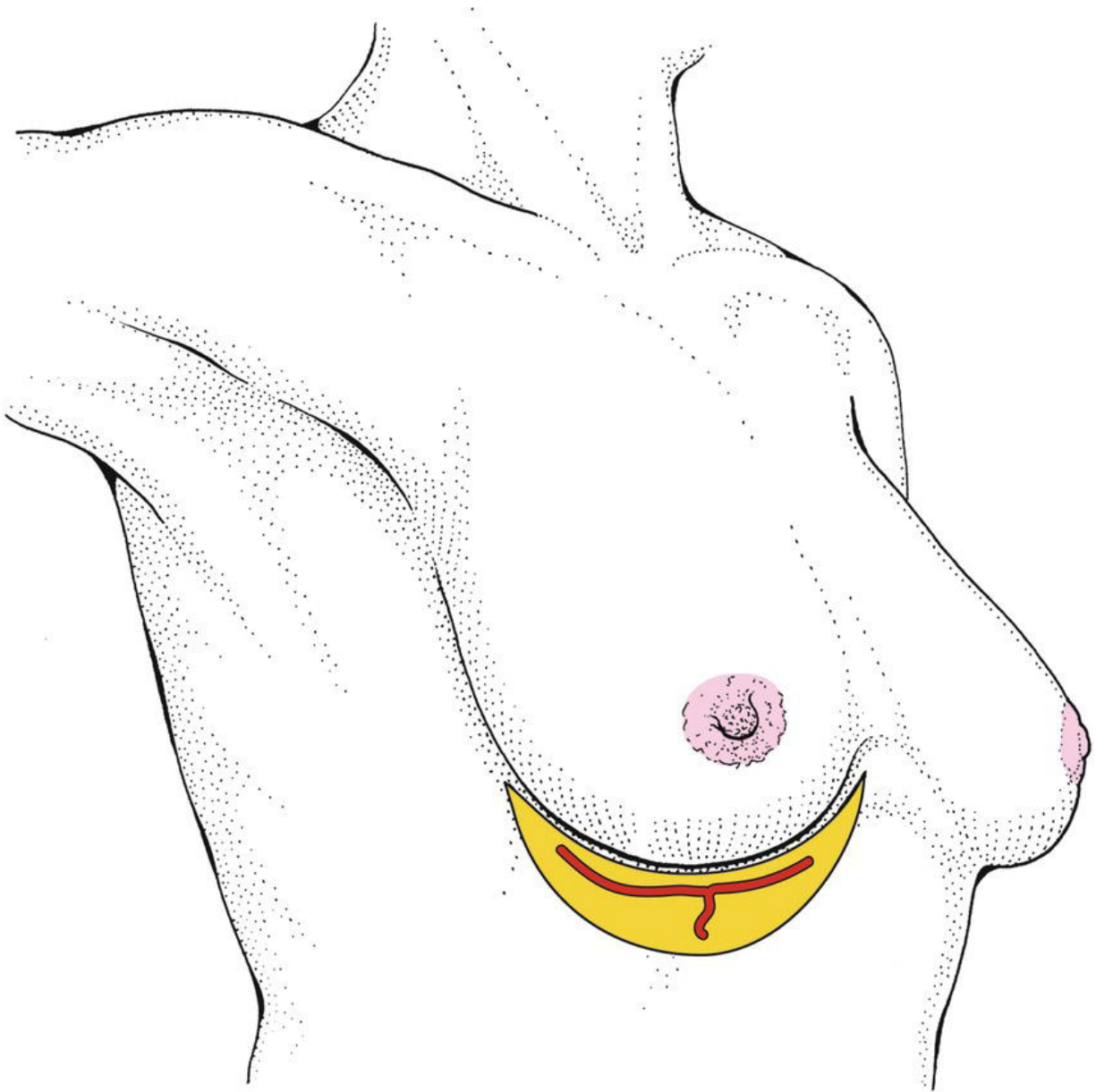
- Always overfill, some tissue will shrink especially after radiotherapy (10–30% shrinkage).
- The flap is inset, without tension, in the most suitable orientation to fill the target defect.
- A number of options may be trialled before the best approach is identified.
- Rotation and flipping of the flap can be done so the fatty tissue faces upwards and not the de-epithelised surface. This gives more natural feel.
- Keep a small skin island with large perforator flaps as an indicator of vascularity and monitoring in the post-operative period. Suture this skin island with surround skin.
- Lift the breast tissue from pectoral fascia all around the wide excision site to get better contours and avoid bulging flaps.
- Suture the flap in place or even leave it in place as the flap will stay in place so long as the closure is appropriate, and the cavity is snug.
- If the colour of the flap skin looks venous congested on table despite good inflow and good blood pressure and waiting for five minutes, take down the flap from inset and see if a kink or compression gets corrected. Try to widen the tunnel if that is the case. But if the issue persists, then consider using staplers to keep the flap back at the donor site for 12–48 hours and then inset it in delayed manner.

Post-operative Care

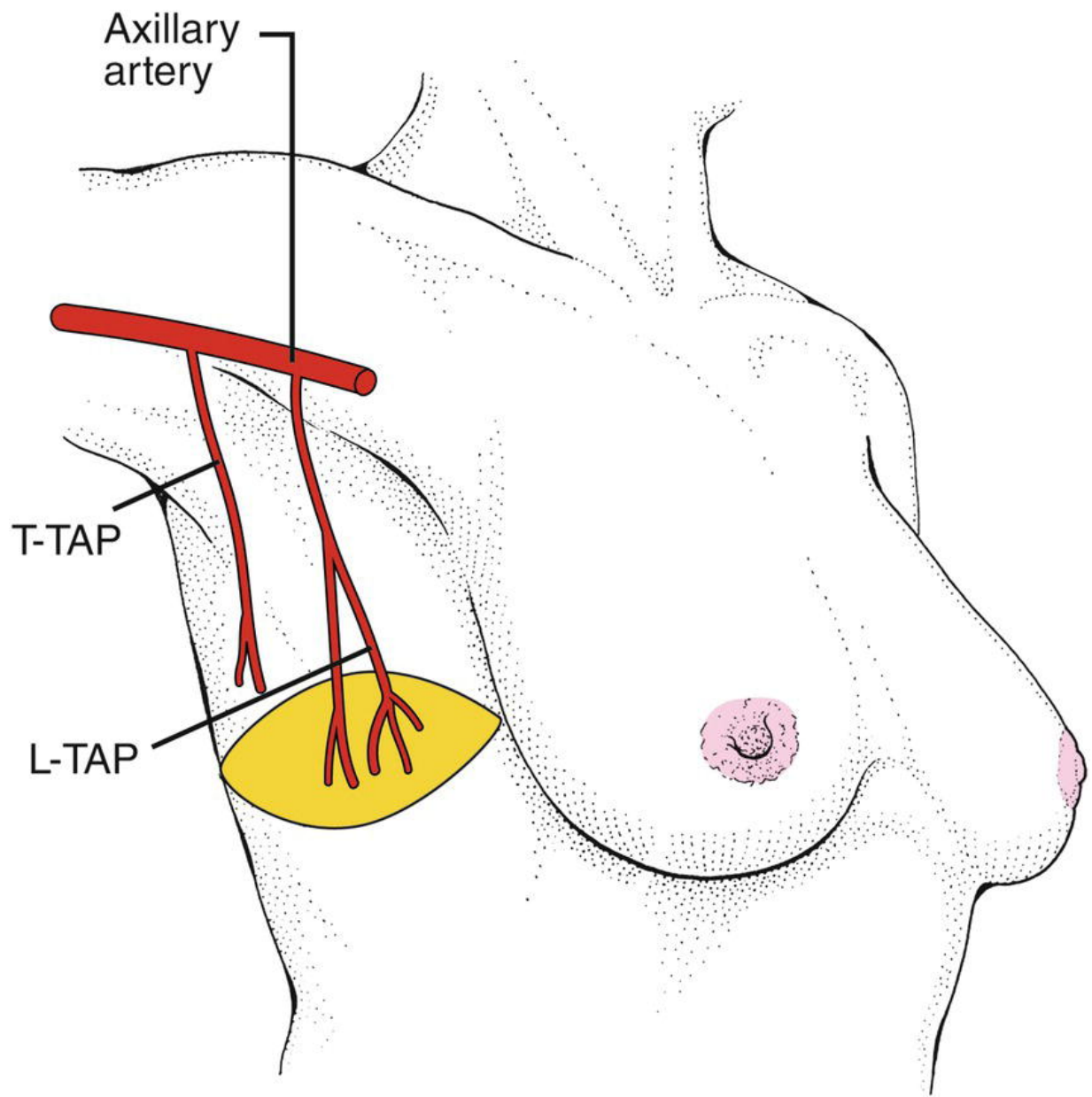
- The patient will typically stay in hospital overnight for observation, but these procedures can be done as day procedures.
- Post-operative supporting medical bra and analgesics
- No drains required, but if drains are required, prefer Blake's soft drains, which are better.

- **IV antibiotics:** One intraoperative IV antibiotic is sufficient (follow local guidelines).
- Negative-pressure dressing if available (change in one week)
- Advise the patient not to raise the arm on the operated side beyond 90° for couple of weeks and not to sleep on the operated side for two weeks. This is to avoid stretch and pressure on the healing wound.
- **Two weeks:** MDT and follow-up visit, then review in six months to assess cosmetic outcome.

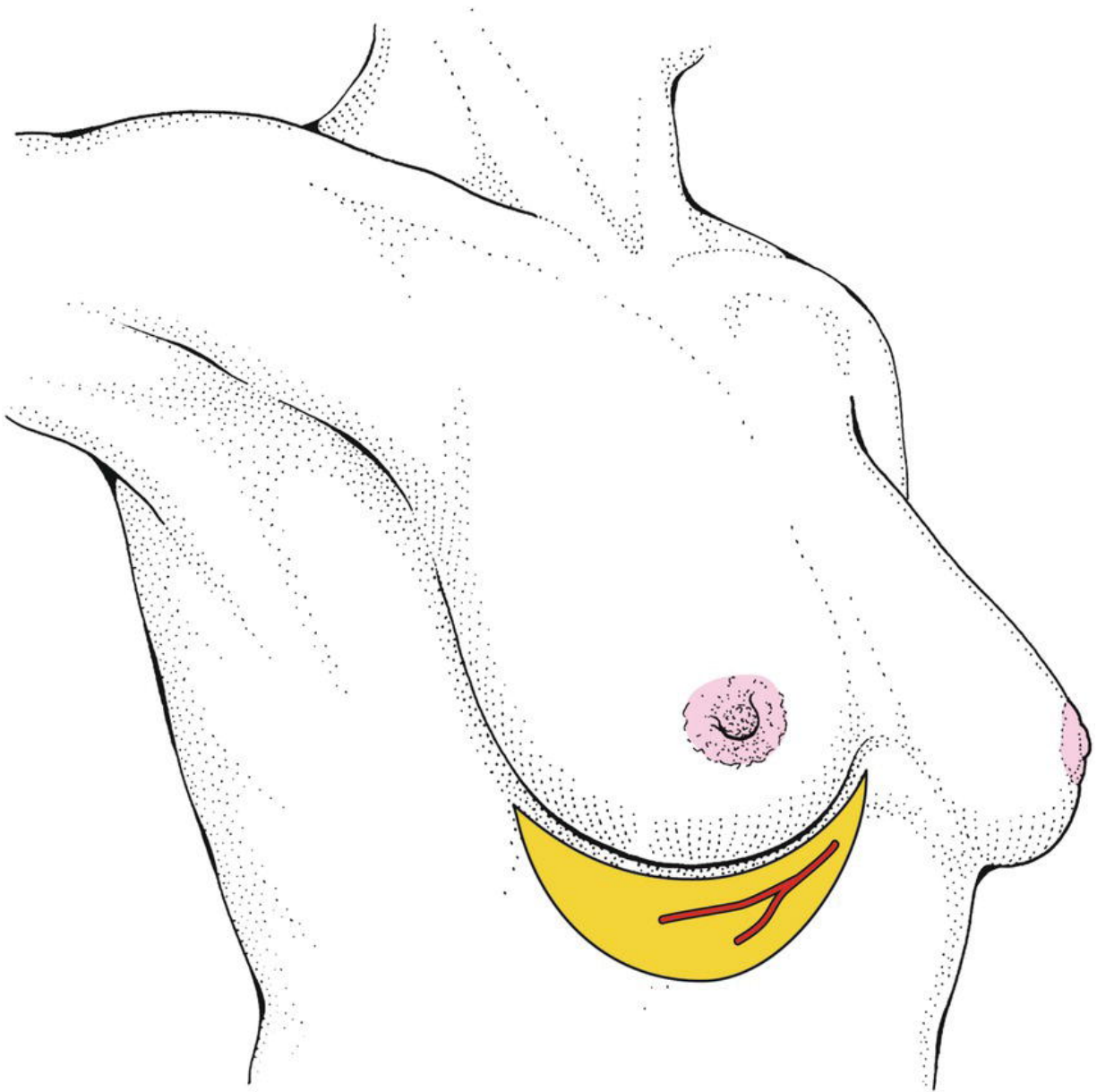
LTAP, TDAP, AICAP, MICAP



AICAP flap



L-TAP flap



MICAP flap

- These flaps are chosen depending on the location of the defect and the availability of perforator vessels.
- It is important to create new IMF in case of AICAP and MICAP flaps by advancing abdominal skin with the help of multiple interrupted 2-0 sutures. Make sure only the fascia is included in these stitches; otherwise, patient can develop chronic chest wall pain.

- TDAP is by far the most difficult flap but potentially can be used almost like muscle-sparing LD flap. But it involves dissection of the vessels through the muscle and is best done with a buddy experienced oncoplastic breast surgeon/plastic surgeon.

Implications of Perforator Flaps

- Perforator flaps do not interfere with follow-up mammograms or future breast investigations.
- Re-excision of margins is possible after perforator flaps.
- Some patients (10–20%) will need further procedure in the form of fat grafting to increase volume.
- Consent patient for all the complications on a special consent form and explain about volume loss and subsequent further procedures.
- Perforator flaps can be done as day procedures.
- In two-stage approach, if the gap is three weeks or more, then capsule will form and will need capsulectomy while doing perforator flap.
- Axillary clearance is difficult if the pedicle is based on lateral thoracic vessels. So, in these situations, better to proceed with adjuvant chemotherapy and bring patient back for completion axillary clearance after chemo (five to six months). By this time, the flap will develop neo-vascularisation, and it is ok to cut lateral thoracic vessel at this point of time while doing axillary clearance.
- Explain to the clinical oncologists about perforator flap and also the radiologists. So they know about it while planning radiotherapy (especially boost) and follow-up mammograms.
- Radiotherapy boost to the tumour bed is an issue with perforator flaps as the boost field will cover the flaps. Although the flaps will withstand radiotherapy, long-term cosmesis may be affected.

Complications

- Infection
- Bleeding
- Numbness, paraesthesia, sensory loss
- Chronic pain
- Seroma
- Delayed healing
- Flap failure (partial or complete)
- Fat necrosis
- Wound dehiscence
- Need for further surgery
- DVT/PE

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How to Select an Implant in Post-Mastectomy Reconstruction

- **Breast implants:** Prior to 1963, various plastic foam materials were used to make implants.
- Although well tolerated, they would shrink and harden with time. Modern silicone implants entered the market in 1963. Various forms of implant are available, but the basic structure is a silicone rubber (elastomer) shell (single or double, smooth or textured, barrier coated or covered with polyurethane foam) filled with saline or silicone gel.
- **Silicone:** Silicone are polymers of silica (metal) and oxygen. There are thousands of varieties; many are highly toxic. Silicones are used in cosmetics (lipsticks, face cream, hair spray), food processing and in medicine (cannula, needles, prosthetic joints, implants, cardiac valves). Every cannula, syringe, needles and lubricating gels contain silicone. Insulin-dependent diabetics can inject up to 25–30 g of silicone over their lifetime!
- **Silicone:** Dimethyl siloxane is the most commonly used silicone in medical products. The breast implant shell is made of cured rubber like fully polymerized silicone, and the gel is made of silicone oils of various chain lengths; medical grade silicone causes nonspecific foreign body response (macrophages engulf particles, giant cell formation and scarring).
- **Silicone breast implant facts:** Cause capsule formation and occasionally capsular contracture. No evidence that silicone implants increase incidence of cancer or recurrence, but emerging evidence that textured implants can cause ALCL. Rheumatologic disorders or silicone-associated disorders (SADs), scleroderma, arthritis and chronic fatigue syndrome have been reported in association with silicone implants in anecdotal reports, but there is no concrete evidence. Silicone gel

can 'bleed' outside from intact silicone shell and get deposited in surrounding tissues (very minute quantity).

- Macrophages can carry these molecules to axillary nodes ('Snow Storm appearance'), but very little escape beyond.
- Silicone is hydrophobic, so it is unlikely to be transported out of local site. Ruptured implant is not a health hazard. It can cause pain, discomfort and change in shape of the breast, which obviously need treatment.
- Ruptured implants can cause intense inflammatory reaction and granuloma formation with axillary painful lymphadenopathy.

Breast Implant Types

- **Anatomical or round implants**
- **Baker implant** has a saline chamber and silicone gel chamber.
- **Polyurethane foam-covered implants:** Supposed to reduce implant movement and capsular contracture
- **Saline implants:** Usually used for cosmetic augmentation (Overfilling can result into firm device, and underfilling can cause rupture due to 'fold flow'.)
- **How to choose the correct implant:** Volume of implant depends on the size of the breast tissue excised and the extent to which skin can be stretched safely. Check for cup size, ptosis, skin thickness, shape, size (volume) and projection. Also, check for chest and shoulder proportion (low height implant for a broad chest and full height for narrow chest) and posture (full projection for concave posture and low projection for concave posture).
- **How to measure chest size:** Measure circumference of the chest around the IMF. Take the measurement in inches and round it up to the nearest inch. If the size is an even number add four, and if it is odd add five – this will then give the chest size.
- **How to measure the cup size:** Take the tape measure across most prominent part of the breast and again measure in inches,

rounding to the nearest inch. The difference in the inches between this measurement and the chest size gives the cup size. For example, a one-inch difference would make the breast an A, two a B, three a C, four a DD, five a DD, six an E.

- So, if the chest size is 34 in. and the breast size is 37 in., that would make the breasts 34C cup size. Implant reconstruction usually looks good up to D or maximum DD cup size. Best results are with C cup.
- **Ptois:** Implant reconstruction is suitable for grades I and II. The NAC is not in the correct position in for grades III, IV and V. In such cases, consider nipple grafting or reduction mammoplasty (wise pattern), followed by mastectomy and implant reconstruction.
- **Soft tissue and skin thickness:** Pinch test (performed in the medial upper pole of the breast). Implant reconstruction will look good on someone with good amount of subcutaneous fat. It also decides less or more cohesive implant Selection (less cohesive soft implant for thick soft tissue cover).
- **Skin laxity/stretch:** Measured by grasping the skin of the medial areola and pulling the breast maximally anteriorly (larger implants for more laxity)

Implant vs Expander?

Indications for Expanders

- Mastectomy weight more than 500 g
- Chances of post-mastectomy radiotherapy
- Patients wishing to go cup size bigger
- High-risk patients such as smoker
- Previous radiotherapy
- **Round or anatomical implant:** Usually anatomical shaped implants to be used for skin and nipple–areola-sparing mastectomy and immediate reconstruction. Very young patients

with no ptosis and fullness in the cleavage may be better with round implant. For re-do implant surgery, round implants are preferred by some surgeons because of the chances of rotation.

