Inferior Pedicle Mammaplasty

26

Christopher Khoo

26.1 History

The technique was first described by Ribeiro [1] and then independently in the same year by Robbins [2] and Courtiss and Goldwyn [3] who offered it as a straightforward alternative to free nipple grafting for extreme macromastia or ptosis. The operative descriptions were essentially the same: a dermo-glandular flap was raised, preserving intrinsic tissue perfusion from anterior perforating vessels to the parenchyma, while the overlying skin was raised and tailored using a keyhole-shaped resection after the description from Wise [4]. The underlying breast tissue is resected to achieve the desired volume reduction, and the skin envelope is closed in an inverted "T" shape. Georgiade et al. [5] emphasized the advantages of this technique: predictable breast shape based on preoperative markings; direct visibility of all areas for ease of resection and hemostasis; retention of normal nipple duct connections; no impairment of subjective sensation; and adequate blood supply. The literature has grown with modifications of the original technique, a more recent example being the use of the inferior pedicle with a combined peri-areolar and vertical skin excision: the "SPAIR mammaplasty" (short scar peri-areolar inferior pedicle reduction, Hammond [6], which maintains the safety of the inferior pedicle technique while reducing cutaneous scarring. Movassaghi et al. [7] have described a modification of the Robertson technique which allows for the elimination of the vertical scar, still using a broad inferior pedicle, but with a low horizontal scar mammaplasty.

26.2 Indications: Aims and Advantages

All breast reduction and mastopexy techniques involve the same basic steps: reduction and reshaping of breast parenchyma volume, tightening of the skin envelope, and uplifting of the nipple-areola complex to correct ptosis and counteract the effects of gravity. It is always understood that tissue handling should preserve blood supply to both breast tissue and skin and crucially to the nipple-areola complex, as well as maintaining sensation.

The aims in aesthetic surgery are to achieve a youthful appearance, with pert breasts resulting from the correction of ptosis and reshaping of breast parenchyma to achieve projection, and for the surgical result to be long-lasting. The surgeon has the opportunity to work on both breasts and to tailor the interventions individually if needed, to ensure the best possible symmetry.

In reconstructive surgery, the reduction is often a contralateral procedure, and the goal is to achieve the best match with the affected side and its reconstruction: whether this has been undertaken with autologous tissue, with the aid

C. Khoo (✉)
Wexham Park Hospital, Berkshire, UK
e-mail: ctkkhoo@bakersbarn.net

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of an implant, or both. While the aesthetic goals are still the same, to achieve a natural appearance, with symmetrical fullness and volume and with both nipples (natural or reconstructed) being at the same level, and also anatomically correctly positioned at the maximum projection of the breast mound, the reduction does not usually need to achieve the same degree of uplift as in the purely cosmetic procedure. It is also the case that in the longer term, the two breasts, which have been reshaped by different techniques, may age differently in terms of shape and symmetry.

26.3 Anatomical Basis: Vessels and Nerves

26.3.1 Blood Supply to the Skin

The skin flaps are used to shape the enclosed breast tissue and benefit from their own blood supply, which is different from that of the breast parenchyma, although the subdermal plexus communicates with the perforator vessels which vascularize the breast tissue.

Laterally the upper quadrant receives supply from the external mammary artery which gives rise to two or three branches which pass anteriorly, ending in the region of the areola. The lower quadrant is supplied from the anterolateral intercostal perforators.

Medially, the upper quadrant is supplied by the internal mammary perforators from the second to the fifth spaces and below this from the anteromedial intercostal perforators.

The nipple-areolar area is supplied by a rich subdermal plexus, and it is this which allows the creation of nipple and areolar flaps, preserving their vascularity (Fig. 26.1).

Knowledge of the vascular and nerve supply is necessary before undertaking surgery to ensure that viability and sensation are preserved. It is an advantage of the inferior pedicle technique that the design of the dermo-glandular pedicle and the

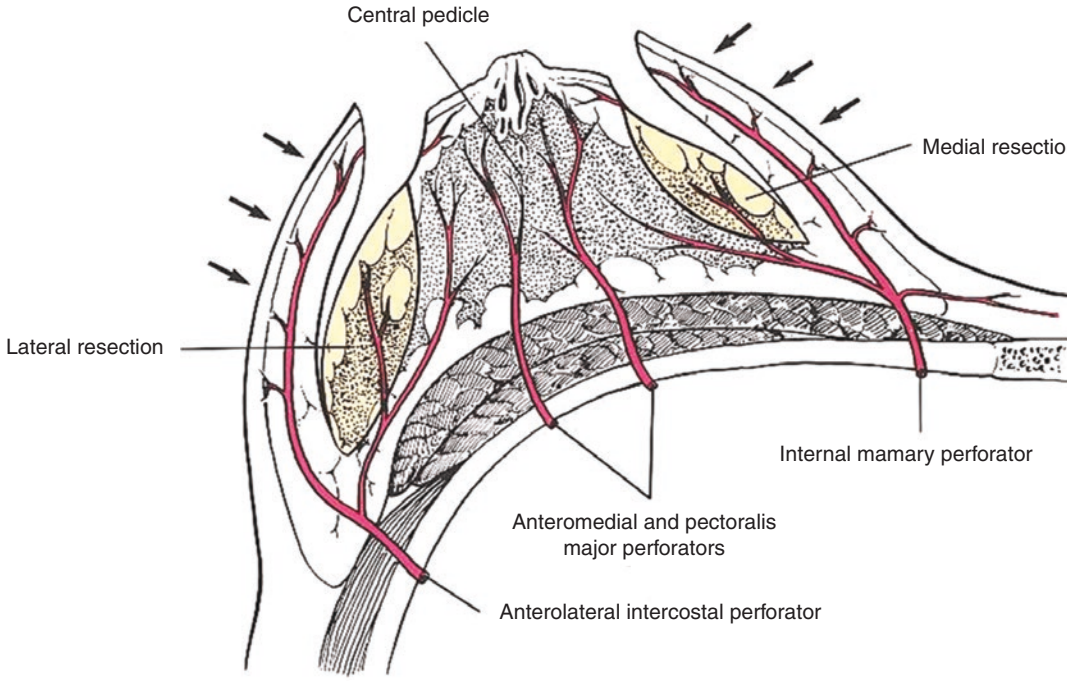


Fig. 26.1 The vascular supply to the skin and the breast tissue (With permission, from Jones G, Bostwick's Plastic and Reconstructive Breast Surgery, Vol 1 page 351, Thieme 1990 ISBN-13: 978-1626236165)