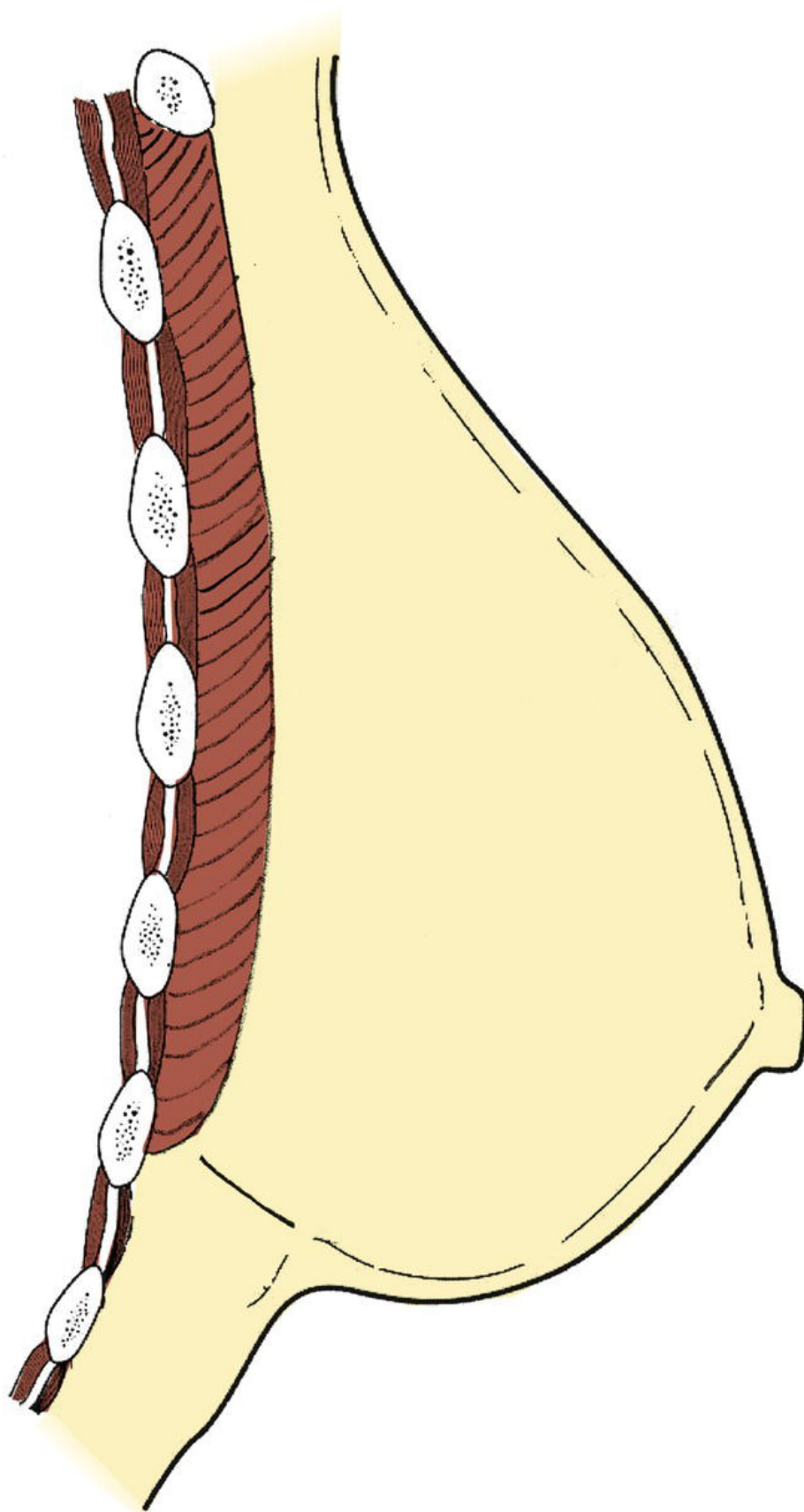
- **Implant sizer:** There are various fixed volume and expandable saline sizers available, which can help with the size of the implant.
- **Breast volume calculator app:** There are mobile phone apps available, which help to calculate the volume of the breast tissue by measuring supra-sternal notch to nipple distance, nipple to IMF distance, projection and width of the breast at the IMF.

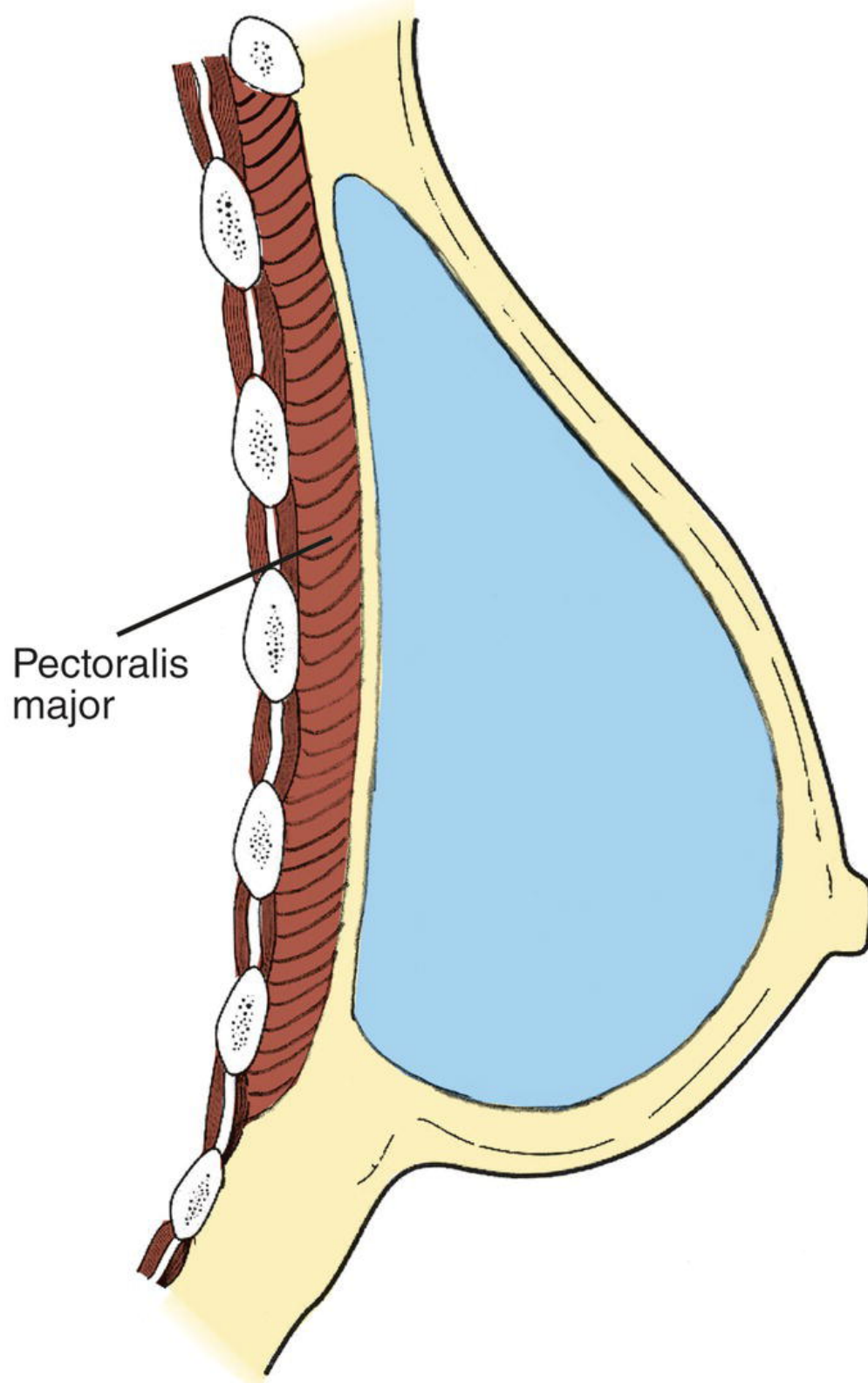
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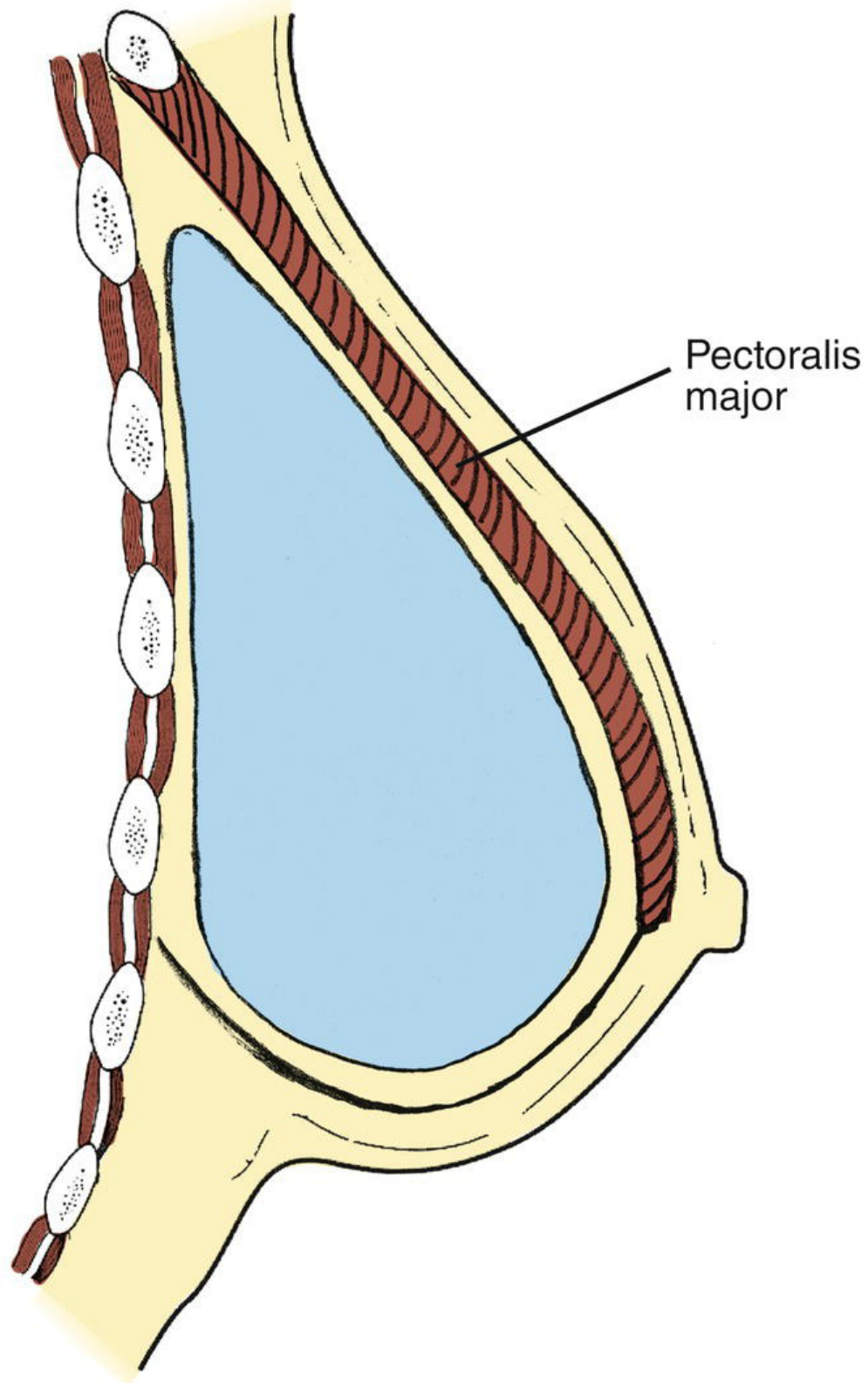
Pre-pectoral Implant Reconstruction

- The standard clinical practice has moved from subpectoral to pre-pectoral immediate reconstruction following skin-sparing mastectomy.
- **Subpectoral reconstruction disadvantages:** Several immediate- and long-term consequences such as retraction, animation, double-bubble effect and restricted implant mobility are some of the biggest drawbacks of subpectoral reconstruction.
- **Pre-pectoral reconstruction:** It is the natural replacement of breast tissue with an implant. This procedure is less invasive surgery, less painful, preserves shoulder function better. It avoids unnecessarily cutting the pectoralis muscle for reconstruction.
- Pre-pectoral reconstruction avoids animation and double-bubble effect in the long run with better cosmetic results. It preserves the mobility to implant/breast. The recovery is faster, less morbidity and even shorter operative time.
- **Pre-pectoral reconstruction indications:** Immediate breast reconstruction, Immediate delayed breast reconstruction following neoadjuvant therapy, delayed breast reconstruction and risk-reducing surgery. It can also be performed as breast revision surgery for animation, capsular contracture, breast deformity and muscular problems associated with previous submuscular implant reconstruction.





Pre-pectoral implant reconstruction



Subpectoral implant reconstruction

Pre-Op Workup and Consent

- **Pre-pectoral reconstruction patient selection criteria:** The criteria include patients with a reasonable subcutaneous layer over the breast tissue and options for fat grafting, non-smoker or ex-smokers, no history of NACT, patients with an active lifestyle, breasts with grade 1 or 2 ptosis and an estimated mastectomy specimen weight of less than 500 g.
- Patients with grade 3 ptosis and anticipated weight more than 500 g can be offered this technique with a modification of creating de-epithelised dermal sling of the excess skin.
- **Pre-pectoral reconstruction learning curve:** Select patients carefully; preferably no anticipated post-operative radiotherapy. Always explain complications, likely outcome and possibility of further procedures such as fat grafting.
- Pre-pectoral implant-based reconstruction can be performed as single-stage (UK) or two-stage reconstruction of the breast (USA); the advantage of two-stage is that it can include routine fat grafting at the second stage.
- **High-risk factors for breast reconstruction:** Smoking, diabetes, obesity, previous scars on the breast, previous radiotherapy

Marking/Incision Planning

- Preoperative marking is vital.
- Always mark with patient in the standing position.
- Mark all the important landmarks, including suprasternal notch, midline, anterior axillary line, IMF and the boundaries of the breast

Procedure

- Keep adequate theatre time for the case (1.5–2 hours on average).

- Optimum antiseptic technique
- Use urinary catheter for the first 24 hours in case of bilateral reconstruction.
- Laminar air flow in theatre, minimum number of people in the theatre
- Supine position with both arms stretched on arm boards. Drape the patient with both the breasts exposed so it allows comparison with the other side.
- **Incision:** Usually IMF incision works very well. Make the incision about a centimetre on the breast skin or below the IMF, avoid making incision exactly along the fold (otherwise, the resulting scar will get stuck with the chest wall causing pain).
- Other incisions like vertical incision at 6 o'clock and lateral incisions at 9 o'clock (right side) and 3 o'clock (left side) with circumareolar extension have also been described.
- Careful dissection is required, keeping the skin flap thickness uniform and minimise use of diathermy especially behind nipple–areola (use blade/scissors) ensuring well-perfused mastectomy skin flaps.
- Exact precise excision of breast tissue as per preoperative marking is vital.
- Rinse the mesh, use antibiotics (vancomycin) to wash pocket (and not the implant) as per choice and local protocol.
- Close any excess dead space, keep the pocket snug but use minimum stitches.
- Stitch the mesh in place first to create a hammock for the implant.
- It is good practice to change gloves before handling implant and placing it in to the pocket.
- Some surgeons prefer to wash the implant in a saline and vancomycin or gentamycin mixture to minimise the chances of infection.

- Under full aseptic technique, place the implant in the mesh hammock and make sure it is orientated if it is an anatomical implant.
- Biological meshes integrate through remodelling and neovascularisation, while synthetic meshes incorporate through fibroblastic and foreign body reaction. All meshes need to be in intimate contact with the mastectomy flap to undergo integration. Hence, it is important to minimise seroma formation.
- Insert a number 10 suction drain and bring it out on the abdominal skin away from the operative incision.
- De-epithelise the edges while closing the wound (2–3 mm) on either side while closing the wound. This is to remove edges that may have been subjected to ‘retraction trauma’ and also to create ‘dermal sling’ and close wound in three layers.

Post-operative Management

- **Drain:** At least 5–10 days, cover with oral antibiotics till drain comes out (hospital stay 1–4 nights).
- Always give post-surgery multiple waterproof layers of dressing.
- Physiotherapy, analgesics, optimise hydration, encourage early mobilisation.
- Low-molecular-weight heparin as per local protocol
- Could use GTN patch, which improves microcirculation in the mastectomy skin flaps. The GTN patch can be applied for the first 24 hours. If patients complain of headache (one of the side effects), then remove the patch immediately. Always check with the anaesthetist if the patch is not contraindicated.
- Post-operative medical soft bra (no cups or wires) for six weeks
- **If post-operative seroma is noted (can happen in larger breasts):** Then aspirate under ultrasound guidance under strict aseptic technique (long needle tunnel to avoid injury to the implant and fluid leak from aspiration site).

- If any skin edge necrosis or gaping is observed, act immediately! Debridement and secondary suturing should be done. Good skin closure is the key.
- **Rippling effect:** Will settle down most of the times as capsule develops, reassure patient. If it persists, consider fat grafting.

Complications

- **Nipple and areola necrosis:** Partial (common) or full thickness
- **Wound infection:** Very difficult to treat because of two foreign bodies
- Wound breakdown, leading to loss of implant
- Capsular contracture
- Implant rotation
- **Volume and shape discrepancy between reconstructed and normal breast over years:** Patients may need fat grafting later on for symmetry and improve the look and feel of the reconstruction.
- Partial nipple necrosis and dents
- Preexisting discrepancy can persist.
- Patient and doctor's idea of cosmesis can be different.
- Implant rippling

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16

Therapeutic Mammoplasty

Introduction

- The main aim of this operation is to remove breast cancer as well as reduction of skin envelop and glandular tissue and then rearrange the remaining breast tissue to make a smaller shaped breast.
- The advantage of this technique is to achieve wide margins even around large tumours and extensive disease and still avoid mastectomy.
- Another advantage of reducing the breast mass in patients with large breasts is the homogeneous exposure of breast tissue to radiotherapy. This avoids the production of hot and cold spots and also reduces the side effects of radiation on breast tissue.
- There is advantage in reducing contralateral breast at the same time, as it improves the overall cosmetic outcome and symmetry.

Indications

- Large tumour size or multifocal cancer in a medium- to large-sized breast with ptosis
- Large patch of microcalcification/DCIS
- Small tumour in a large-sized breast for homogeneous radiation exposure
- Choice of a pattern of mammoplasty is guided by the location of cancer in the breast.
- **Wise pattern:** Majority cases are suitable for this approach with moderate- to large-sized breasts. The design is versatile and

can be rotated around the nipple to cover all quadrants of the breast. Most of the scars are hidden around areola and IMF.

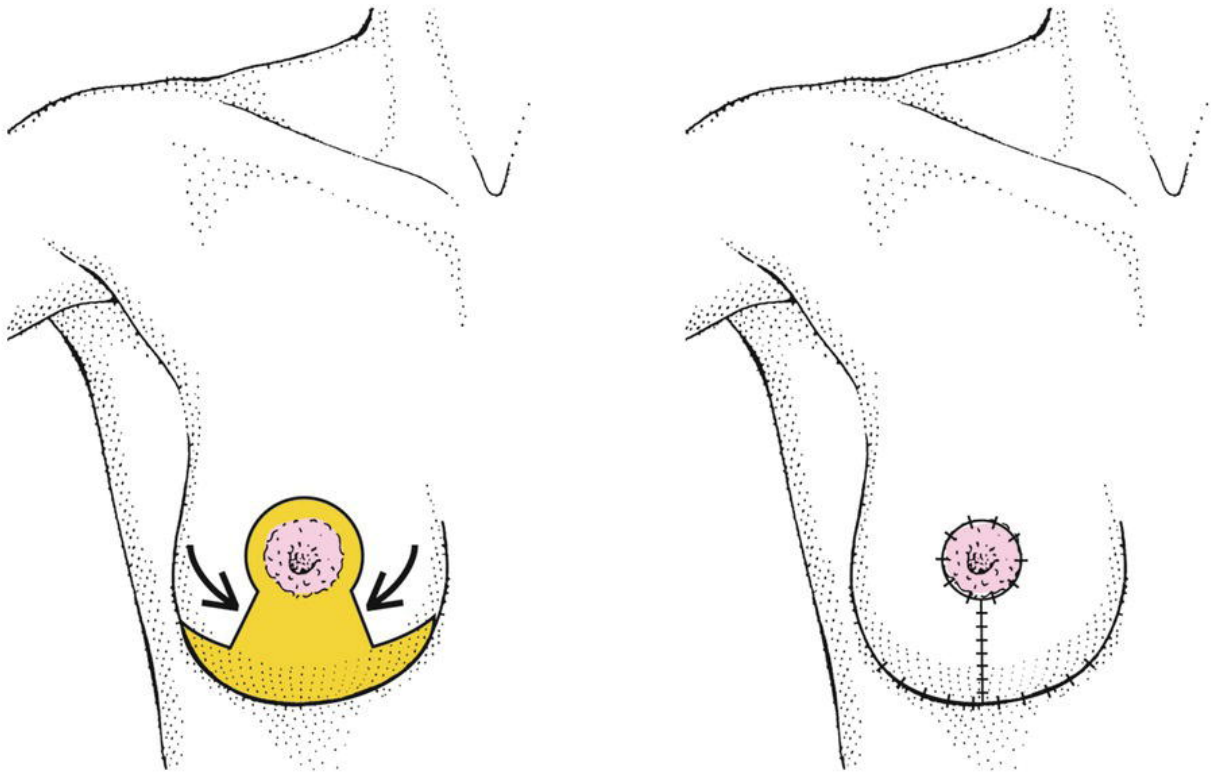
- **Vertical scar mammoplasty:** Suitable for young patient with elastic skin and glandular breast with minimal ptosis, suprasternal notch to nipple distance no more than 30 cm, resection not expected more than 500 g.
- Comorbidities like diabetes, high BMI, history of smoking and previous radiotherapy are relative contraindications for this procedure.

Pre-Op Workup and Consent

- Explain in detail about the procedure and its potential consequences and complication.
- The operation typically takes around two to three hours for each side, so ideal to plan the procedure with two teams and two scrub nurses and operate simultaneously on both sides to reduce anaesthesia time.
- Explain the patient that mastectomy maybe still needed in case of more extensive disease and positive margins on final pathology.
- **Clinical photography:** Consent patients and arrange for clinical photograph before and after the surgery.
- If the distance from suprasternal notch to nipple is 50 cm or more, then there are very high chances of nipple–areola not surviving on any pedicle. So, it is better to consent patient for excision and then grafting of nipple–areola on the reduced breast in appropriate position as full-thickness graft.

Marking/Incision Planning

Wise Pattern



Wise pattern mammoplasty

- There is certainly an advantage of the mobility of breast tissue in the lower pole of the breast. Hence, the greater the degree of ptosis, the greater the amount of tissue available in the lower pole for use during mammoplasty and the better the results.
- Ask patient to strip up to waist, expose the umbilicus (important landmark to mark the midline). Ask patient to stand in front of you, facing you while you sit in the chair.
- Mark the midline from suprasternal notch to umbilicus.
- Ask patient to turn right and left slightly so that the nipple–areola is facing you (the side you want to mark).
- For marking the meridian, mid-clavicular point is about 6.5–7 cm from suprasternal notch. This is the line that goes through the middle of the breast itself and does not always cross the nipple, but it should divide the breast mound into two visually equal parts.

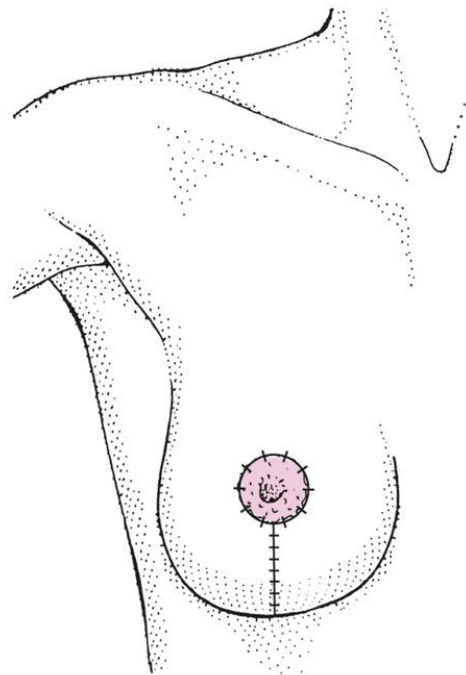
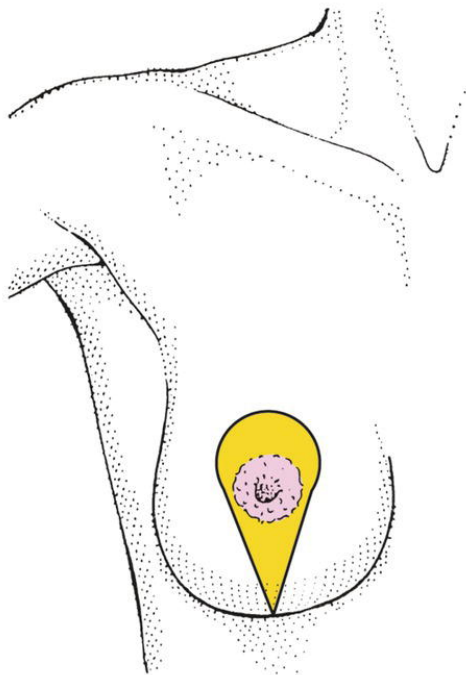
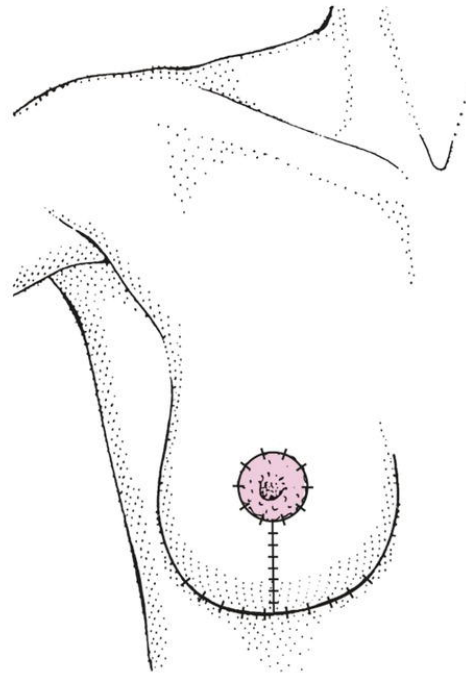
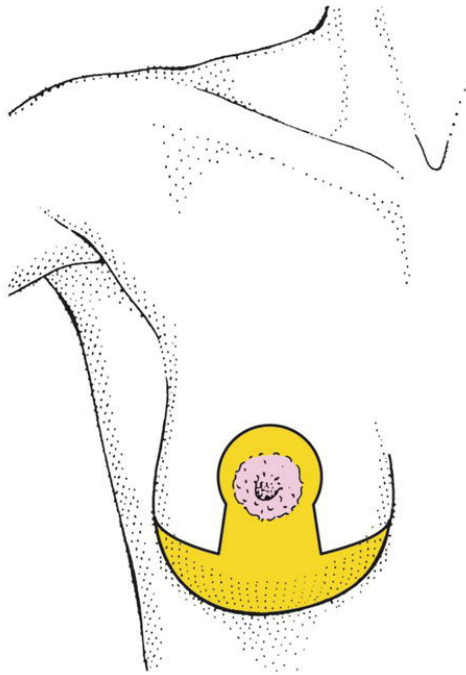
- Put a measuring tape around patients' neck and allow 'free fall' on the breast and nipple–areola. It usually falls along the meridian.
- Mark the meridian from mid-clavicular point to nipple and straight down on abdominal wall up to umbilicus.
- Make sure meridian on each side is equal distance from the midline at all levels.
- Sometimes, the breasts are not of equal width and one side will be broader than the other and the measurements from the midline to the meridian will be different on the two sides. So keep this in mind and make adjustment in the marking.
- Ask patient to gently lift both the breasts and mark a line going through both the IMF, especially where the line crosses the midline.
- Put your flexed middle finger behind breast tissue at the level of IMF and feel the 'pulp' of your thumb (same hand) anteriorly along the meridian (Pitanguy point). This is the new nipple position (do not mark new nipple position above the level of current IMF). Mark the new nipple position along the meridian just at the level or slightly below the level of IMF.
- Mark the new position of superior end of areola 2 cm above the new nipple position mark. The new position mark of superior end of areola will determine the nipple position, so do not mark it more than 2–3 cm from new nipple position.
- Ask the patient to stand steady and move the breast medially and laterally to mark the vertical limbs. These vertical limbs should not be more than 6–7 cm long (usually one-third the length of distance from suprasternal notch to new nipple position).
- Pinch the two marked vertical lines to bring them together; this will tell you where to join the new areolar marking to the vertical limbs. The vertical limbs should be no more than 6–7 cm long.
- Join the IMF line with the lowest point of the vertical limbs with a line that is slightly curved on the breast and not parallel to IMF.

- Always measure the markings on both sides and make sure they are identical and equidistant especially as far as the midline and meridian are concerned.
- For vertical scar mammoplasty, curve the vertical lines to meet on the meridian about at least 2–3 or even up to 4 cm from the IMF on the breast.
- But the excision part for glandular tissue in vertical mammoplasty is the same as wise-pattern mammoplasty, it is just that the skin excised is less.
- Make sure the two vertical limbs can be ‘pinched’ and approximated easily or there is risk of too much tension on the suture line when the wound is closed.
- The length of the vertical segment is determined by adding the nipple diameter to one fourth the distance between sternal notch and the new nipple position.
- After marking the length of the vertical segment, a horizontal segment is drawn, leading from the vertical segment to the IMF. It is advisable to avoid extending the horizontal segment into the cleavage medially and beyond the anterior axillary line laterally.
- It is better to have slightly laterally placed nipples than medial, so it is fine to mark new nipple position slightly lateral to the meridian.
- Similarly, slightly low placed NAC is better than high riding nipple.
- Also remember, the skin in the superior pole of the breast will retract after the operation, pulling the NAC superiorly in the long term.
- In case NAC is not to be saved, join the new superior areolar position point to the vertical limbs as an ‘angle’.
- Take into account while marking that there is usually size discrepancy between two sides and the NAC may be at different levels. Try to correct this when you mark the new nipple position.

- Also mark the lateral border of breast in 'mid-axillary line'. Your Incision should not cross this line.
- The vertical limbs should line the meridian when the breast is moved medially or laterally. Some surgeons mark the vertical limbs as a line joining the meridian when the breast is moved medially or laterally.
- Measure the distance between suprasternal notch and all the new marked lines and the new nipple position and make sure it is identical on both sides.
- Most (95%) wise-pattern mammoplasty cases can be managed with superior, superomedial or superolateral pedicle techniques. Use of inferior pedicle or two pedicles is rare.

Vertical Scar Mammoplasty Marking

Inverted T-mammoplasty



Vertical mammoplasty

- Marking is similar to wise pattern.
- The new nipple position is marked lower (about 1–2 cm) than that of the wise pattern because while suturing, there is more ‘coning’ of the breast due to which the projection of the nipple is more than that from the wise pattern and the nipple ends in a higher position.
- Join the lower ends of vertical segments as a curved line 2–6 cm above IMF.
- This approach will work best with medial pedicle.

Procedure

Wise-Pattern Mammoplasty Procedure

- This procedure takes at least 1.5–2 hours for each side, so having two teams operate simultaneously is desirable.
- Choose the pedicle for nipple–areola (usually opposite side of the cancer).
- Usually, no drains and no hydro-dissection is required.
- SNB and ANC can be performed through a separate incision, but SNB is possible through the same wise-pattern incision.
- The other option is to fashion an additional secondary pedicle to fill the defect if the nipple pedicle cannot be extended.
- The pattern can be rotated around the nipple to accommodate skin excision over the tumour location; however, this needs some expertise and practice with the classical design before a surgeon can confidently do it.
- This allowed mobilisation of the breast tissue that was approximated without any tension at the suture lines.
- If nipple pedicle was not thinned out, it would not allow mobility to the nipple and the pedicle would remain quite rigid.
- For central cancers located behind the nipple, the wise pattern may be used if there is at least 8–10 cm length of skin available between the areolar margin and IMF. (Inferior pedicle-based

mammoplasty and round skin patch can be inset into the nipple–areola defect after de-epithelialisation.)

- If the closure of the vertical limbs appear tight and under tension, some liposuction is helpful rather than cutting out more tissue.

Vertical Scar Mammoplasty Procedure

- The vertical scar is an adaptation of the wise pattern with some modifications mainly to remove horizontal segment of the scar.
- The tissue dissection is mostly the same as in wise-pattern mammoplasty.
- Pedicle is kept full thickness or thinned out if superior.
- Lower parenchymal dissection is down to IMF with lateral and medial sections just as in wise pattern. New IMF is thus raised.
- The lower end of vertical limb can be purse-stringed, de-epithelialised and purse-stringed or made a short horizontal T scar.
- The breast looks upside down in profile with more fullness at the top but gradually descends into more anatomical shape.
- Other difference from a wise pattern includes a thicker pedicle; however, if it is superiorly based, it may be thinned out for allowing mobility to the nipple.
- The lower glandular dissection is carried down to the IMF similar to wise pattern, which results in raising the fold at closure.

Complications

- **Wound healing problems – T-junction necrosis:** Because of the extensive scar of the wise pattern, there are more chances of wound healing problems, infections and necrosis. All these are treated with dressings and antibiotics. This may delay adjuvant treatments and lead to hypertrophic scars.
- Fat and nipple necrosis

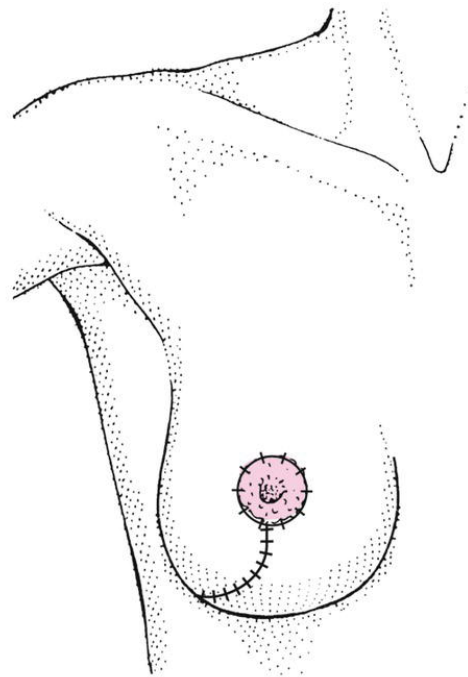
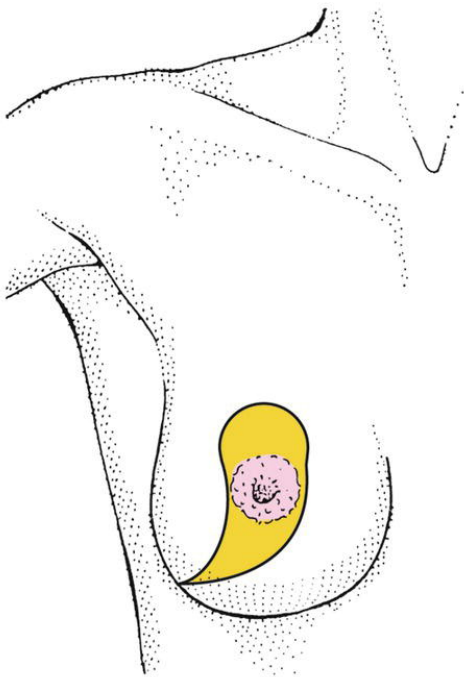
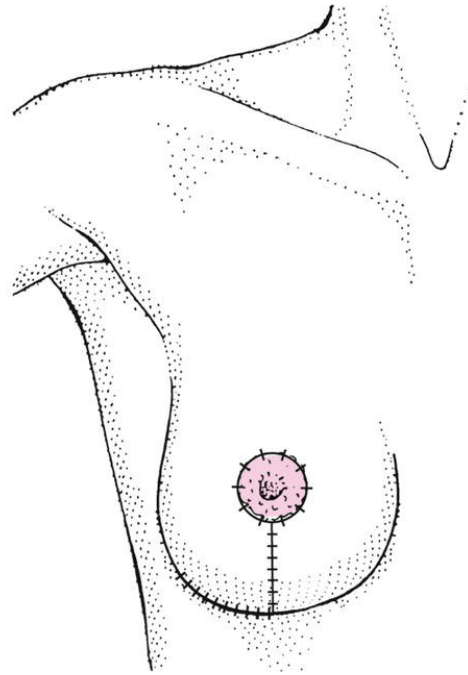
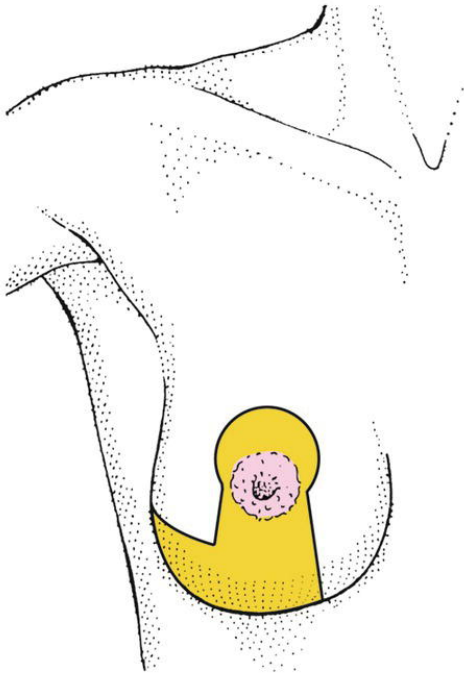
- Scarring and fat necrosis can present challenges to radiologist at future imaging of the breast that may lead to further biopsies.
- **Asymmetry:** If there is natural asymmetry in the breasts, it may persist after bilateral reduction mammoplasty and may become more apparent to the patient, but if it has been explained to them prior to the operation, they will not complain about it.
- Hypertrophic scars
- **Contour problems:** Contour problems will arise because of asymmetric tissue excision, fat necrosis and radiotherapy and can be addressed with lipo-modelling/fat grafting.
- Numbness of nipple–areola
- Infection
- Hematoma, seroma
- **Tear drop deformity of nipple:** While stitching the wound around the nipple if there is tear drop deformity, the lower edges can be squared off by de-epithelialising small crescents and stitching to the new edges.
- High nipple position
- **Pseudo-ptosis or bottoming out:** A later problem is pseudo-ptosis when the breast tissue bottoms out below the nipple and the upper half becomes empty. The inframammary scar is seen to ride up the breast mound rather staying in the fold. To prevent this, it is essential to stitch the Scarpa's fascia to the deeper fatty tissue.

For large-sized breasts with higher degree of ptosis, the most commonly used mammoplasty is the wise pattern because it can be used for tumour location almost anywhere in the breast and a good cosmetic outcome for the reduced breast.

Mammoplasty diagrammatic representation: The diagrams of various mammoplasty techniques below helps the surgeon to utilise one of the many described techniques and pattern of most suited mammoplasty according to the location

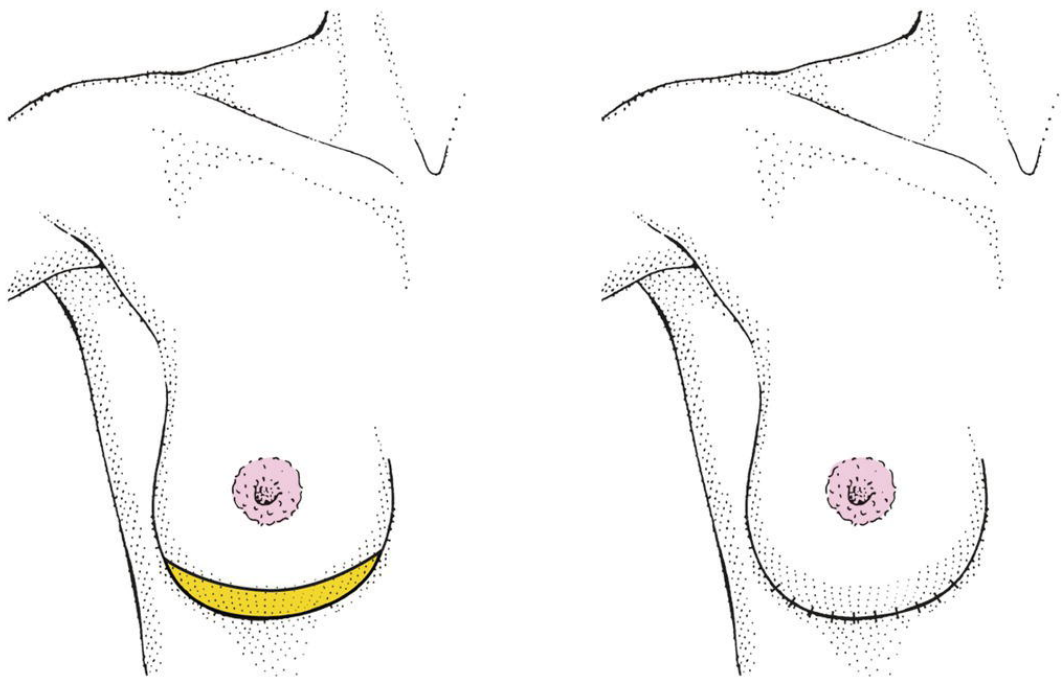
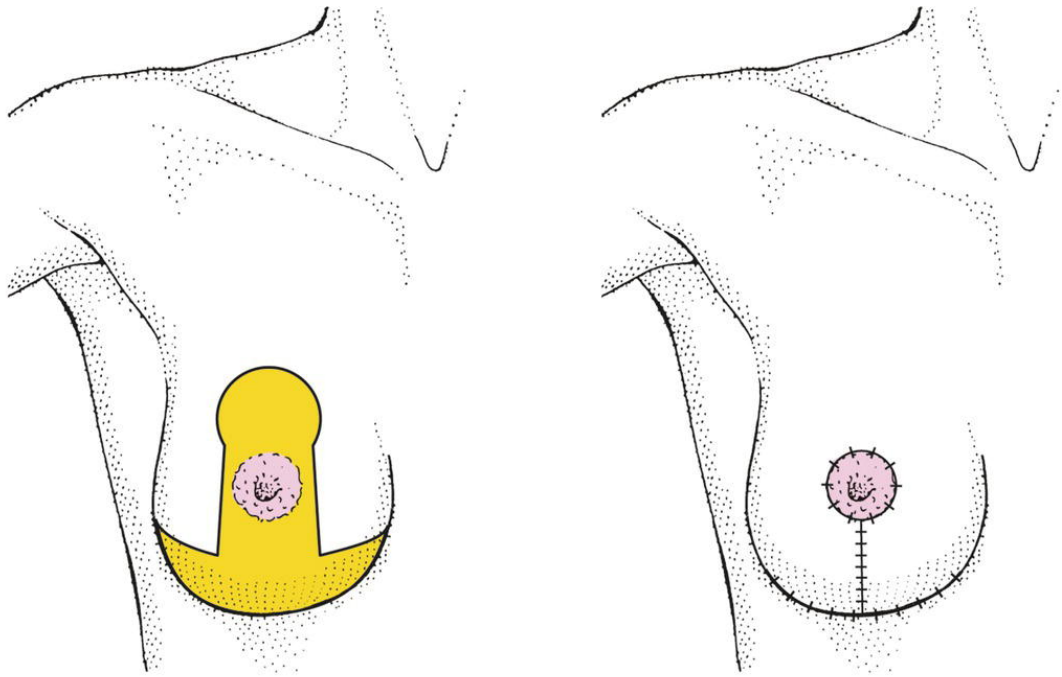
of breast cancer in the breast. Most of these patterns are suitable for small- to moderate-sized breasts with early degree of ptosis.