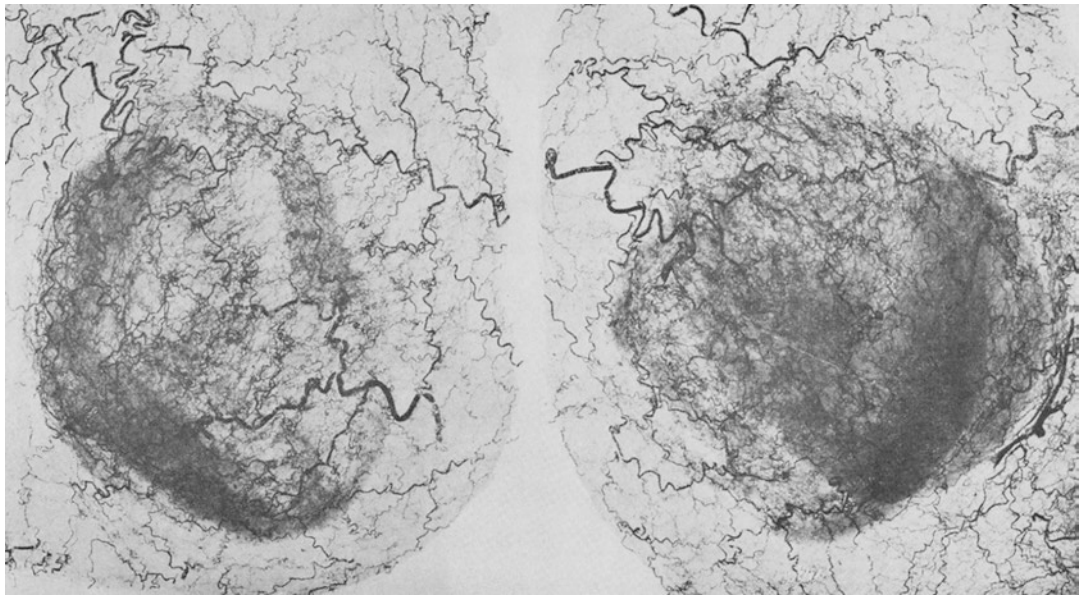


Fig. 26.2 The blood supply of the mammary glands and their overlying skin (With permission, from Michel Salmon: Arteries of the Skin eds Taylor GI and Tempest M, Churchill Livingstone London 1988 ISBN 0-443-03605-5)

skin flaps preserves adequate perfusion and sensibility, most crucially to the nipple and areola.

26.3.2 Blood Supply to the Breast

The breast tissue is supplied by the internal mammary, external mammary (lateral thoracic) arteries, and the superior thoracic and intercostal arteries. One of the branches from the internal mammary artery has classically been regarded as the "principal artery" of the gland, arising usually from the second or third space to run on the medial surface of the breast tissue, dividing into branches which run upwards to the superomedial part and downwards towards the nipple. Additional branches are given off and run on the surface of the gland.

A constant vessel arises either from the external mammary artery, or the axillary artery, to supply the superolateral part of the gland, giving off ascending and descending branches. Hence, the breast tissue may be considered two have two dominant pedicles, both medial and lateral. The accuracy of the pioneering work of Michel Salmon (which led to the publication of "The arteries of the skin" in 1936) was decisively confirmed by Taylor and Tempest whose injection studies have shown a rich vascular supply to both the breast and the skin overlying it, with rich communications between them. It is these anastomoses which allow the breast and its overlying skin to remain viable after surgical intervention which separates the overlying skin from the breast parenchyma (Figs. 26.2, 26.3, and 26.4).

26.3.3 Sensory Supply to the Skin of the Breast

The nerve supply to the skin of the breast arises segmentally from the intercostal nerves, from both the anteromedial and anterolateral branches. The nipple-areola and central breast areas are innervated by T3–T5, with nipple sensation coming mainly from the lateral cutaneous branch of T4. In the upper breast, there is additional innervation from the cervical plexus. Supraclavicular nerves from the lower part of the cervical plexus also innervate the upper and lateral areas.