L-Mammoplasty



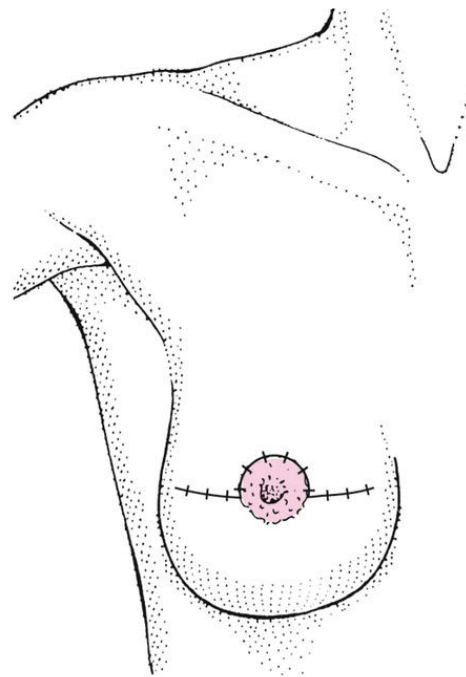
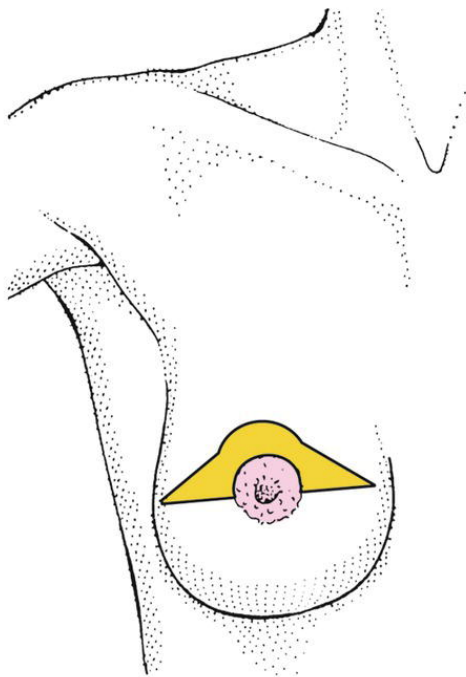
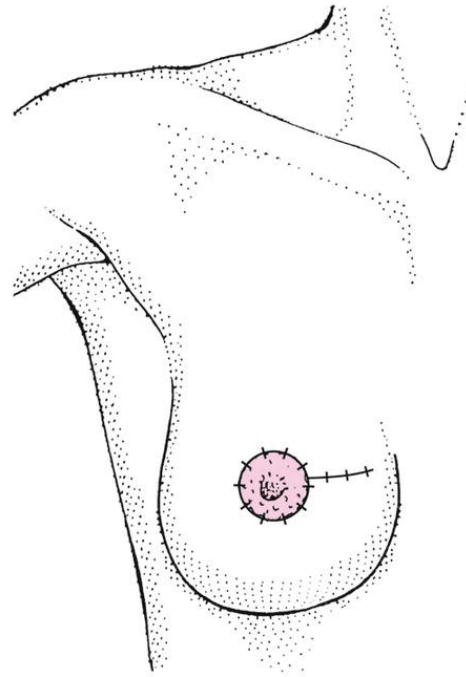
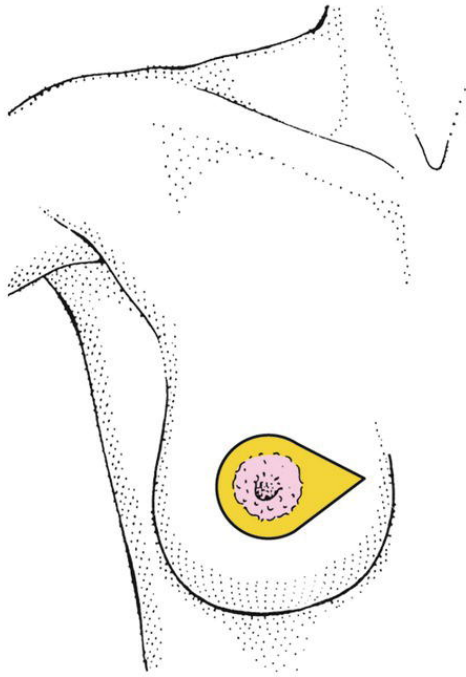
J-Mammoplasty

Inferior pedicle mammoplasty



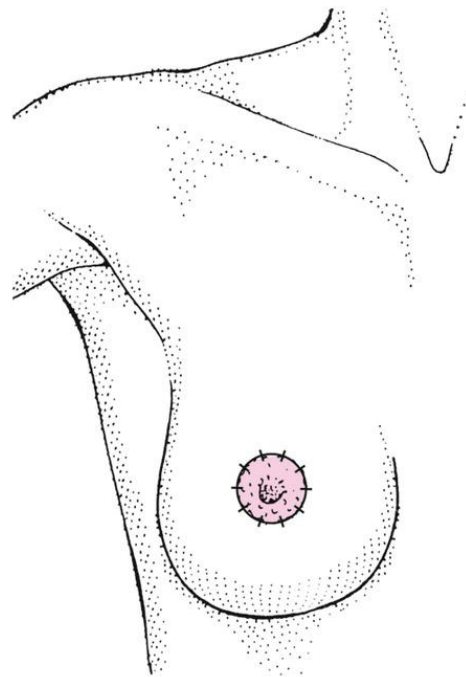
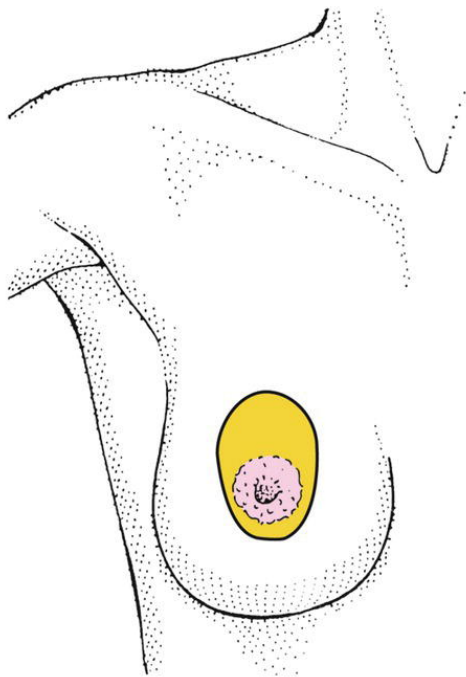
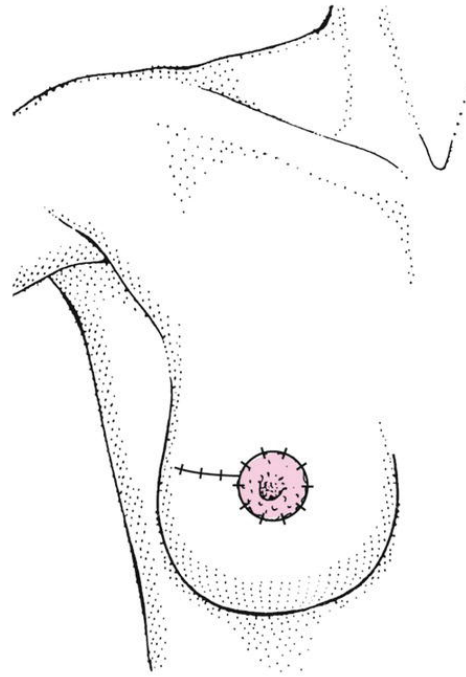
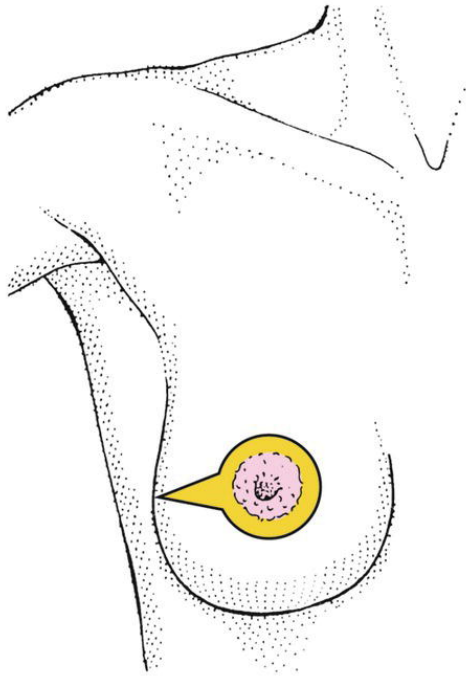
Inferior mammary fold mammoplasty

Medial mammoplasty



Omega mammoplasty

Lateral mammoplasty



Periareolar mammoplasty

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17

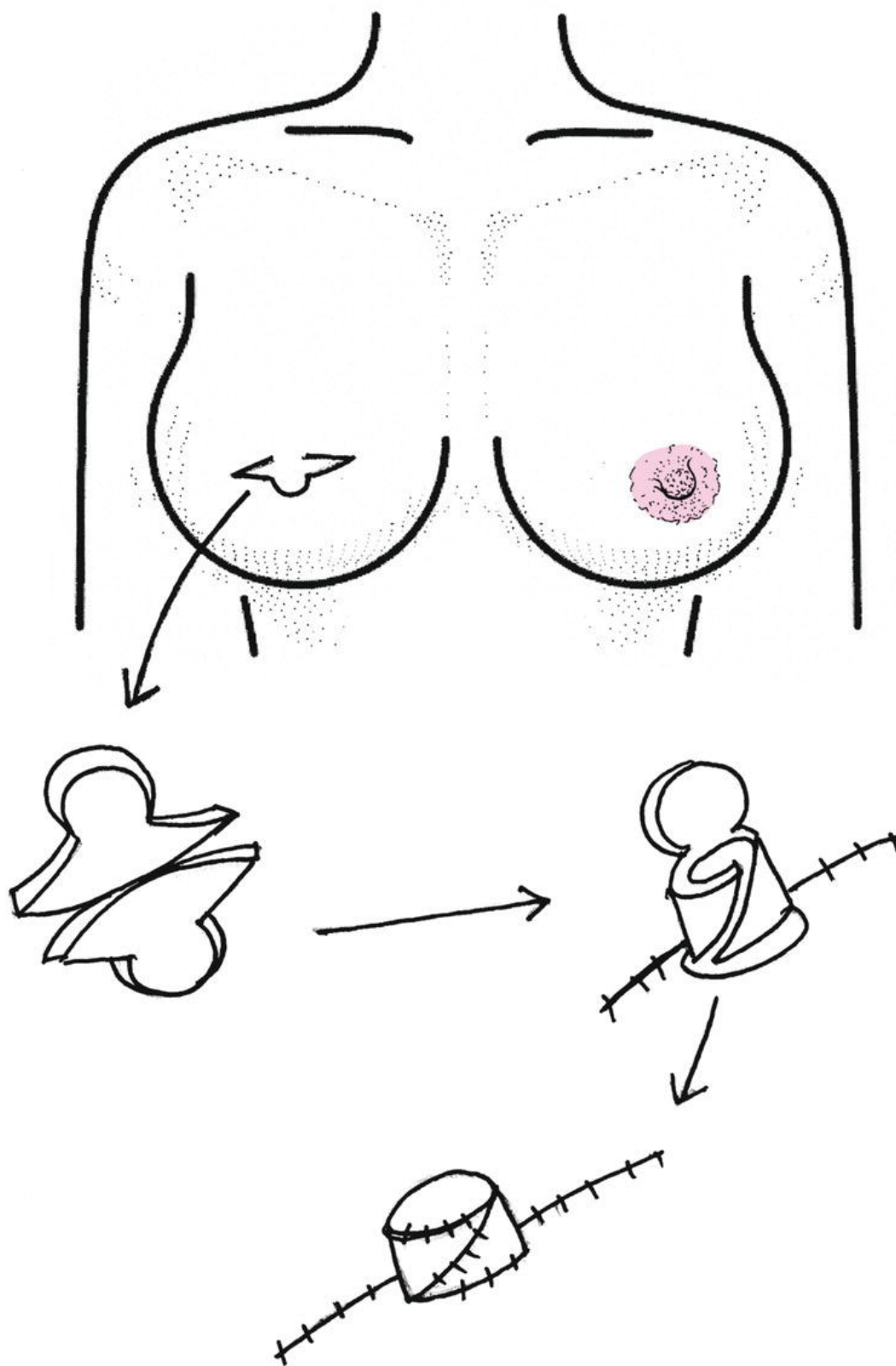
Nipple Reconstruction

Introduction

- Nipple reconstruction is a simple procedure that contributes significantly to overall breast aesthetics.
- Several techniques are described with no agreement on the best approach.
- General agreement does exist for the optimal technique for areola reconstruction using tattoo.
- In most cases, the author prefers a local flap design; however, where the contralateral nipple is noted to be large, a nipple-sharing procedure is considered.
- Typically performed with local anaesthesia as an outpatient

Operative Technique – Local Flap Technique

Markings



Nipple reconstruction

- **Ignore position of the contralateral nipple:** The nipple reconstruction must be appropriately located for the subject breast rather than match the contralateral side.
- **Mark breast meridian:** A line bisecting the breast vertically
- **Mark preferred nipple position:** Typically at the point of maximal breast projection when viewed from the side
- The use of an external nipple prosthesis placed at the planned location can help.
- Stand back and view planned nipple location from differing angles.
- Agree nipple position with patient.

Equipment

- Standard operative instrumentation
- Absorbable sutures
- Foam dressing

Surgical Technique – C-V Flap Technique

- Flap Design

Consider the shape and size of the contralateral nipple: Adjust template design accordingly.

Nipple reconstructions will contract; plan for the larger size than contralateral nipple where possible.

Mark the width of the C-V flap base (usually around 8–10 mm) at the site of the planned nipple reconstruction with two vertical lines.

Mark the ‘V’ flaps on each side, attempting to keep the donor site scars within the planned areola tattoo (usually around 45–50 mm diameter).

The proximal width of each ‘V’ flap is typically 10 mm tapering to a point.

- Infiltration of local anaesthetic
- Antiseptic skin preparation
- Sharp dissection to elevate lateral skin flaps preserving blood supply at the base of the reconstruction (approximately 8 mm width)
- Preserve a thin layer of subcutaneous fat beneath the skin flaps laterally, becoming thicker on moving towards the centre of the reconstruction.
- Preserve the subcutaneous fat layer at the base of the reconstruction to maintain blood supply.
- Lift the apex of the reconstruction vertically with a skin hook.
- **Ensure the skin flaps are sufficiently elevated by performing a trial closure:** Rotate the apex of each lateral triangular flap to its new position on the contralateral side.
- The resulting reconstruction should form a cylindrical shape.
- **Assess tension in closure:** If excessive, cautiously trim excess subcutaneous fat to permit tension-free skin closure.
- Experiment with flap positioning to achieve optimal placement.
- Lift the apex of the reconstruction away from the chest wall with a single skin hook and secure the apex of each triangular flap with 4/0 braided fast-absorbing suture placed through the skin (Vicryl Rapide – Ethicon).
- Check position satisfactory.
- Complete closure of the reconstruction with interrupted 4/0 braided fast-absorbing sutures.
- Close the 'C' flap over the apex of the reconstruction with fast-absorbing sutures.
- **Donor site closure in layers:** 3/0 monofilament absorbable interrupted dermal sutures (Monocryl Ethicon) with running braided 4/0 fast-absorbing suture to the skin
- Complete closure with tissue glue and Steri-Strips

- **Apply protective foam dressing to prevent compression of the reconstruction for one week:** The author uses the foam taken from a surgical scrub brush cut to shape with a central hole secured to the breast with tape.

Post-operative Care

- Dressings to remain dry for one week
- Wound check with removal of external foam at one week

Complications

- **Loss of volume and nipple projection due to contraction:** 25% loss of nipple projection anticipated
- Infection
- Stretching of scars
- Flap necrosis
- Further surgery

Operative Technique– Nipple Sharing/Nipple Grafting

Where contralateral nipple is large and considered a good donor site for nipple reconstruction or during skin-sparing mastectomy with autologous reconstruction when ipsilateral nipple is replaced as a graft

Markings

- Markings for preferred nipple position as note above
- Central aspect of skin island if nipple grafting is undertaken as part of immediate autologous breast reconstruction

Equipment

- Standard operative instrumentation
- Absorbable and non-absorbable sutures

- Cotton wool or foam

Surgical Technique – Nipple Sharing

- The inferior half of the donor nipple will be harvested as a graft.
- Control the donor nipple with two stay sutures at the superior and inferior rim.
- Incise the inferior base of the donor nipple from the 3 o'clock to the 9 o'clock position.
- With retraction on the stay sutures, bisect the nipple and remove the inferior half and place in a saline-soaked gauze.
- Close the donor site by folding the remaining hemi-nipple along a horizontal axis and suturing the perimeter of the donor site with interrupted fast-absorbing braided 4/0 sutures (Ethicon Vicryl Rapide).
- Apply tissue glue to suture line and waterproof dressing.
- **Place nipple graft at pre-marked site of nipple reconstruction:** Assess skin marking indicating new nipple base width with diameter of available nipple graft and modify accordingly.
- De-epithelialise the pre-marked disc of skin at the recipient site, taking care to preserve the underlying dermis.
- Place nipple graft on de-epithelialised bed and orientate.
- Secure graft in place with peripheral interrupted fast-absorbing 4/0 braided sutures (Ethicon Vicryl Rapide).
- Apply antibiotic ointment (chloramphenicol) and secure with foam or cotton wool tie-over dressing with two 4/0 Silk mattress sutures orientated perpendicular to each other.

Surgical Technique – Nipple Graft

Observe oncological principles when deciding to perform immediate nipple graft at the time of mastectomy with immediate autologous breast reconstruction

- Place a 4/0 monofilament stay suture through the nipple to be harvested.
- **Remove the nipple with traction on the stay suture and tangential excision at the base:** Place in saline-soaked swab.
- On completion of the autologous reconstruction, mark the preferred nipple position, typically in the centre of the skin island.
- Assess the base width of the nipple graft and draw a circle of this diameter at the planned nipple graft site.
- Place the graft on the circle and ensure the size is appropriate.
- De-epithelialise the marked circle of skin, retaining the underlying dermis.
- Place nipple graft on de-epithelialised bed and orientate.
- Secure graft in place with peripheral interrupted fast-absorbing 4/0 braided sutures (Ethicon Vicryl Rapide).
- Apply antibiotic ointment (chloramphenicol) and secure with foam or cotton wool tie-over dressing with two 4/0 monofilament mattress sutures orientated perpendicular to each other.

Post-operative Care

- Keep dressing dry for one week.
- Remove tie-over dressing at one week.
- Apply further protective dressings as required until graft has stabilised, often after two weeks.
- **Avoid graft debridement if discoloured:** Allow to separate.