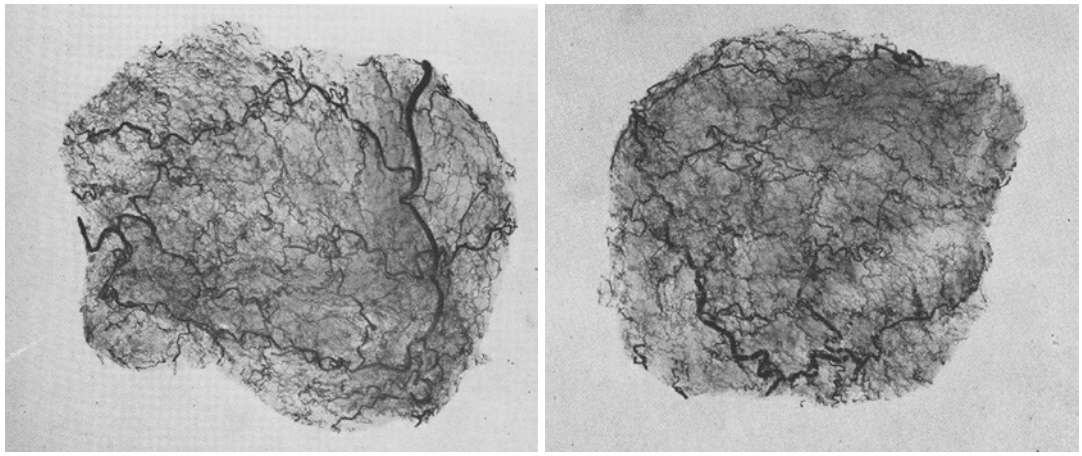


Fig. 26.3 Parenchyma of the same breasts, the overlying skin removed (With permission, from Michel Salmon: Arteries of the Skin eds Taylor GI and Tempest M, Churchill Livingstone London 1988 ISBN 0-443-03605-5)

Fig. 26.4 The skin covering the same mammary glands (With permission, from Michel Salmon: Arteries of the Skin eds Taylor GI and Tempest M, Churchill Livingstone London 1988 ISBN 0-443-03605-5)

26.4 Operative Planning

When bilateral reduction mammaplasty is carried out for purely aesthetic reasons, the surgical goal is to achieve aesthetic proportion on the chest wall, with equal breast volume following correction of ptosis, mastopexy, and positioning of both nipple-areolar complexes in a corrected, uplifted, and symmetrical position. Planning is also governed by the need to achieve an aesthetic appearance appropriate to the patient's body habitus and age. For example, the desired degree of ptosis, and the position of the nipples will affect the degree of uplift necessary created by the mastopexy. The patient's own wishes are extremely important, and decision-making should also take

account of the limitations of the chosen technique, immediate consequences (such as the extent of scarring), and longer-term results that the procedure is likely to achieve.

During the process of breast reconstruction, the surgeon will attempt to shape the reconstructed breast to achieve appropriate volume and contour and (if completion surgery is delayed) to allow for positioning of the nipple-areola complex in the best position, at the point of maximum prominence. Reduction mammaplasty of the opposite breast can then be undertaken to achieve the best possible symmetry with the reconstructed side, always bearing in mind aesthetics appropriate to age. However, the concern is to create the best possible match with the reconstructed side, whose characteristics depend to an extent on the nature of the reconstructive technique (e.g., autologous tissue, or if used, the type and shape of the implant).

26.5 The Procedure

26.5.1 Preoperative Markings and Surgical Planning

In the bilateral aesthetic procedure, the optimal position of the nipple is determined both by reference to the level of the inframammary fold and to external anatomical landmarks. The patient should be marked while standing or sitting upright.

The **breast meridian** (BM) is the line intersecting the mid-clavicular point, running downwards through the nipple, continuing on the undersurface of the breast, and crossing the inframammary crease. It can easily be determined by running a tape measure around the neck and pulling it tautly downwards over the nipple. The line is marked with a surgical marker (Fig. 26.5).

In contralateral symmetrization surgery following breast reconstruction, the ideal nipple position should be marked on the mound of the reconstructed breast, and the new nipple position of the side to be uplifted should match to this spot (or to the position of the reconstructed nipple and areola if already created) (Fig. 26.6).

Measurements can be helpful during planning: in a patient of average build and height, a distance of 18–20 cm from the sternal notch to the nipple is usual. It is helpful to draw in the **midsternal line MSL**, a vertical line running through the sternal notch to the xiphisternum. The distance from the midsternal line to the nipple (sitting on the breast meridian BM) is about 10 cm. Skin marker "A" is at the position where the breast meridian meets the upper part of the new areola (Fig. 26.7).