Complications

- Infection
- Bleeding
- **Graft failure:** Partial/complete

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18

Management of Breast Infection

Introduction

- Breast infections can be broadly broken down into lactational and non-lactational; these are either a diffuse infection in the case of mastitis or localised abscess collections. Both require different treatment approaches.

Mastitis

- This generally encompasses a cellulitic infection of the breast itself and/or the overlying skin with no underlying collection.
- Most cases can be treated with a course of simple antibiotics, and again hospital admission is generally not required.
- Broad-spectrum penicillin is generally sufficient, flucloxacillin for the pregnant/breastfeeding patient and co-amoxiclav otherwise.
- The area of erythema should be marked with a permanent marker pen to allow assessment of response to antibiotic therapy, and the patient should be reviewed every 24 hours. Simple analgesia of paracetamol +/- an NSAID usually suffices.
- Occasionally, a patient may be systemically unwell and require admission for observation and IV antibiotics. Even where there is no clinical suspicion of an underlying infection, an US should be performed to ensure this is not the case.

Lactational Breast Abscesses

- Although most common within the first month postpartum, these can occur at any point during breastfeeding and can often

be recurrent.

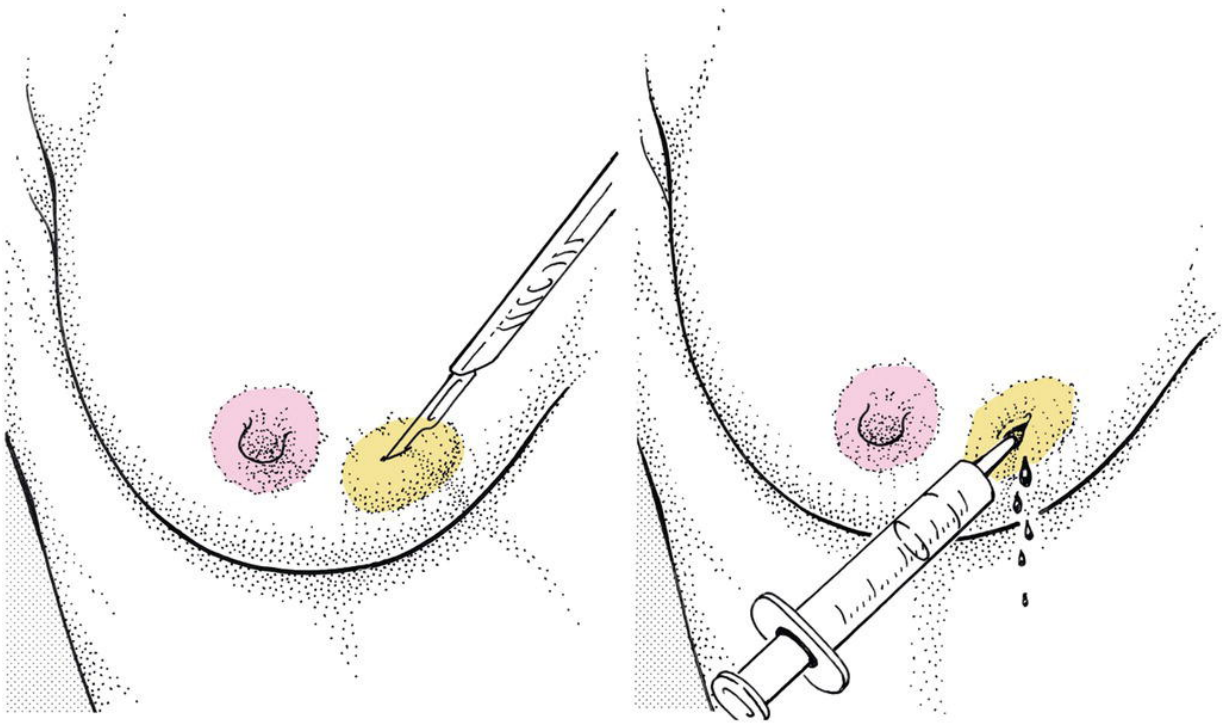
- It is most likely to be secondary to transposition of bacteria from babies' mouth through cracking of the nipple and upward transmission through the ductal system.
- Other causes may be engorgement, milk overproduction and poor systemic health of the mother. *Staphylococcus aureus* is the most common organism (including methicillin-resistant *Staphylococcus aureus* [MRSA]).
- Other organisms such as *E. coli* and streptococcal variants may be involved. In the initial period of infection, an oral antibiotic may prevent further infection, with flucloxacillin being the treatment of choice.
- Erythromycin may be used where there is a penicillin allergy.
- Cold compresses may give some relief, and continued breastfeeding and gentle massage to the affected area should be encouraged if tolerated.
- As with any breast infection, an US must be performed to assess for an underlying collection, bearing in mind that this may not be evident within the first 24–48 hours of infection.
- Any signs of systemic compromise obviously require admission for IV antibiotics, fluids and observation; this is, however, rarely necessary.
- Where the infection is widespread but the mother is well, we have found administering a single shot of IV antibiotics, commencing an oral course and review within 48 hours in the clinic can avoid most admissions.
- Where an abscess is evident on clinical exam or US, this requires immediate drainage, and the procedure is described below.

Non-Lactating Abscesses

- These are either peri-areolar or peripheral.

- The most common cause of peri-areolar abscesses is periductal mastitis secondary to cigarette smoking.
- More frequently, anaerobic bacteria are the causative organism.
- These should be treated exactly the same as any breast abscess as described, and co-amoxiclav is the antibiotic of choice.
- Erythromycin should be used in penicillin allergy and metronidazole in cases of poor or slow healing.
- Patients must be counselled in the importance of smoking cessation, and expectations must be managed at the initial consultation.
- These often require multiple drainages over a number of weeks, can be very painful and if smoking is not stopped will almost certainly be recurrent.
- Patients can often become, understandably, very frustrated.

Procedure for Abscess Drainage



(a)

(b)

Breast abscess drainage

a: open incision and drainage

b: aspiration of abscess

- *A simple procedure often done poorly.*
- The patient should have the procedure explained to them in detail with emphasis on the use of local anaesthetic.
- The overriding concerns are always pain, given the level they are often already in and the safety of local anaesthetic to the breastfeeding infant.
- Reassurance must be strongly given regarding both.
- This should preferably be carried out in a designated treatment room with an experienced nurse assistant.
- Much of the setup of equipment should be done before the patient arrives to prevent increased anxiety waiting and

watching equipment being moved around.

- We prefer a local anaesthetic with adrenaline, and in Edinburgh, used levobupivacaine. The patient should be made comfortable and asked about allergies.
- The bed height should be comfortable for the surgeon to sit at the patient's side with the US and monitor all in line with each other.
- The area should be thoroughly cleaned with either chlorhexidine or betadine and then draped.
- The US can then be used to determine the point where the needle should break the skin; in cases of lactational mastitis, this should be distant to the abscess itself to minimise the risk of a milk fistula.
- The chosen point should then be infiltrated very superficially with a small-bore needle with the anaesthetic so as to raise a pleb in the skin; this should be the only painful point in the procedure.
- A larger bore needle can then be used to generously infiltrate anaesthetic around the margins of the abscess, starting from the pleb itself.
- A minute should be taken to allow this to work. A large-bore white needle can then be used to drain the abscess; this should be done where possible under US guidance.
- Any pus should be sent for MC+S. Consideration should be given to send for testing for tuberculosis (TB) if the patient has risk factors for exposure.
- Once the abscess cavity has been collapsed entirely, this should then be re-infiltrated with a mixture of sterile saline and the remaining allowed dose of local anaesthetic and then re-aspirated.
- This is repeated until the aspirate is clear of pus. A review should be carried out in 48 hours to assess progress and, not uncommonly, the collection requires repeat drainage and washout.

- Oral antibiotics should be given for a minimum of five days. Peri-areolar collections may be treated in exactly the same manner, and anaesthetic with adrenaline **can** be used around the nipple contrary to popular belief.
- In cases where the overlying skin is very thin or necrotic, this is most commonly due to delayed presentation. In these cases, the approach is very similar, with particular regard to generous local anaesthetic.
- The skin should be excised as required; the underlying abscess should be thoroughly cleaned with gentle curettage to the cavity walls.
- A small wick of material (Aquacel/Caltestat) should be placed through the wound, but the cavity should NOT be packed under any circumstances; this only adds to the pain and slows healing. Again, the patient requires regular review.
- Where a large abscess with significant damage to skin and breast tissue is encountered, this should again be treated similarly but with more extensive excision; however, this should be dressed with a vacuum dressing such as a PICO™ dressing.
- This drains the areas of excess fluid and detritus and is important for patient comfort and hygiene as well as drawing skin edges together and encouraging vascular neogenesis to the region promoting healing.
- Beware the patient who has been treated conservatively with multiple courses of antibiotics in the community and now presents with a lump.
- Although these require triple assessment, there should be a high index of suspicion for an antibioma.
- These are thick-walled chronic sterile abscess collections that can often appear suspicious on imaging.
- These are treated in exactly the same manner as other abscesses; although aspiration may prove difficult, repeated drainages and flushes of the cavity are key to successful treatment.

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19

Management of Unusual Presentations of Breast Cancer

Inflammatory Breast Cancer

- Aggressive form of breast cancer
- Characterised by large area of oedema/erythema/swelling of the breast
- Cancer is usually diffuse, but sometimes there is a localised mass.
- Inflammatory breast cancer should be on the list of differential diagnosis for any patient presenting with breast inflammation.
- Often involved axillary nodes/distant metastases present at initial presentation, lymphovascular invasion and skin involvement are common.
- Triple assessment, staging tests, including bone scan and CT of the chest/abdomen
- Treatment should usually start with NACT and rarely in elderly women with ER-rich cancers neoadjuvant endocrine therapy.
- Surgery and radiotherapy to follow
- Mastectomy is the recommended procedure.
- Rarely, BCS is possible after an excellent response to systemic therapy.
- Consider delaying reconstruction as high chances of post-op radiotherapy unless excellent response to systemic treatment.
- Close monitoring, regular follow-up is required.
- Formerly poor prognosis but in those with excellent response to treatment and a pathological complete response, prognosis now

much better.

Male Breast Cancer

- First reported in the 'Edwin Smith Papyrus' (Egypt 2500–3000 BC)
- 1% of all breast cancers cases
- 400 male breast cancers diagnosed every year in the UK, up to 10% of breast cancers in Middle East and Africa are in men.
- Median age at diagnosis 60–65 years
- **Male breast cancer:** Risk factors:
 - **Age:** above the age of 65
 - Klinefelter's syndrome
 - Orchitis, orchidectomy, undescended testes, congenital inguinal hernia, testicular injury (all thought to alter the oestrogen and androgen balance)
 - Family history, BRCA mutation
 - Obesity, excess alcohol consumption
- **Male breast cancer:** Symptoms, signs and diagnosis
 - Lump
 - Breast swelling
 - Pain
 - Nipple discharge
 - Nipple inversion
 - Skin ulceration
- Pathology and types of cancer are similar to women (mostly invasive carcinoma. DCIS and invasive lobular cancer are very rare).
- **Male breast cancer:** Treatment

- **Surgery:** Mastectomy or WLE (not frequently an option due to small breast size and delayed presentation)
- SNB or axillary clearance if multiple involved nodes
- **Radiotherapy:** Chest wall/lymphatics frequently given after mastectomy due to T4 disease at presentation
- Locally advanced breast cancer should be treated with NACT to allow mastectomy.
- Consider chemotherapy if risk of recurrence significant.
- **Hormonal therapy:** 80–85% are ER+ (higher rate than in female breast cancer).
- Tamoxifen is the standard drug of choice (limited evidence of efficacy of aromatase inhibitors).
- **Prognosis:** Same as female breast cancer (stage-wise comparison)

Pregnancy-Associated Breast Cancer

- **PABC:** Defined as breast cancer diagnosed during pregnancy, or up to one year after delivery or anytime while the patient is lactating
- Difficult diagnosis to make due to physiological changes and low index of suspicion (often delayed diagnosis)
- 0.2–3.8% of all breast cancer cases
- Usually presents with a lump/mass that can be large and often with clinical and histological nodal involvement and sometimes distant metastases at presentation either due to biological behaviour/delay in diagnosis
- Triple assessment should be carried out for any lump during pregnancy.
- Mammogram can be performed with abdominal lead shielding. MRI of the breast is difficult due to position issues.

- FNA is difficult to interpret, core biopsy should be performed (although it comes with a risk of milk fistula, especially for central lesions) if patient is breastfeeding. Some advice to stop breastfeeding (if possible) before core biopsy but impractical for most.
- **Staging:** X-ray chest, UV liver, MRI for the liver and bones are options. Avoid bone scan. No data for PET.
- Treatment should not be delayed because of pregnancy.
- **Multidisciplinary approach:** Breast surgeon, oncologist, obstetrician, neonatologist and anaesthetist should be involved in decision-making.
- Surgery is safe during any trimester. BCS should generally be avoided in the first trimester due to the need to delay in radiotherapy until after delivery. Mastectomy can be done in any trimester. Avoid immediate reconstruction, due to increased operating time and difficulty in achieving symmetry in the long term.
- **SNB:** Tc99 alone (emerging evidence) can be used, but avoid patent blue (conflicting evidence in the literature on its safety in pregnancy).
- ANC is safe.
- **Chemotherapy:** contraindicated in the first trimester. Taxanes and methotrexate better avoided (not enough evidence for safety).
- No endocrine treatment or radiotherapy during pregnancy
- No formal recommendation for termination of pregnancy. No survival advantage; abortion can, however, simplify treatment for some women with advanced cancers. Discuss with patient, warn about future potential infertility with chemotherapy!

Paget's Disease of Nipple

- James Paget (1874) described first case

- Characterised by rash/ulcer/bleeding/burning sensation/itching/on nipple, nipple deformity
- More than 95% of patients have DCIS or invasive cancer in the breast, sometimes in unrelated quadrants.
- 0.7–4.9% of all cancers
- It occurs either due to transformation of superficial keratinocytes (epithelial cells) of nipple into malignant cells or more likely cancer cells from mammary ducts infiltrate nipple.
- Paget's disease starts on nipple and then spreads to areola unlike eczema that generally involves the areola only.
- **Pathology:** Large, round cells with plentiful cytoplasm and enlarged nuclei on nipple. Almost always Paget's cells are HER-2 positive.
- Diagnosis is made on punch biopsy or core biopsy through the nipple – this also samples underlying breast tissue.
- US, mammogram and MRI should be performed to look for signs of occult cancer within the breast.
- **Treatment:** Excision of nipple–areola followed by radiotherapy is acceptable treatment if there is no evidence of DCIS/invasive cancer in the breast
- Reconstruction can be done using Grisotti flap or a reverse perforator flap like LICAP.
- It is also possible to just excise nipple–areola (preferably full thickness up to chest wall) and close the defect with multiple purse-string sutures, including a purse-string for the skin. The resulting scar settles down very well in few months. The tattooing of nipple–areola can be then offered.
- Any BCS for Paget's is likely to cause asymmetry, and it is important to explain patients about the need for contralateral reduction surgery later on (wait till effects of radiotherapy are settled).
- If localised DCIS or invasive cancer breast conservation with excision of nipple can be performed.

- Mastectomy with/without reconstruction if underlying more widespread DCIS/invasive cancer.
- SNB indicated only if there is underlying invasive cancer or in patients undergoing mastectomy.

Occult Breast Cancer

- Breast cancer presenting as axillary lymphadenopathy with occult primary (no clinical/radiological evidence of primary in breast on standard imaging)
- Approximately 0.3–1.0% present as axillary metastases with occult primary
- When a woman presents with axillary lymphadenopathy as the only clinical sign, breast cancer is far more likely cause than other malignancies such as lung cancer, melanoma or lymphoma
- Core biopsy of axilla with special immunohistochemistry required to establish breast origin. Node should be marked if neoadjuvant therapy being considered so targeted axillary dissection is a possibility after chemotherapy.
- No definitive guidelines for investigation and management of this rare presentation
- High-quality mammography, US, colour Doppler ultrasonography, breast MRI, tomosynthesis, PET and scintimammography are all options.
- MRI most helpful, if no cancer visible on mammography and US as has high sensitivity and may enable preoperative localization of the primary, thus allowing surgeon to perform a breast conserving procedure.
- Options are mastectomy with axillary clearance followed by systemic adjuvant therapy, and frequently post-mastectomy radiation or whole-breast radiation alone. Several reports have confirmed safety of breast-conserving approaches.

- NACT is an option in patients with large or multiple involved axillary nodes.
- Axillary nodal dissection followed by chemotherapy and then radiation to the breast and sometimes even regional nodal radiation has also been described.
- After induction chemotherapy if no visible disease present in the axilla, targeted axillary dissection – removing the prior marked and localised involved node and an SNB is an option. Options for patients with residual nodal involvement are axillary nodal dissection and axillary radiation, which is also given in patients whose nodes are negative on a post-neoadjuvant TAD.

Angiosarcoma of the Breast

- Most cases are radiation induced.
- First reported case in 1981
- Numbers have increased due to increasing numbers of BCS and breast radiotherapy.
- Radiotherapy-induced angiosarcomas develop within the radiotherapy field and usually a long latency between the radiotherapy and the angiosarcoma development (average 75 months).
- Usually multifocal and appear as painless multicoloured nodules in the field of previous radiotherapy
- Diagnosis is usually by punch biopsy.
- Grade of angiosarcoma most important prognostic indicator (most radiotherapy-induced angiosarcomas are high grade)
- Angiosarcomas are rapidly growing but usually do not metastasise to axillary nodes.
- Treatment is wide excision, including all skin in field of radiation with a wide clear margin (usually their extent is much more than what is visible) with appropriate tissue replacement cover (abdominal flap, LD flap or skin graft)

- Poor prognosis

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20

Surgical Management of Metastasis of Breast Cancer and Local Recurrence

Local Recurrence After Mastectomy

- Usually occurs in skin flaps close to scar
- Up to half of patients with local recurrence have systemic disease.
- It can be classified as single spot, multiple spots or field change (diffuse).
- **Symptoms suggesting local recurrence include:** Rash, nodule, pain, limitations to movement, leaking, smell, ulcer, occasionally associated lymphoedema of the breast/arm
- Local recurrence can be ulcerated and result in discharge, slough, pus or malodour and can be painful and restrict movement.
- Recurrences should be excised surgically in the absence of metastatic disease if resectable.
- If recurrence is localised and in a reconstructed breast, local excision to clear margins with radiotherapy (if not given prior) is an option.
- Larger area of recurrence may require the reconstruction to be removed or replaced – for instance, by a myocutaneous flap (LD).
- Excision + skin graft may be required in some cases or a local advancement flap.
- Resection of recurrence is not always possible, so surgical debridement, removing all dead tissue of the surface and regular daily dressings with antibiotics should be considered as a palliative measure.

- For troublesome bleeding from unresectable recurrence, apply a solution of local anaesthetic plus epinephrine and consider glue once bleeding stopped.
- Charcoal, hydrocolloid gel, hydrogel dressings can improve malodour.
- **Larva/maggot therapy (biosurgery):** Debridement of sloughy, necrotic wound can be effective as was first used in World War and American Civil War. Fly *Lucilia sericata* (common green bottle fly) larva are used for medicinal purpose.
- Local advancement flaps can be helpful following excision of ulcerating areas.
- Free tissue transfer (TRAM/DIEP flap) can allow excision of in large areas of recurrence.
- Systemic therapy should be changed if feasible.

Local Recurrence After BCS

- Local recurrence after BCS can present as another lump or a skin lesion.
- Most are diagnosed on routine mammogram as a mass lesion or microcalcification during routine follow-up visit.
- Recurrences should be excised surgically in the absence of metastatic disease if resectable, with or without breast reconstruction.
- If local recurrence is within a few years following BCS, then usual recommendation is for mastectomy with or without reconstruction.
- If recurrence after BCS is of low grade and occurs after many years or is a second primary cancer, then a second wide excision is an option. Studies show this approach does not appear to compromise survival.
- Given that the breast is usually smaller after prior BCS, if a second wide excision is performed, then it needs to be combined

with augmentation of the treated breast by a local intercostal perforator flap, lipofilling or together with a contralateral reduction.

- Axillary procedure like SNB or clearance is required.
- Change systemic treatment if feasible

Management of Lymphoedema Associated with Recurrence

- Associated with local/axillary recurrence
- The cornerstones of care are skin care, exercise, compression therapy and manual lymphatic drainage.
- Consider referral to a lymphoedema specialist for fitting of a compression sleeve.
- Oedematous and hypertrophic fat tissue can be removed by a liposuction procedure (liposuction cannula is inserted via small incision on the arm into the subcutaneous tissue to remove oedematous fatty tissue).
- Studies show that microsurgery to anastomose lymphatics to blood vessels can be effective. Lymph node transfer has also been tried and is of uncertain value.