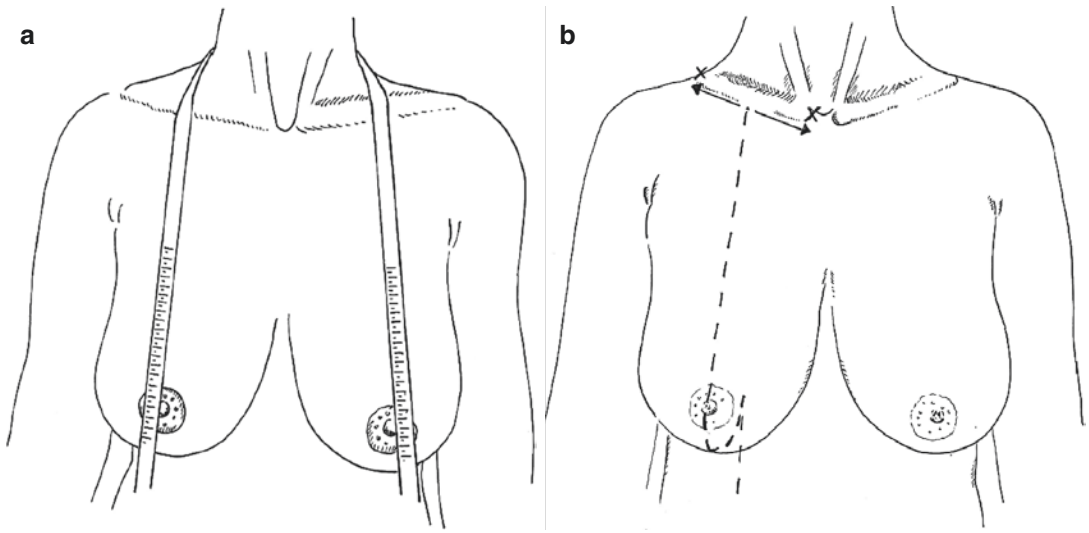


Fig. 26.5 The use of a tape measure (**a**) to define the breast meridian (**b**) in bilateral surgery (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

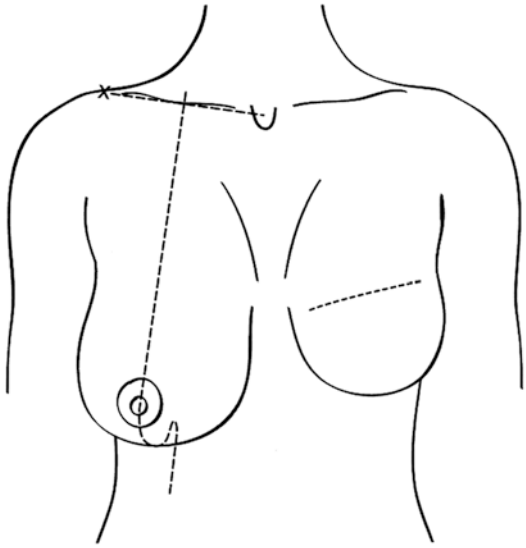


Fig. 26.6 Marking the breast meridian for symmetrization surgery (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

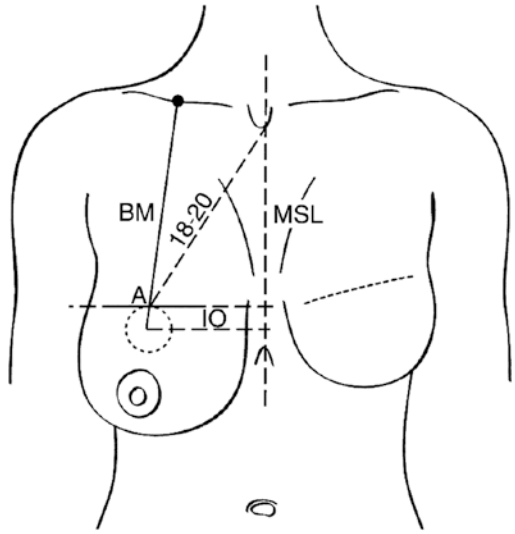


Fig. 26.7 Skin measurements (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

The **nipple position** can also be checked against the level of inframammary crease, which is palpated from behind the breast.