Systemic Metastatic Disease

- Bones, spine, lung, liver and brain are the common sites for breast cancer spread.
- Traditionally, metastatectomy is not performed for breast cancer, but it is happening in selected cases now, especially after a long disease-free survival.
- Low-volume, limited, isolated, stable disease is suitable for resection.
- **Multidisciplinary approach:** Breast surgeon, orthopaedic surgeon, spine surgeon, neurosurgeon, hepatobiliary and

thoracic surgeon should be involved along with the oncologists.

- Establish diagnosis and 'map' the extent of disease with full staging investigations.
- Assess general condition of the patient, multidisciplinary discussion.
- Optimise general condition of the patient, anaesthesia review is essential.
- Treatment developments mean greatly improved survival for metastatic breast cancer patients.
- Improved survival with local surgery; Case series and systematic review suggest survival benefit with surgery to primary tumour in selected patients.
- The best candidates for surgery are younger patients with smaller volume disease (oligometastatic disease), less visceral metastases, good performance status and long disease-free interval after treatment of the primary tumour.

Anaesthesia in Palliative Surgery

- Anaesthesia follows all usual principles of pre-op assessment, intra-op care, post-op care.
- Differences are potential for systemic problems related to background pathology e.g. pleural effusions, renal failure, pulmonary metastases, bony metastases (intra-op positioning), cerebral metastases.
- Analgesia doses also different if patient opiate tolerant – intra- and post-op dosages tailored to individual patient's needs. Always worth contacting acute pain team in advance and letting them know of problems with specific opiates.
- Whilst may not be fit in any sense of the word, procedures required for palliation so whilst high risk, benefit may well outweigh.

- Best to contact anaesthetist as soon as possible to discuss as may require in patient care or specific pre-op investigations and post-op ward comfortable with palliative care patients (may be better post-op on palliative care ward than acute surgical).

Lung Metastases

- About 3% of all women with breast cancer develop solitary pulmonary lesions, of which up to 40% will be metastases.
- Establish the diagnosis (FNA/core biopsy, bronchoscopy, CT)
- Rule out any other metastasis
- MDM discussion with thoracic surgeon
- Small, isolated metastatic deposit, stable disease, relapse after a long disease-free interval are favourable factors for lung resection.

Liver Metastases

- Only 5% patients have isolated liver metastases, rest of the patients will have widespread disease.
- Radio frequency ablation and surgical resection have been used in the treatment of liver metastases along with Cryo-ablation, Chemo embolisation, Photodynamic therapy and cyberknife.
- Patient should have good performance status and normal liver function tests to consider surgical resection.

Brain Metastases

- Usually multiple lesions
- In one third of brain metastases patients, the brain is the only site of metastases.
- Steroids, whole-brain radiotherapy (WBRT), stereotactic radiotherapy/radiosurgery (gamma knife, cyberknife) and

hormonal treatment are routinely used.

- Surgical resection is possible in small number of cases.
- Surgical excision combined with WBRT and steroids improves survival.
- The presence of leptomeningeal disease is a sign of poor prognosis and contraindication for surgery.
- Stereotactic radio therapy or radio surgery is a good alternative option to surgical resection.

Bone Metastases/Spinal Metastases

- Most common site of breast cancer metastases
- Most common presenting symptom is pain, fractures develop at a later stage, especially in weight-bearing bones.
- Radiotherapy, bisphosphonates (inhibits normal and pathological bone resorption, reduce incidence of pathological fractures and hypercalcaemia), hormonal treatment or systemic steroidal treatment is the routine treatment for bone and spinal metastases.
- Surgical intervention can be considered for impending fractures, fractures and cord compression.

More Surgical Intervention

- Insertion of central line for total parenteral nutrition
- Ascites/pleural effusion drainage, insertion of catheter
- ERCP and stenting for portal lymphadenopathy and jaundice

Conclusion

- Multidisciplinary approach is required, not just breast team.

- Small isolated low-volume metastatic disease, resectable, recurrence after a prolonged disease-free interval
- Surgery in combination with other modalities of treatment may offer significantly improved survival.
- Quality of life is important.

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21

Management of Complications of Breast Surgery

Haematoma

- Not uncommon after any surgical procedure on the breast
- Can occur spontaneously in patients on anticoagulants or after a seat belt injury in road traffic accidents. These post-trauma haematomas are usually managed conservatively.
- Haematoma be limited after breast surgery by a policy of stopping anticoagulants or switching anticoagulants prior to surgery.
- Can be reduced after more extensive surgery (mastectomy or mammoplasty or large breast excisions) by use of tranexamic acid given before and after surgery
- Many small haematomas will resolve without treatment.
- Compression bandaging if applied early can stop a small- or moderate-sized haematoma increasing in size and can lead to haematoma dispersal.
- For larger expanding haematomas, a further operation is required at which the bleeding is stopped and drains inserted.
- If the haematoma is large, then the total blood lost can be significant, requiring a blood transfusion.

Seroma

- A seroma is a collection of inflammatory fluid that develops commonly after breast surgery. It is more common after mastectomy and after an axillary clearance but does occur after BCS.

- Seromas develop typically 7–10 days after surgery when the drains have been removed. While most seromas are harmless and resolve on their own, they can sometimes cause discomfort and restrict movement.
- Seromas can be prevented by closing any defect in the breast after BCS or by quilting the axilla or the chest wall after an axillary clearance or a mastectomy.
- The most effective technique to stopping seroma formation after a mastectomy or an ANC is to close the space left after surgery with a continuous barbed suture taking loose bites 2–3 cm apart of the two surfaces to be opposed such as the chest wall and the skin and subcutaneous fat anteriorly in a mastectomy. Five to seven rows of sutures will be required in most mastectomies, so more than one suture is required. This technique allows mastectomy and axillary clearance without drains and reduces seroma rates and volumes to very low levels.
- Fibrin glue also reduces seroma but is not as effective as quilting.
- In patients who develop a large seroma that is painful, it should be aspirated, but if refilling occurs, then after aspiration to dryness inject 1 ml of 40 mg of triamcinolone acetonide, a potent depot steroid. This is very effective if used early at stopping further seroma development.
- A few patients develop thick-walled chronic seromas need excision of the walls of the seroma and the space obliterated with multiple quilting sutures.

Capsular Contracture After Implant Insertion

- This is common after implant insertion and recognised by hardening and sometimes distortion of an implant.
- It used to be thought that capsular contracture was lower with textured implants and with submuscular placement, but it is likely that the site and type of implant used is unrelated to the likelihood of capsular contracture occurring.

- It is more common in patients who have chest wall radiotherapy either after a mastectomy and reconstruction or after breast conservation treatment in a patient who has had a prior breast augmentation with an implant.
- Capsular contracture is primarily treated surgically by capsulectomy or capsulotomy usually with implant replacement.
- Other methods such as closed capsulotomy are no longer used.
- It is unclear if the use of acellular dermal matrix at the time of breast reconstruction with implants reduces capsular formation.
- There is much anecdotal evidence that capsular contracture improves after lipofilling around the implant.
- In patients who get recurrent capsular contracture, removal of the implant and alternative autologous reconstructive options should be considered.

Implant Rupture

- This is not common and with newer generation of implants occurs in less than 5% at 10 years.
- If there is concern this is present, then an US followed by an MRI are the investigations of choice.
- Free silicone within the implant capsule can be from implant bleed as well as implant rupture.
- Most patients with implant rupture should have the implant removed, the capsule washed out, and the implant replaced. If the implant is removed and no implant placed back into the capsule, then a partial or total capsulectomy should be performed and the defect closed with quilting sutures to stop seroma formation. In these cases, even the skin envelop may need to be reduced as there will be lot of loose skin (prefer wise-pattern incision for skin reduction).
- Intracapsular implant rupture in selected patients can be treated conservatively and periodic MRI performed to show that the rupture remains intracapsular with no silicone migrating

through the capsule, known as extracapsular rupture or to regional nodes.

- Ruptured silicone implants are associated with silicone migration to regional lymph nodes. Affected axillary nodes can be enlarged and tender. They should be treated conservatively and removed or aspirated with a liposucker only if causing significant pain. Removing large numbers of infiltrated silicone nodes can result in arm oedema so is not advised.

Indentation/Contour Deformity After Breast Surgery

- The best option to improve the contour and improve indentation after BCS or mastectomy is to use autologous fat grafting, also known as lipofilling or lipomodelling.
- Fat is harvested from sites such as the anterior legs or the abdomen remembering not to take fat from the lower abdomen if a future deep flap may be required.
- The fat is prepared either by centrifugation, washing and sedimentation or by using specific devices such as Revolve™.
- Newer devices that clean the fat reduce the rate subsequent fat necrosis of injected fat.
- Between two and four episodes of fat grafting are usually required to produce a satisfactory improvement.
- More episodes are required in patients with prior radiotherapy.
- Patients should not smoke before or after the procedure of lipofilling.
- Patients should wear a well-fitting bra worn night and day for a few weeks after the lipofilling procedure to limit breast movement.
- Local intercostal perforator flaps can also be used to correct breast deformities.

- As the breast reduces in volume over time after wide excision and radiotherapy, one option to achieve better symmetry is to reduce the size of the opposite breast by a reduction mammoplasty.

Twitching/Animation Effect

- Animation is often seen after subpectoral implant placement and twitching is commonly seen after breast reconstruction with an LD myocutaneous flap.
- In patients with implants behind pectoralis major muscle, the implant can be moved to pre-pectoral in front of the muscle and the pectoralis major reattached, this stops the animation.
- In patients who have had an LD breast reconstruction with twitching of the muscle where the TD nerve has not been divided at surgery, then it can be divided surgically through an axillary approach.
- Some patients develop twitching of the latissimus muscle even after denervation, and for these women, 100 units of BOTOX injected in 4 ml of saline is injected under US guidance into the muscle as it leaves the axilla. This is very effective but needs to be repeated every three to six months. With time, twitching generally resolves after two to three years of BOTOX injections.

Asymmetry

- Breast asymmetry is common after unilateral breast operation. The options are to reduce the larger breast, augment the smaller breast or a combination of the two.
- Asymmetry can also be because one breast is hypoplastic or tubular when the nipple position is often at the wrong height and too lateral.
- Implants are regularly used to improve symmetry but are best combined with lipofilling.

- Lipofilling alone can be sufficient to produce symmetry in many women and has the advantage of leaving a softer and more natural feeling breast than an implant.
- Local perforator flaps or larger myocutaneous flaps are also options to help achieve symmetry.

Morphoea of the Breast

- Morphoea is localised scleroderma.
- It is a rare skin condition where areas of breast skin become oedematous and loses its normal texture. It can be painful. It is more common after radiotherapy.
- Morphoea is a chronic condition with no cure.
- Local corticosteroid application has been used with limited success.
- Immunosuppressive medications such as oral methotrexate have also been tried.
- We have had great success with liposuction to deflate the breast and simultaneous lipofilling.
- Lipofilling needs to be repeated between two and four times.
- Surgical excision is an option, but radiotherapy fields are usually large so excision of all treated tissue is an extensive surgical procedure and a myocutaneous flap is usually required to fill the defect after excision.

Infection Post Breast Surgery

- Perioperative antibiotics limit the rate of post-operative infection.
- *Staphylococcus aureus* is the most common organism.
- Signs of infection include fever, redness, swelling, pain, fluid discharge, feeling generally unwell.

- Infection is more common if seromas develop, so preventing seromas by quilting reduces post-operative infection.
- US of the infected area is often useful to determine the presence of any pus or seroma.
- Aspirate or drain any pus or infected seroma
- Surgical drainage of pus requires only a small incision.
- Packing has no value in breast infection and should not be used.
- If the wound opens and pus leaks over a large area through the wound, placing a wound bag – modified colostomy bag is an effective option.
- Vac dressings can be applied when the amount of wound drainage is minimal.

Breast Oedema

- Reported in up to a quarter of patients after BCS
- Larger tumour size, oncoplastic surgery, axillary lymph node dissection, locoregional radiotherapy, radiotherapy boost to the tumour bed and adjuvant chemotherapy are all risk factors for breast oedema.
- Breast oedema is independently associated with more breast pain and with poorer quality of life, physical functioning and body image.
- In many patients, the breast oedema settles with time.
- For patients with persistent oedema regular manual lymphatic drainage can help.
- Liposuction in the subcutaneous plane followed by immediate lipofilling can cure breast oedema.

Damage to Intercostobrachial Nerve

- The ICB nerve and adjacent intercostal nerves are not usually preserved and are commonly damaged during an ANC. These nerves are hardly ever damaged during SNB.
- ICB neuralgia is a common cause of arm pain after axillary surgery.
- It is caused by damage to the ICB nerve and cutaneous branches of other intercostal nerves during axillary surgery.
- Symptoms typically begin immediately after surgery. Onset of pain beyond six months is unusual.
- Patients with ICB neuralgia have constricting, burning, lancinating sensations and sensory loss in the axilla.
- Shoulder movements increase the severity of the pain, and a frozen shoulder can develop.
- There are no current effective treatments other than analgesics or agents like pregabalin.
- The ICB nerve and adjacent intercostal nerves can be dissected out during an axillary clearance or axillary dissection procedure in patients who do not have extensive axillary node involvement. An attempt should be made to identify and preserve these nerves if possible.

Spontaneous Effusion Around Implant

- Occasionally patients who have had implants (post mastectomy reconstruction or cosmetic) can present with spontaneous effusion around the implants.
- ALCL obviously needs to be excluded in these cases on aspiration of effusion.
- Some will settle down with 1–2 aspirations, but some may continue to develop recurrent seromas in the breast.
- The ultrasound may show that the implant is intact and there are some reactive slightly enlarged, shotty axillary nodes.
- Otherwise, patients are well with no recent viral illnesses.

- These patients usually have history of going to the gym (who works out daily and lifts weights) horse riding, golf, sailing or gardening / manual heavy lifting work. One of the actions of stretching probably causes inflammatory effusion around the implant.
- While the patient would be best served in the long term with a capsulectomy and implant exchange +/- mastopexy a further aspiration with injection of 40 mg of triamcinolone would be worth a try in case of recurrent seromas.
- This should be done with ultrasound guidance. Insert a venflon and remove the needle which then leaves the cannula in and attach a 3 way tap to the cannula to ensure flow only one way. After complete aspiration, inject the triamcinolone chasing it to ensure all the steroid gets into the cavity with local anaesthetic and epinephrine.
- Anaesthetise the skin and tract to the implant before placing the venflon. Send 50 mls fluid to pathology if it has not been done already (You need that volume of fluid to exclude ALCL).
- But if not then surgical exchange of implant and capsulectomy will work.

Breast Implants and ALCL

- ALCL is mainly linked to textured breast implants used in augmentation or reconstruction.
- Breast implant associated ALCL is a type of T-cell lymphoma. Early recognition, prompt diagnosis and appropriate treatment are the cornerstones of care.
- Texturing of implants is required for anatomically shaped implants to stop them rotating. Rotation is not an issue in round implants, and no confirmed cases of ALCL have been reported with round, smooth surface prostheses.
- The true incidence of ALCL remains uncertain but occurs in up to 1 in 1000 with the most aggressively textured implants.

Evidence suggests lower rates of ALCL with less textured prostheses, with a rate of ALCL of around 1 in 50,000–80,000.

- The most common symptom of ALCL is swelling around the breast implant (related to a delayed seroma) and is seen in almost 80% of women with ALCL. Other symptoms include a mass (40%), capsular contracture (8%) and a rash (2%).
- Women who develop these symptoms require specialist investigation. In ALCL, US usually shows fluid around the implant, which should be aspirated and a sample of 50 ml of fluid sent for cytology.
- Large anaplastic cells that stain positive for CD30 are present in ALCL fluid. Approximately 10% of delayed implant seromas are related to ALCL.
- Staging using combinations of MRI, CT and PET allows assessment of extent of local disease and the presence of metastases.
- If the ALCL is limited to the implant capsule, treatment is complete capsulectomy and removal of the implant. There is no need for mastectomy, removal of intact capsule and implant is curative in vast majority.
- A new round, smooth surface implant or autologous reconstruction is an option for women with early-stage ALCL.
- Lymph node biopsy is not required unless enlarged or suspicious lymph nodes are present.
- Surgery can be difficult and should be performed by surgeons who have expertise in total capsulectomy. As many implants are subpectoral, removing the capsule from the intercostal muscles and costal cartilages can be challenging.
- Same scar of previous surgery can be used again, but excised the scar. The previous scar should be extended for adequate exposure.
- The key is to remove the entire capsule intact with the implant inside, without making a hole and not to spill the contents. The most difficult part is the posterior capsule if it was subpectoral

reconstruction, the capsule is stuck to intercostal muscles. (Always consent the patient for pleura puncture and pneumothorax, explain the potential risk to your anaesthetists.)

- In early disease, surgery is usually curative and recurrence rates are low.
- For patients with metastatic disease, chemotherapy alone or combined with the monoclonal antibody brentuximab is often effective.
- NACT for more advanced disease plus brentuximab frequently results in a pathological complete response.
- For all women having breast prostheses, informed consent must include a discussion of the risk of developing ALCL.
- Textured breast prostheses continue to be offered to women who have anatomically shaped prostheses.
- The current strategy is to discuss the risk of ALCL in women having textured prostheses without causing unnecessary anxiety, because the absolute risks of ALCL remain low.
- In case of metastatic ALCL, it is usually the trend that in such patients is to give chemo and brentuximab first and allow the response to treatment to guide any post-surgery therapy. Some patients even can get a complete pathology response who then have had marrow replacement. It is best to discuss these cases with the haematology team about how best to manage such patients given that these patients are sufficiently uncommon so no one centre has much expertise.

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Surgical Management of Congenital Abnormalities of the Breast

Introduction

- Congenital abnormalities of the breast and chest wall are common.
- Psychological issues are important in this patient group, particularly during puberty and adolescence; issues include social embarrassment, low self-esteem, depression and isolation from peers. Problems that occur relate to sexual relationships and cultural beliefs.
- There are also functional problems encountered later in life with lactation and breastfeeding.
- Congenital abnormalities of the breast and chest wall are seen frequently in breast, paediatric and plastic surgery clinics. These cases often require multidisciplinary team approach in their management.
- The spectrum covers a wide range of abnormalities from aplasia, asymmetry, underdeveloped breasts and abnormal shapes to accessory breasts/nipples.
- The treatment for many of these conditions includes surgical correction and considering the fact that the child is still growing, treatment timing is crucial and many of the surgical corrective procedures require more than one operative procedure.
- Although these deformities have less impact on functional capacity, the psychological consequences can be serious in adolescent patients. These patients can experience embarrassment, social isolation and complexities in relationships and sexual development. The majority of these patients are young, healthy individuals.

- The key steps in successful management are diagnosis, appropriate referral, avoidance of unnecessary investigations, multidisciplinary team approach, psychological support, optimum timing of surgery and avoiding unnecessary surgery.
- Congenital abnormalities can be corrected at a single surgical setting; however, a multidisciplinary approach and staged treatment are required for more complex deformities. Timing of procedures is crucial as the development continues.
- Scars, changes in the opposite breast and breastfeeding are all related issues that need to be considered. Recent new technology and a better understanding of these conditions have brought subtle but important changes in the methods used to treat these abnormalities.
- Implants are commonly used in congenital anomalies.
- Liposuction for accessory axillary breast tissue is now an available mode of treatment for smaller-sized accessory breast tissues with mainly fatty component. Even in larger accessory breasts, it can be combined with excision and makes identification of the plane between normal and accessory breast tissue easier to find.
- Lipofilling for hypoplasia and asymmetry achieves better shape and contour of the treated breast. This technique can be used in with or without implant placement or as a primary treatment for a relatively small degree of asymmetry. The trend is also to place expanders followed by anatomical/round implant for asymmetry, rather than using silicone gel implants alone, as there is often less skin on the hypoplastic breast. The use of adjustable expanders/implants allows adjustment in the volume of the reconstructed breast.
- Dual plane technique (placement of subglandular expander and then submuscular implant as a second-stage procedure) for tubular breast appears to give good results.
- It ensures that the expander stretches the breast tissue to widen the breast base. The permanent implant can then be camouflaged by placing it under the chest wall muscle. The

pectoralis muscle is released, allowing for enhanced projection, shape and position.