The **skin resection** follows a keyhole pattern with a rounded circum-areolar scar above and an inverted "V" resection below. The two limbs, medial and lateral, run downwards from point "A" (Fig. 26.7). The tissue margins are then brought together to tighten the breast horizontally. Excess tissue inferiorly is excised, leaving a horizontal scar in the inframammary crease. While it is possible to make the markings using a standard pattern, free-hand marking tailored to the actual breast will give the best results (Fig. 26.8).

The **medial keyhole line** is marked by displacing the breast laterally and running a line down from point "A" to meet the point where the breast meridian crosses the inframammary crease. Point "B" is marked 7–10 cm down from point "A" (Fig. 26.9).

The **lateral keyhole line** is marked in a similar fashion by displacing the breast medially and running a line down from point "A" to again to meet the point where the breast meridian crosses the inframammary crease. A point, also called "B," is marked 7–10 cm down from point "A" (Fig. 26.10).

The **inferior markings** consist of two extensions laterally and medially from points "B." Medially, the line "y" extends towards the midline and is drawn to meet a line of equal length "y" passing from the point at which the breast meridian BM crosses the inframammary crease. Medially, these two lines should be of equal length. The same markings are made laterally, to create upper and lower lines "x" which are of the same length. All three points marked "B" in the diagram will come together when the inverted T scar is closed (Fig. 26.11).

The inferior pedicle outline is marked within the area defined by the previous markings and is shown by the shaded area in the diagram (Fig. 26.12). The base width should be about 8 cm, preserving the central parenchymal attachments, giving the pedicle both an inferior and a central base.

The **nipple and areola**, at the top of the flap, will be raised to the marking "A." The shaded areas under "A" represent the uppermost part of the keyhole-shaped resection which will be made