- A combination of implants and muscle or myocutaneous flaps are used in reconstruction of chest wall deformities such as Poland's syndrome. The correction of unilateral chest wall deformities by perforator flaps (DIEP, SIEA and GAP) is an acceptable surgical procedure for reconstruction, with minimal donor site morbidity. Endoscopic LD flap harvest for Poland's syndrome has been described and gives better cosmetic results and less scar tissue.
- Mastopexy is sometimes needed and usually effective to correct breast contour without any volume change. This technique is used in the correction of tuberous breasts in Poland's syndrome following expansion and replacement with implants. Mastopexy is also required in correcting hypoplasia; the skin of the normal breast is tightened, while that of the hypoplastic breast is expanded.
- In summary, careful assessment of congenital abnormalities of breast and chest wall is vital in a multidisciplinary setup. A thorough workup is recommended since many of these conditions are associated with other ectodermal defects. In the absence of any other abnormalities, selection of appropriate corrective procedure is vital.
- These conditions often require multiple procedures, and the timing of treatment delivery is crucial. Many of these patients present at a very young age and need psychological support during the long course of treatment.
- With good surgery, symmetry can be achieved, and this can have a dramatic effect on these patients' lives. Given that most will live a normal lifespan, it is important to invest time and effort to get the surgery right to produce a good cosmetic result.

Embryology

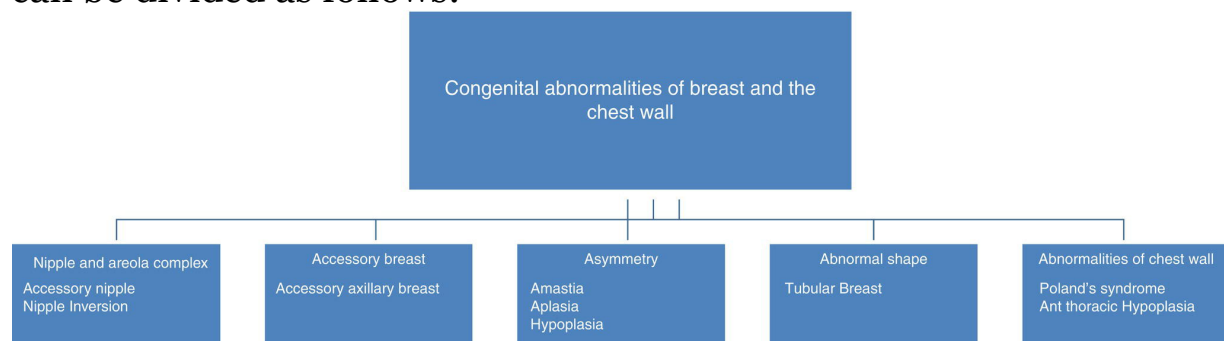
- The breast is a modified apocrine gland. During the fourth to sixth weeks of gestation, an ectodermal 'mammary ridge' or the

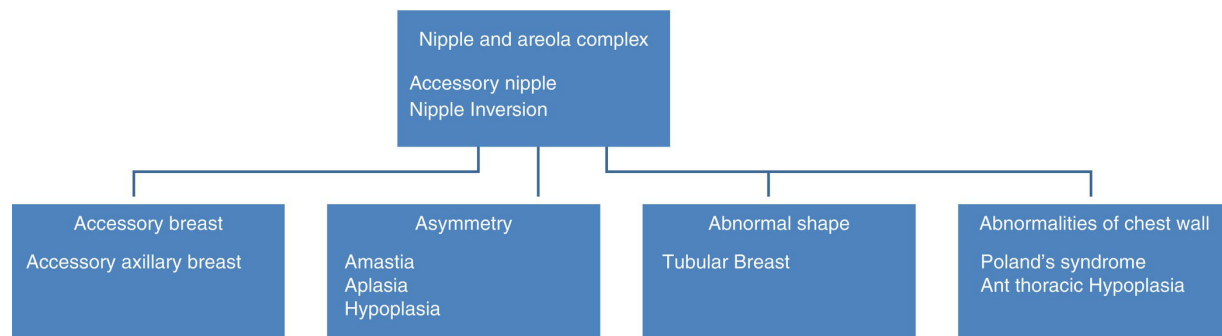
‘milk-line’ develops that extends from the future axilla to groin. The epithelial cords appear as 15–20 buds. These buds disappear or coalesce in human embryo, and usually one bud that is located in the fourth or fifth intercostal space persists and develops. The future breasts develop from these buds in an identical manner in male and female infants.

- These ectodermal buds grow into the underlying mesoderm as branching lactiferous ducts by 15–20 weeks.
- The nipple and areola develop from the ectoderm at the junction of 15–20 lactiferous sinuses, which arise from the ducts.
- Maternal levels of oestrogen are low during pregnancy but increase at birth. Stimulation by neonatal pituitary to secrete prolactin and the effect of oestrogen can cause unilateral or bilateral breast enlargement and even secretion of ‘witch’s milk’. These changes are seen in male or female infants but usually settle down within weeks. These secretions should not be ‘squeezed out’ as it can lead to persistence of milk production.
- The breast tissue undergoes lobular proliferation in the female at puberty when the breast buds develop into adult size breasts; the process is called thelarche.

Congenital Abnormalities of the Breast

The common congenital abnormalities of the breast and chest wall can be divided as follows:





Congenital Abnormalities of Nipple

Accessory Nipples (Also Known as Polythelia)

- Accessory nipples are seen in 1–5% of the general population (differences among ethnic groups have been noted), with the same incidence in male and females.
- Accessory nipples develop along the milk line; more than 90% are seen in the inframammary region. These nipples can be unilateral or bilateral and in some are quite well developed with surrounding areola. They are prone to the same diseases as normal nipple.
- There is some evidence that polythelia may be familial and related to urological (ectodermal) abnormalities. Urological workup has been recommended to rule out associated abnormalities, but in clinical practice, this is not considered necessary as accessory nipples are common whereas urological abnormalities are rare and usually obvious because of other symptoms.
- Most require no treatment unless the nipple causes irritation or is excised for cosmetic reasons.

Congenital Nipple Inversion

- Sir Ashley Cooper first described congenital inverted nipples in 1840.
- It is seen in 2% of the general population, with a family history of such a condition in 50% of patients. The cause for this abnormality is thought to be tethering and shortening of breast

ducts, and development of fibrous bands behind the nipples during intrauterine life.

- It can cause mechanical problems with breastfeeding; however, many can breastfeed without any difficulty, probably because of changes that occur in breast during pregnancy.
- There are variety of procedures described for the surgical correction (tightening of the areolar edge circumferentially, use of adjacent dermal flaps to augment nipple etc.); however, loss of sensation and inability to breastfeed are major concerns with surgical procedures.
- Most of the procedures involve short circumareolar incision or an incision at the base of the nipple. The tight bands are stretched, but it is often required to divide the ducts. A stitch can be placed at the base of nipple when it is everted, but this is not recommended.
- A device called a Niplette is available from pharmacies. This is a suction device which, when used regularly, is successful in a few women at everting the nipple.

Athelia

- Complete absence of nipple and areola is termed as athelia. This condition can be familial (autosomal dominant), may be unilateral or bilateral, and is seen in association with amastia or rare syndromes such as scalp-ear-nipple: SEN syndrome (scalp nodules and ear malformation), Al-Awadi/Rass-Rothschild syndrome and Poland's syndrome.
- A thorough investigation to rule out any other associated ectodermal abnormalities is required.
- Nipple and areola reconstruction can be carried out using small tissue flaps along with tattooing of a new areola in the absence of any other deformity.
- Skin grafts could also be used to create areola.

Congenital Abnormalities of Breast

Accessory Breast Tissue or Supernumerary Breasts (Polymastia)

- This condition is seen in around 1–2% of the general population, but figures as high as 6% has been reported. There is female preponderance, with some reported as hereditary cases.
- In about one third of patients, accessory breasts are found in more than one site; the most common site is the axilla.
- Axillary accessory breast tissue can have its own NAC.
- Polymastia is usually diagnosed at puberty or during pregnancy when the accessory breast tissue develops along with the normal breasts.
- These are mostly asymptomatic, but can cause discomfort, and in some are seen as cosmetically unacceptable.
- Accessory breast tissue is susceptible to all the normal changes and disease spectrum seen in the normal breast. Breast cancer cases have been reported in accessory breast tissue.
- The best policy is to try and avoid surgery, as it may cause unsightly scars, restriction of movement, cause pain and is not without complications. Any surgery needs an experienced surgeon and careful preoperative marking. Scar placement for any surgery is vital; it should not extend beyond edge of pectoralis major.
- Liposuction is useful for the fatty element of accessory breasts, and in some cases, it is the only treatment required. Liposuction is also valuable in helping to define the planes between accessory breast tissue and the underlying axilla.
- A combination of surgery for the glandular element and liposuction of the fatty element has been described. Excess overlying skin should be excised in case of large accessory breasts.
- In the post-operative period, seroma, incomplete excision, damage to intercostal-brachial nerves, painful scar and

deformity due to excess removal of tissue are some of the complications of surgery.

- Literature suggests high incidence of post-operative complications. Hence, the need to avoid surgery if possible.

Asymmetry

Asymmetry (Aplasia and Hypoplasia) of Breast

- One breast can be hypoplastic or absent (aplasia), and this can occur in isolation or in association with a defect in (one or both) pectoral muscles. Some degree of breast asymmetry is common, but it is more pronounced in cases of hypoplasia.
- This 'true asymmetry' can be treated with various treatment options including augmentation of the smaller breast with implant, reduction and mastopexy of the larger breast or a combination of both these options.
- Where there is asymmetry in the skin, the use of expanders prior to permanent implant replacement can improve symmetry.
- To get true symmetry, there is usually a need to operate on both breasts.
- The best age to perform surgery is when the breasts have fully developed – usually about 17 or 18 – before going off to college or university.
- More than one operation may be required.
- Some hypoplastic breasts can also have a tubular element. Lipofilling (although controversial, its risks and benefits should be discussed with the patients) is useful to provide implant cover and improve contour to obtain a high degree of symmetry.

Amastia

- The total absence of breast tissue and NAC is called amastia, whereas the absence of breast tissue only is called amasia.

- In amastia, the mammary ridge disappears completely or fails to develop.
- There is often evidence of associated ectodermal defects such as cleft palate, isolated pectoral muscle and upper limb deformities, urological abnormalities and even Poland's syndrome. Familial cases have been reported with autosomal dominant trait.
- New breasts can be reconstructed using expanders and implants or using myocutaneous flaps such as the LD myocutaneous flap.

Abnormalities of Shape of the Breast

Tubular Breasts

- This condition is characterised by normal function/physiology of the breast tissue, but abnormal anatomical shape.
- It can be unilateral or bilateral, and the classical features include some or all of: lack of breast skin, breast hypoplasia and asymmetry, conical breasts, herniated nipple areolar complex, large areola and a constricted breast base.
- The first correction technique for tuberos breasts was described by Rees and Aston in 1976. They suggested widening of the constricted ring at the base of the breast tissue by radial scoring, essentially making cuts at the base of the breast from the centre like the hands of a clock. Several similar techniques to expand the base width have been since described.
- Standard treatment includes placement of expanders through an IMF incision following radial scoring and later replacement with implants. These procedures do not correct the 'herniated NAC', and a second procedure is often required to correct this deformity, such as reducing the size by circular peri-areolar round block mastopexy. (This could also be performed at the time of primary surgery in select cases.)
- Dual plane technique for tubular breast is now in vogue. This technique differs from the subglandular position in that the

implant is placed in the subpectoral plane. The upper two-third of the implant is covered by muscle, and the lower one-third is covered by breast tissue. A short scar correction of the tuberous breast has also been described.

- Lipofilling in the periphery of the breast (not recommended within the breast) helps to achieve a final better contour and adds volume along with the expander.
- The long-term outcome from surgery is not always satisfactory, with loss of sensation, scar issues and asymmetry being common complications.

Lipofilling Tubular Breasts

- This is a novel approach and helps to restore shape and volume of the breast with autologous tissue rather than implants.
- During the procedure, mark out the new breast dimensions with the patient upright before surgery.
- Start injecting fat through a series of needle holes placed in the new inframammary line. Put the blunt needle through the fibrous bands and inject fat to stretch these.
- Use an orange venflon needle as a sharp dissector if you feel the bands are not relaxing. If you inject the fat to create the shape to the dimensions of the template that you have marked, the neo breast evolves over time.
- It's important to put more fat centrally around and inferior to the nipple. The same is true when using fat to create a new breast after a flat mastectomy or in Poland's syndrome.
- By putting fat into the tight areas under pressure, the skin or the tight bands in tubular breasts stretch. This happens even with radiotherapy treated skin. In reality it's a lot easier than it seems.
- You need to place your hands over the breast and palpate at regular intervals during the procedure to decide which areas need more fat so you get the shape you want.

- At the end of the procedure, use a blunt injecting needle to redistribute any lumpy areas of fat to smooth it out.
- You can use brown coloured mepore tape as an external scaffold to help keep the shape and leave this on for 10 days or so.
- Advise patients to wear a firm soft cotton and Lycra bra for 6 weeks night and day that we fit and provide.
- It is believed that movement reduces fat take, you seem to get better fat takes in areas where space is limited such as post mastectomy where there is little chance of fat movement.
- While you should overfill, there is a limit to how much fat the tissue will take and stop when you feel the skin and tissues are stretched as much as you think is safe.
- Always tell patients it will take more than one episode to get a good shape although.

Congenital Chest Wall Deformity

Poland's Syndrome

- Unilateral chest wall hypoplasia with ipsilateral upper limb deformity is called Poland's syndrome.
- Poland's syndrome consists of some or all of: absence or hypoplasia of the breast, absence of pectoralis major +/- minor, absence of nipple, absence of adjacent muscles, costal cartilage and rib abnormalities and upper limb deformities (syndactyly, micromelia or brachydactyly).
- Familial cases have been reported.
- It is three times more common in males, with an incidence of 1 in 7,000 to 1 in 1,000,000 in general population. Pectus excavatum and Poland's syndrome, which includes defects of the chest wall, are the most common forms of congenital chest wall defects. These defects could be corrected surgically.
- Hypoplasia of the subclavian artery and its branches is thought to interrupt supply on day 46 embryo and result in the features

known as Poland's syndrome.

- Some evidence indicates a correlation between Poland's syndrome and carcinoma of underdeveloped breast and leukaemia, but the frequency of this is not clear.
- Repair should be considered as a single-stage procedure in adults and two stages in children. Aplastic ribs can be reconstructed using bone grafts or prosthetic mesh. Muscle flaps and breast implants can be used to correct muscle and breast hypoplasia.
- The aim of the treatment should be to achieve symmetry.
- Surgical procedures usually involve a combination of replaceable expanders (subsequently replaced by permanent implants), Becker expander/prostheses implants (shaped or round), placement of these devices in a dual plane – if the pectoral muscle is normal, and autologous muscle flaps like LD. The LD flap harvest can be done endoscopically.
- The other more complicated procedures of autologous tissue reconstruction such as abdominal (TRAM, DIEP) or buttock (SGAP or IGAP) flaps are usually reserved for more challenging cases.
- Another option is to use rectus abdominus TRAM flap (free or pedicled). A two-flap technique including free and pedicled TRAM flaps for chest and breast reconstruction has been described.
- Use of lipofilling and contralateral reduction/mastopexy improves long-term cosmetic results.
- The best time for operation is in the late teens, but operation can be performed from 11 to 12 years onwards, to help with self-esteem and normal psychological, social and sexual growth.
- The management of these patients requires multidisciplinary team approach including paediatrician and plastic surgeon, to decide the optimum age for reconstruction. The future growth of the child should be considered in treatment planning.

Anterior Thoracic Hypoplasia

- This condition is rare. It includes posterior displacement of ribs, sunken chest wall anteriorly, hypoplasia of the ipsilateral breast (always present) and a superiorly placed nipple and areola.
- The sternum and pectoralis major are normal.
- Treatment consists of augmentation mammoplasty using anatomical implants.
- The LD muscle flap is not usually considered, since the pectoralis major is present and normal.

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Landmark Surgical Trials, Studies and Papers in Breast Diseases

	Trial study	Details
1	Astley Cooper 1829 Diseases of the Breast, Part 1. Longmans: London	First to truly make the distinction between cysts and true breast malignancy
2	Halsted 1894 Annals of Surgery 1894; 20 :497–556	Argument for radical surgery, disease spreads in a methodical order through nodes and muscle and then distally from there. Halsted's first description of mastectomy widely excising skin, subcutaneous fat and the pectoralis major muscle. Division of pectoralis minor with all nodes below pectoralis minor taken.
3	Patey 1948 British Journal of Cancer 1948; 2 :7–13	First in the literature to challenge the Halsted approach to breast cancer Proved that removal of pectoralis major does not improve outcomes and is not required to adequately clear the axilla. His 'modified radical mastectomy' remains in common use today
4	Lacour 1976 Cancer 1976; 37 :206–214	Two groups randomised to radical mastectomy and extended mastectomy with no significant difference in five-year survival, thus demonstrating the including IM nodes (with significant associated morbidity) does not improve survival

	Trial study	Details
5	Haagensen 1981 Diseases of the Breast 1981; 852–863	Identified subset of patients with what we now call locally advanced disease. Patient with chest wall or skin involvement and inflammatory breast cancer. Those for whom surgery should not be the initial treatment and radiotherapy or neoadjuvant/primary systemic therapy should be considered first.
6	Fisher 1977 Cancer 1977; 39 :2827–2839	A trial that questioned the paradigm of breast cancer spread and suggested its systemic nature at diagnosis in some patients. Showed that leaving nodes did not have an effect on overall survival and thus axillary nodal involvement is a marker of systemic disease, but not a prerequisite for its development. Suggested breast cancer does not spread in an orderly manner from primary, to regional nodes and beyond. It started the debate on whether axillary clearance was necessary for all breast cancer patients
7	Veronesi 1981 NEJM 1981; 305 :6–11	First study to challenge the concept that mastectomy was required for all breast cancers. Demonstrated that BCS with radiotherapy produces the same survival. In this study, the BCS was, however, quadrantectomy
8	Fisher 1985 NEJM 1985; 312 :665–673	Showed that BCS with WLE (not quadrantectomy) with radiotherapy has comparable results to a mastectomy. Also demonstrated the effectiveness of adjuvant radiotherapy in reducing local recurrence rates. This study effectively changed the surgical approach to small breast cancers forever.

	Trial study	Details
9	Veronesi 1990 EJSO 1990; 16 :127–133	Studied a large group of patients undergoing mastectomies and BCS, both with axillary dissections. It looked at the nodes taken from each level, and where only a single positive node was identified, it was nearly always at level 1, thus nodal metastasis skipping level 1 is very low (it was round 1%). It, therefore, effectively demonstrated that the axilla can be adequately staged by sampling and that a sentinel node is very likely to lie in the level 1 area.
10	Giuliano 1994 Annals of Surgery 1994; 220 :391–401	First large study to show that the sentinel node could be intraoperatively mapped using a dye and that these were the most likely to contain disease, the process that remains in use today.
11	Atkins 1955 BMJ 1955; ii :1473–1474	First to demonstrate that mammary duct fistulae can be responsible for recurrent sepsis and could be ‘laid open’ with excellent outcomes
12	Fisher, NSABP-04 2002	Compared three approaches of radical mastectomy, total mastectomy with RTx and total mastectomy alone showing no difference in survival between the three groups. Routine clearance for clinically node-negative disease is not necessary; however, it did show that axillary node status is an important prognostic factor and useful in making decisions on adjuvant treatments
13	Fisher, NSABP-06 2002	Compared WLE with clearance (+/- WBRT) to modified radical mastectomy and clearance without radiotherapy (for cancers under 4 cm). Demonstrated no survival benefit in mastectomy over WLE+RTx in early disease. Importantly, it also found significant decrease in survival where RTx was omitted post WLE.