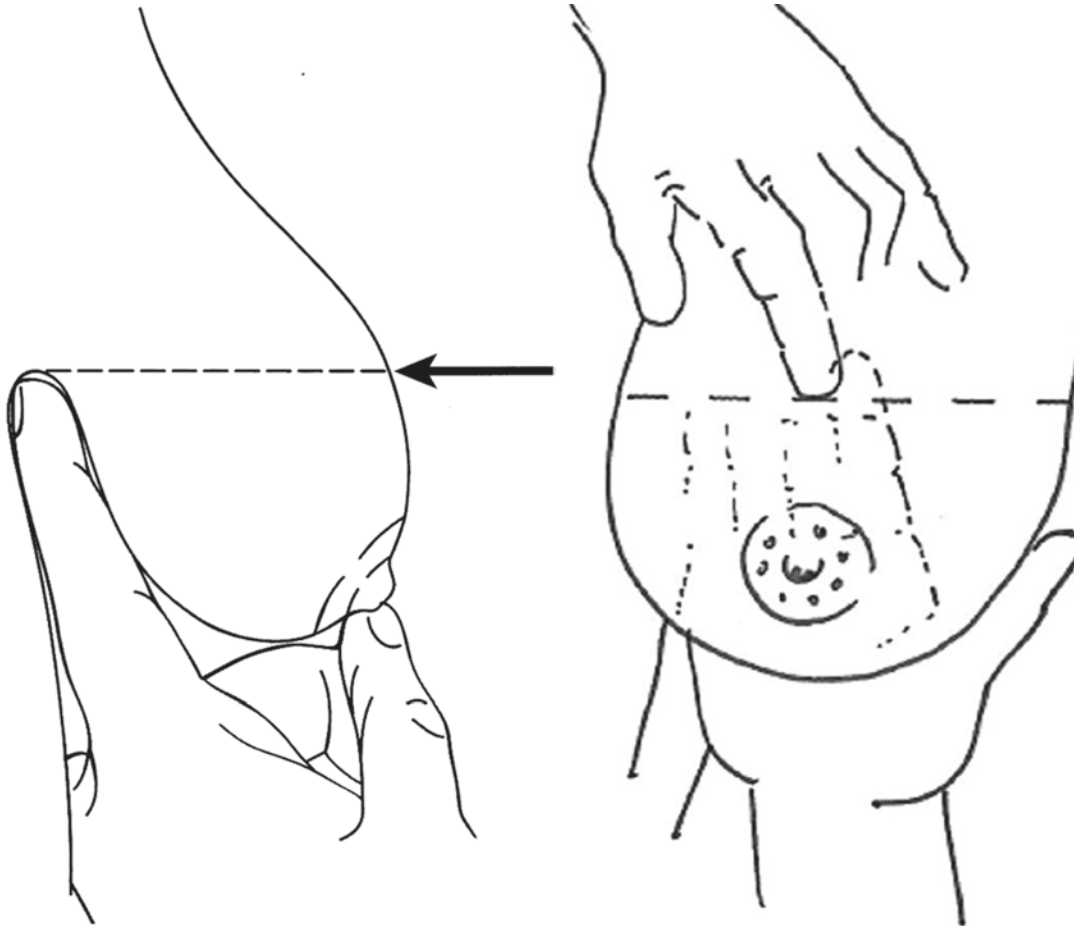


Fig. 26.8 Position of the nipple in relation to the breast mound (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000; and D Gault)

to fit in the uppermost part of the dermo-glandular pedicle, placing the nipple and areola in their new position [Fig. 26.13, also Fig. 26.14).

The inferior pedicle is preserved within the markings and is shown by the shaded area. The shape of tissue resection resembles a keyhole, without the central section (representing the pedicle). The superficial surface of the flap (shaded) is de-epithelialized, preserving the dermis and its subdermal vascular plexus.

After the removal of the keyhole-shaped tissue bloc which may be in several sections but with the rough shape of a keyhole when put together [Figs. 26.15 and 26.16], there is space higher up on the breast mound into which the upper part of the pedicle can be moved (up to point "A" in previous Figs. 26.7 and 26.13).

The closure of the skin flaps around the uplifted pedicle brings the skin edges together as a circum-areolar scar around the margin of the areola and a vertical scar (where the two lines "A and B" meet in the midline of the breast. Inferiorly, the closure of the two lateral triangular spaces (lines "xx" and "yy" in Fig. 26.11) results in a new inframammary crease [Fig. 26.17].

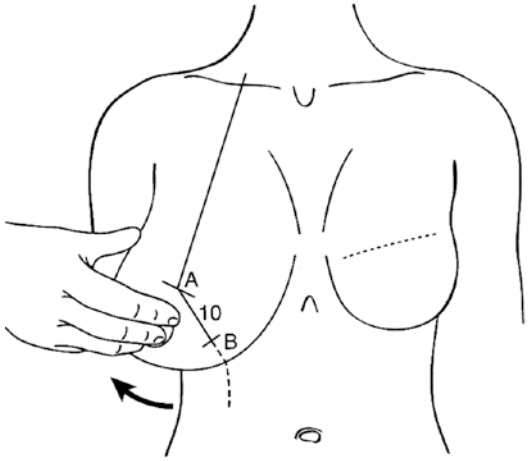


Fig. 26.9 Marking the medial resection line A–B (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

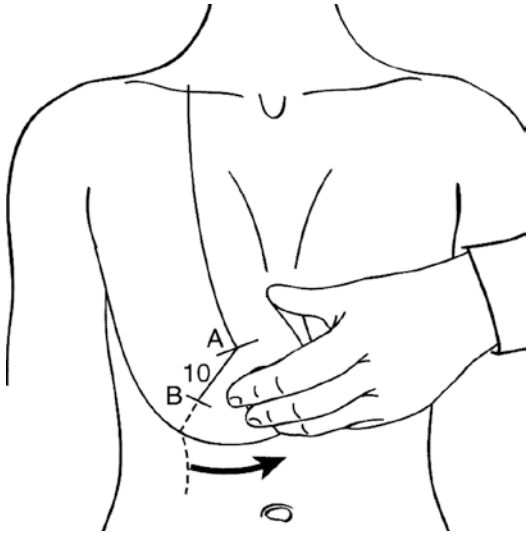


Fig. 26.10 Marking the lateral resection line A–B (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