	Trial study	Details
14	Veronesi, MILAN 1 trial 2002	As above but focussing on cancers under 2 cm, but interestingly showed higher local recurrence but no difference in long-term survival
15	Houssami 2014	Seek to address the ongoing debate of what constituted negative surgical margins by means of a meta-analysis of 33 studies. Positive margin defined as 'ink on tumour' for invasive disease and associated with a two-fold increase in local recurrence but showed that a 1-mm margin can be considered negative
16	Krag 2010 NABP B32 Lancet Oncology 2010 Oct; 11 (10):927–933	Clinically node-negative patients with negative SNB do not benefit from axillary clearance
17	Galimberti, IBCSG 23-01 2013 Lancet Oncology 2013; 14 :297–305 Sola AATRM 2013 Annals of Surgical Oncology 2013; 20 :120–127	Both studies showed no difference in DFS comparing to axillary clearance to no further surgery in patients with isolated tumour cells (ITC) or micrometastasis (deposits <2 mm) in the excised sentinel node(s)
18	Giuliano Z0011, 2017	Patients with T1–T2 cancers and less than 2 positive lymph nodes have no OS benefit with axillary clearance

	Trial study	Details
19	Bing 2016 BJS 2016; 103 (1):81–87 Donker 2015, AMOROS Trial Lancet Oncology 2015; 15 (12):1303– 1310	Despite a higher rate of axillary recurrence with axillary node sampling with targeted radiotherapy, axillary clearance did not improve OS or breast cancer-specific survival, this paper pools the 20-year survival data of the original studies This was later confirmed in the AMOROS trial, which found in select patients that axillary radiotherapy is comparable to clearance for DFS and OS
20	Mansel 2006 ALMANAC Trial JNCI 3 2006; 98 (9):599– 609	Axillary clearance vs SNB alone (if negative) or SNB and ALND or RTx (if positive) showed lower morbidity and improved QoL in SNB
21	Losken 2014 Annals of Plastic Surgery 2014; 72 (2):145–149	Oncoplastic resections are associated with lower positive margins (and therefore re-excisions) but higher rates of completion mastectomies. Patient satisfaction was higher. They also had fewer complications and reduced local recurrence at five years
22	Agha 2018 BJS Open Access	A meta-analysis showing nipple-sparing mastectomy and skin-sparing mastectomy have comparable DFS and local recurrence rates
23	O’Connell 2018 Plastic and Reconstructive Surgery 2018; 142 (3):594– 605	Immediate DIEP in patients undergoing post Mx RTx is acceptable in terms of aesthetic outcome and patient satisfaction

	Trial study	Details
24	Caudle 2016 JCO 1 2016; 34 (10):1072–1078	Clipping nodes with biopsy-confirmed metastatic disease allows for selective removal (targeted axillary dissection) and improves evaluation of residual axillary disease following chemotherapy
25	Kuehn 2013 SENTINA Trial Lancet Oncology 2013; 14 (7):609–618	Sentinel node biopsy prior to administering neoadjuvant chemotherapy is acceptably accurate but is less accurate with a higher FN rate following NAC. Also demonstrates the need for a minimum of three nodes to be taken to have an acceptable FN rate in assessing the axilla
26	Nguyen 2017 ASO 2017; 24 (10):3011–3016	A minimum of three nodes must be taken at SNB by dual tracer post NACT. FN rate is reduced further when a previously clipped positive node is taken
27	Gentilini 2012 SOUND Trial The Breast 2012; 21 (5):678–681	This ongoing trial has randomised patients with negative preoperative US of the axilla to either SNB or observation to determine if low-risk patients require an SNB
28	Delay, E 1998 Autologous latissimus breast reconstruction: a three-year clinical experience with 100 patients Plastic Reconstructive Surgery 1998; 102 (5):1461–1478	Described experience of LD flap reconstruction with 100 patients over three years of particular note they describe. The supplementary volume from five fatty zones: fat on the cutaneous paddle, fat taken from the surface of the muscle, the scapular fat pad, the anterior fatty zone and the supra-iliac fat pad often negating the need for an implant with the reconstruction

	Trial study	Details
29	Kronowitz, S 2016 Lipofilling of the breast does not increase the risk of recurrence of breast cancer: a matched controlled study Plastic Reconstructive Surgery 2016; 137 (2):385– 393	The study results showed no increase in locoregional recurrence, systemic recurrence or second breast cancer, demonstrating the oncologic safety of lipofilling
30	Clough, K 2003 Annals of Surgery 2003; 237 (1): 26–34	Demonstrated the therapeutic mammoplasty (with symmetrising surgery) as a sound oncological technique in patients for whom tumours were considered too large for BCS
31	McCulley, S 2005 Planning and use of therapeutic mammoplasty- Nottingham Approach British Journal of Plastic Surgery 2005; 58 (7):889– 901	A review of 50 cases outlining the preferred surgical approach based on the location and size of tumour with excellent description of incision planning, NAC pedicle orientation and method of filling defects following disease excision

	Trial study	Details
32	Moustapha Hamdi Pedicled perforator flaps in breast reconstruction: a new concept. British Journal of Plastic Surgery 2004 Sep; 57(6):531–539.	Described indications, technique and use of perforator flaps in partial breast reconstruction

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Appendix

History-Taking and Clinical Examination of Breast

History

- **Symptoms:** Lump (duration, site, change, associated symptoms)
 - Pain (type, side, duration, periodicity, associated lump)
 - Discharge (side, site, single duct, multi-duct, colour, blood)
 - Skin changes, tethering, nipple retraction
- Past history of breast diseases and investigations
- Past medical history
- **Family history:** Breast, ovarian, relationship, age at diagnosis
- **Menstrual and obstetrics history:** LMP, age at first live birth, age at menarche and menopause
- Breastfeeding
- Hormonal treatment (HRT, IVF) and contraception
- **Medications:** Anti-depressants, duration of therapy
- Allergy
- **Social history:** Occupation, smoking, alcohol, family

Examination

- Introduction, explain the process of examination, chaperone.
- Ask the patient to sit up.
- Inspect for distortion, skin/nipple change, tethering, etc.

- Get the patient to raise their arms and check the inframammary fold.
- Get the patient to lean forward.
- Get the patient to push on their hips.
- Lie the patient semi-supine (45° angle) with arms above head.
- Examine the normal side first.
- **Palpate all four quadrants:** (line passing through midclavicular point and a line passing horizontally through nipple divides breast into upper outer [UOQ], upper inner [UIQ], lower outer [LOQ] and lower inner [LIQ] quadrants)
- Palpate behind nipple and areola.
- Palpate the axilla.
- Demonstrate skin tethering, deep fixation, measure the size of the lump.
- Palpate the axilla with patient sitting.
- Palpate the supraclavicular fossa.
- Check liver, lungs and spine.

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WHO Surgical Safety Checklist

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Index

- abnormalities of shape of breast [76](#)
- abscesses [62](#)
 - drainage procedure [62](#)–63
 - lactational [62](#)
 - non-lactating [62](#)
 - peri-areolar [62](#)
- accessory breast tissue [75](#), *see also* [polymastia](#)
- accessory nipples [74](#)
- ALCL [71](#)–72
- allergies [10](#)–12
- amastia [75](#)
- anaesthesia, in palliative surgery [68](#)
- anaphylaxis treatment [19](#)
- anatomy, surgical [13](#)
- angiosarcoma of breast [65](#)–66
- animation effect, breast surgery [70](#)
- anterior intercostal artery perforator (AICAP) [45](#)
- anterior thoracic hypoplasia [77](#)
- antibiotics [14](#)–15, [17](#)
 - cefuroxime powder [15](#)
 - IV antibiotics [14](#), [17](#)
 - oral [15](#), [17](#)
- anticoagulants [10](#)–12

- aplasia [75](#)
- areola reconstruction [60](#)
- arterial supply [28](#)
- asymmetry of breast [75](#)
- asymmetry, breast [70](#)
- athelia [75](#)
- autologous fat transfer [43](#)
 - complications [44](#)
 - donor sites [43](#)
 - equipment [43](#)
 - fat preparation [44](#)
 - indications [43](#)
 - markings [43](#)
 - operative technique [43](#)–[44](#)
 - post-operative care [44](#)
 - surgical technique [43](#)
 - theatre preparation [43](#)
- axillary node clearance (ANC) [20](#)
 - anatomy [20](#)
 - complications [23](#)
 - indications [20](#)
 - operative technique [21](#)–[22](#)
 - post-operative care [23](#)
 - quilting [22](#)
- biosurgery (Larva/maggot therapy) [67](#)
- bone metastases [68](#)

- botox injection [38](#)
- brain metastases [68](#)
- BRCA mutation [64](#)
- breast [81](#)
 - clinical examination [81](#)
 - history taking [81](#)
- breast cancer [55](#), [57](#)
- breast conservation surgery (BCS) [24](#), [38](#), [45](#), [65](#)
- breast implants [50](#)
 - anatomical [50](#)–51
 - baker implant [50](#)
 - breast implants and ALCL [71](#)–72
 - expander vs. implant [50](#)–51
 - polyurethane foam-covered implants [50](#)
 - round [50](#)–51
 - saline implants [50](#)
 - types [50](#)
- breast infections [62](#)
 - lactational [62](#)
 - non-lactational [62](#)
- breast oedema [71](#)
- breast reconstruction [34](#), [52](#)–53
 - delayed [40](#), [42](#), [52](#)
 - high-risk factors [53](#)
 - immediate [40](#), [42](#), [52](#)
 - skin-sparing mastectomy [52](#)

breast reduction mammoplasty [55](#)

vertical scar mammoplasty [55–57](#)

wise pattern [55–59](#)

breast surgery [1–4](#), [69](#)

breast volume excision [2](#)

capsular contracture after implant insertion [69](#)

cautery settings [2–3](#)

consent [2](#)

damage to intercostobrachial nerve [71](#)

haematoma [69](#)

incisions [2](#)

indentation/contour deformity after [70](#)

infection [70](#)

intraoperative photography [2](#)

nerve blocks [2](#)

positioning [2](#)

post-operative care [3–4](#)

pre-operative [2](#)

procedures [1](#)

seroma [69](#)

specimen handling [2–3](#)

spontaneous effusion around implant [71](#)

twitching/animation effect [70](#)

breast volume calculator app [51](#)

breast-conserving surgery (BCS) [6–7](#), [67](#)

- breast, anatomy [5–6](#)
 - apocrine gland [5](#)
 - arterial blood supply [7](#)
 - axillary tail of Spence [7](#)
 - embryology [5](#)
 - lobes [5](#)
 - lymphatic drainage [8–9](#)
 - mammary ducts [5–6](#)
 - mammary ridge [5](#)
 - milk-line [5](#)
 - nerve supply [8](#)
 - nipple and areola [7–8](#)
 - pectoral fascia [5](#)
 - ptosis [6](#)
 - causes [6](#)
 - Regnault's classification [6](#)
 - types [6](#)
 - subareolar plexus of Sappey [9](#)
 - suspensory ligament of Cooper [6](#)
 - venous drainage [8](#)
- C-V flap technique [60–61](#)
- capsular contracture [69](#)
- capsulectomy [69, 71](#)
- cavity margins [26](#)
- chemotherapy [65](#)
- chest wall deformities [73](#)

- clavipectoral fascia [21](#)
- clinical photography [55](#)
- congenital abnormalities of breast [73](#)–75
- congenital chest wall deformity [76](#)–77
- congenital nipple inversion [74](#)–75
- contour deformity [70](#)
- core biopsy [10](#)–11
 - indications [11](#)
 - procedure [11](#)
- cyst aspiration [10](#), [12](#)
 - indications [12](#)
 - procedure [12](#)
- DCIS, *see* [ductal carcinoma in situ \(DCIS\)](#).
- DIEP flap [41](#)–42
 - anatomy [41](#)
 - surgical technique [41](#)
- donor site closure [42](#)
- donor sites [40](#)–43
- Doppler flow signals [45](#)
- drain management [32](#)
- drainage [37](#), [39](#)
- dual plane technique [73](#), [76](#)
- ductal carcinoma in situ (DCIS) [45](#), [55](#)
- ductal papilloma [13](#)
- ducts, mammary [13](#)–15, [17](#)
- dye injection [19](#)

early-stage breast cancer (ESBC) [18](#)

indications [18](#)

embryology [74](#)

erythromycin [62](#)

extended latissimus dorsi (LD) myocutaneous flap [34](#), [37–38](#)

anatomy [34–35](#)

blood supply [35](#)

contraindications for [34](#)

dissection [36–37](#)

dissection technique [36–37](#)

harvest site closure [37](#)

indications for [34](#)

mobility [38](#)

operative technique [35–38](#)

post-operative care [38](#)

preoperative marking [35](#)

stitching into mastectomy defect [37–38](#)

theatre preparation [35–36](#)

variations of [37](#)

extra nodal disease [20](#)

extracapsular rupture [70](#)

fat grafting [38](#), [43](#)

fat necrosis [57](#)

fat preparation [44](#)

fat transfer [43–44](#)

fine-needle aspiration cytology (FNAC) [10](#)–11

indications [10](#)

procedure [10](#)–11

flap inset [42](#), [48](#)

flap necrosis [38](#)

flap revision surgery [38](#)

flaps

AICAP [48](#)–49

LTAP [48](#)–49

MICAP [48](#)–49

TDAP [48](#)–49

free flap breast reconstruction [40](#)

free tissue transfer [40](#)

anatomy [41](#)

complications [42](#)

equipment [41](#)

imaging [41](#)

indications/contraindications [40](#)

markings [41](#)

operative technique [40](#)–42

post-operative care [42](#)

theatre preparation [41](#)

Goldilocks mastectomy [30](#)–31

haematoma [33](#), [69](#)

haemostasis [26](#)

HER2-positive breast cancer [20](#)

hormone receptor (HR)-positive disease [20](#)
HR-negative disease [20](#)
hydro-dissection [24](#)–26, [31](#)–32, [36](#)
hypoplasia [75](#)
ICB neuralgia [71](#)
implant insertion [38](#), [69](#)
implant reconstruction [34](#)
implant rupture [69](#)–70
incision choice [24](#)–25
incision planning [13](#)–15
infection post breast surgery [70](#)
inflammatory breast cancer (IBC) [20](#), [28](#), [64](#)
inframammary fold (IMF) [35](#), [55](#)–56
intercostal arteries [45](#)
intercostobrachial nerve damage, *see* [ICB neuralgia](#)
internal mammary (IM) nodes [19](#)
lactational breast abscesses [62](#)
landmark surgical trials, studies and papers in breast diseases [78](#)–80
larger myocutaneous flaps [70](#)
larva/maggot therapy (biosurgery) [67](#)
lateral intercostal artery perforator (LICAP) [45](#)
lateral thoracic artery (LTAP) [45](#)
lipofilling [24](#), [26](#), [34](#)–35, [38](#), [70](#), [73](#), [76](#)
liposuction [73](#), [75](#)
liver metastases [68](#)

- lobular cancer [45](#)
- local anaesthesia [10](#)–12
- local flap design [60](#)–61
- local perforator flaps [45](#), [70](#)
 - contraindications [45](#)
 - morbidity [45](#)
 - volume replacement [45](#)
- local recurrence
 - after BCS [67](#)
 - after mastectomy [67](#)
 - management of lymphoedema associated with [67](#)
- localisation [24](#)
- locally advanced breast cancer [20](#)
- lung metastases [68](#)
- lymph node biopsy [72](#)
- lymphoedema, associated with recurrence [67](#)
- macrophages [50](#)
- male breast cancer [64](#)
 - pathology and types [64](#)
 - prognosis [64](#)
 - risk factors [64](#)
- marking [13](#)–14

- mastectomy [24](#), [28](#)–31, [34](#)–35, [38](#), 55
 - blood supply [28](#)
 - arterial supply [28](#)
 - venous drainage [28](#)
 - complications [29](#)
 - embryological plane [31](#)
 - Goldilocks mastectomy [30](#)–31
 - IMF incision [30](#)
 - incision planning [29](#)–33
 - indications for [28](#)
 - inflammatory breast cancer [28](#)
 - patient choice [28](#)
 - marking/incision planning [29](#)–33
 - nipple-sparing mastectomy [30](#)
 - post-mastectomy radiotherapy [38](#)
 - post-operative management [32](#)–33
 - pre-operative workup [29](#)
 - procedure [31](#)–32
 - psychology of [29](#)
 - simple/transverse mastectomy incisions [30](#)
 - skin-sparing mastectomy [30](#)
 - surgical anatomy [28](#)–29
- mastitis [62](#)
- mastopexy [73](#)
- medial intercostal artery perforator (MICAP) [45](#)
- metastatic disease, systemic [67](#)–68

- microdochectomy [13](#), [16](#)–[17](#)
 - complications [17](#)
 - indications [13](#)
- microvascular free tissue transfer [40](#)
- mini-LD flap [37](#)–[39](#)
 - indications [38](#)
 - marking [39](#)
 - post-operative care [39](#)
 - procedure [39](#)
 - technique [39](#)
- morphoea of breast [70](#)
- multidisciplinary meeting (MDM) [2](#)
- muscle or myocutaneous flaps [73](#)
- muscle twitching [38](#)
- myofascial LD flap [37](#)
- neoadjuvant chemotherapy (NACT) [45](#)
- nipple abnormalities [74](#)
 - accessory nipples [74](#)
 - athelia [75](#)
 - congenital nipple inversion [74](#)–[75](#)
 - polythelia [74](#)
- nipple and areola necrosis [53](#)
- nipple discharge [13](#), [17](#)
- nipple grafting [61](#)
- nipple inversion [17](#)
- nipple necrosis [17](#), [33](#), [57](#)

- nipple reconstruction [60](#)
 - C-V flap technique [60](#)–61
 - complications [61](#)
 - equipment [60](#)–61
 - local flap design [60](#)–61
 - markings [60](#)–61
 - nipple grafting [61](#)
 - nipple-sharing procedure [60](#)–61
 - post-operative care [61](#)
- nipple-sharing procedure [60](#)–61
- nipple-sparing mastectomy [30](#)
- obesity, excess alcohol consumption [64](#)
- occult breast cancer [65](#)
- oestrogen [74](#)
- Paget’s disease of nipple [65](#)
- partial breast reconstruction [45](#)
- patient consent [10](#)–12
- patient-reported outcome measures (PROMs) questionnaire [1](#)
- perforator flaps [45](#)
- Poland’s syndrome [76](#)–77
- polymastia [75](#)
- polythelia [74](#)
- post-operative management [17](#)
- pre-operative workup [13](#)

- pre-pectoral reconstruction [52](#)–53
 - advantages [52](#)
 - complications [53](#)–54
 - indications [52](#)
 - learning curve [53](#)
 - marking/incision planning [53](#)
 - patient selection criteria [53](#)
 - post-operative management [53](#)
 - procedure [53](#)
 - single-stage [53](#)
 - two-stage [53](#)
- pregnancy-associated breast cancer (PABC) [64](#)–65
- pseudo-ptosis [57](#)
- ptosis [50](#), [55](#)
- punch biopsy [11](#)–12
 - indications [11](#)
 - procedure [11](#)–12
- quilting [3](#), [32](#)–33
- radio necrosis [34](#)
- radiotherapy [55](#)
- regional nodes [70](#)
- remove breast cancer [55](#)
- Rotter's nodes [9](#)
- ruptured implants [50](#)

- sentinel node biopsy (SNB) [9](#), [18](#)–[20](#), [22](#)
 - anatomy [18](#)–[19](#)
 - complications [19](#)
 - dye injection [19](#)
 - internal mammary nodes [19](#)
 - operative technique [19](#)
 - preparation [19](#)
 - targeted axillary dissection (TAD) [19](#)
- seroma [33](#), [69](#)
- seroma aspiration [12](#)
 - indications [12](#)
 - procedure [12](#)
- silicone [50](#)
- silicone breast implant facts [50](#)
- skin laxity/stretch [50](#)
- skin-sparing mastectomy [30](#), [36](#), [41](#)
- smoking [45](#)
- soft tissue and skin thickness [50](#)
- specimen orientation [25](#)–[26](#)
- spinal metastases [68](#)
- spontaneous effusion around implant [71](#)
- subpectoral reconstruction [52](#)
 - disadvantages [52](#)
- supernumerary breasts [75](#)
- surface marking, breast [6](#)
- systemic metastatic disease [67](#)–[68](#)

- T-junction necrosis [57](#)
- targeted axillary dissection (TAD) [19](#)
- tear drop deformity of nipple [57](#)
- thelarche [5](#)
- therapeutic mastoplasmy [55](#)
 - complications [57–59](#)
 - indications [55](#)
 - marking/incision planning [55–57](#)
 - pre-op workup and consent [55–59](#)
 - procedure [57](#)
- thoracodorsal (TD) artery [35](#)
- thoracodorsal artery perforator (TDAP) [45](#)
- total duct excision (TDE) [13–17](#)
 - indications [13](#)
- triple-negative breast cancer (TNBC) [20](#)
- tubular breasts [76](#)
- twitching [70](#)
- ultrasound guidance [10–12](#)
- venous drainage [8](#), [28](#)
- vertical scar mastoplasmy [55–57](#)
- whole-breast reconstruction [45](#)

- wide local excision (WLE) [24](#), [26](#), [45](#)
 - cavity margins [26](#)
 - closure [26](#)
 - complications [26](#)–27
 - incision choice [24](#)–25
 - indications [24](#)
 - localisation [24](#)
 - post-operative care [27](#)
 - preparation [24](#)
 - surgical techniques [24](#)–26
- wise pattern mammoplasty [55](#)–59
- wound edge necrosis [33](#)
- wound healing problems [57](#)

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