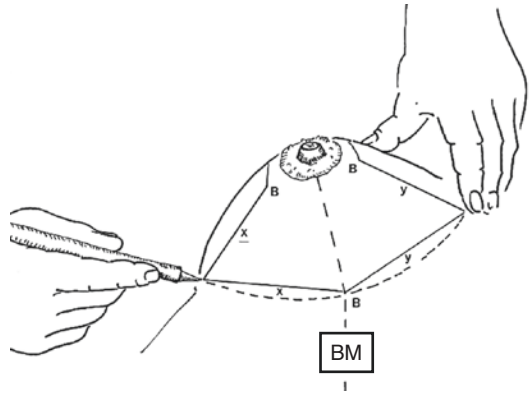


Fig. 26.11 The inferior skin markings: an inferior, third point b, sits where the breast meridian (BM) crosses the inframammary crease, where the other points b will come together (Illustration D Gault)

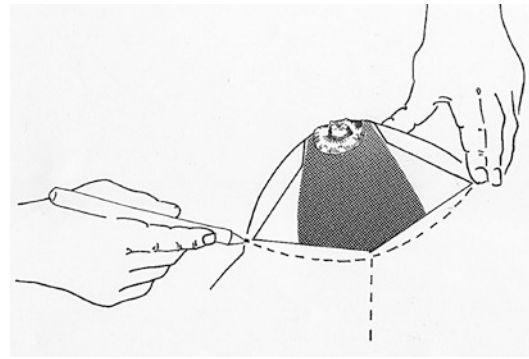


Fig. 26.12 Outline of the inferior pedicle (shaded) (Illustration D Gault)

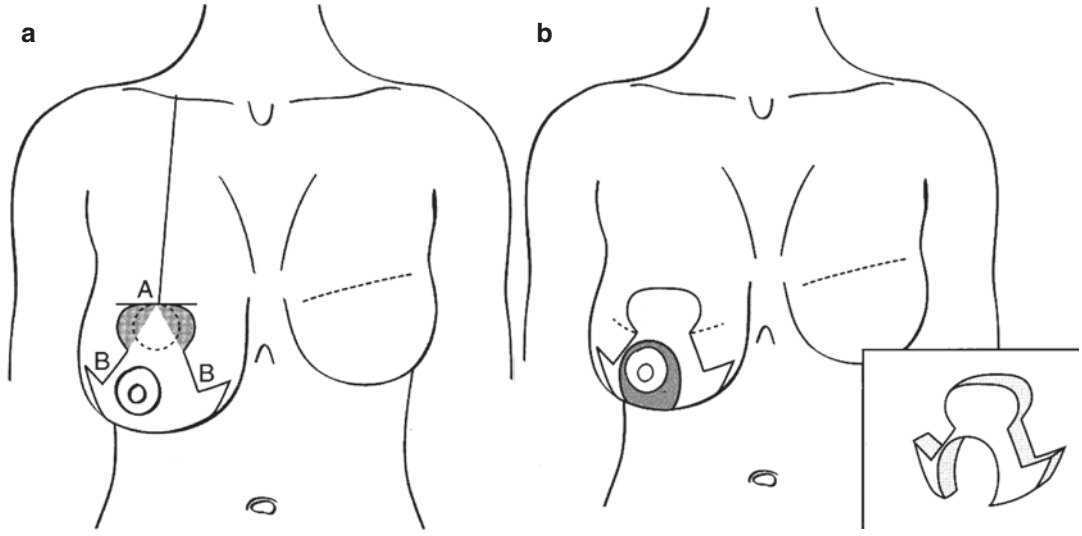


Fig. 26.13 Skin markings for the new position of the nipple and areola (**a**). The shape of the resection, around the pedicle, is shown in the small box (**b**) (With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

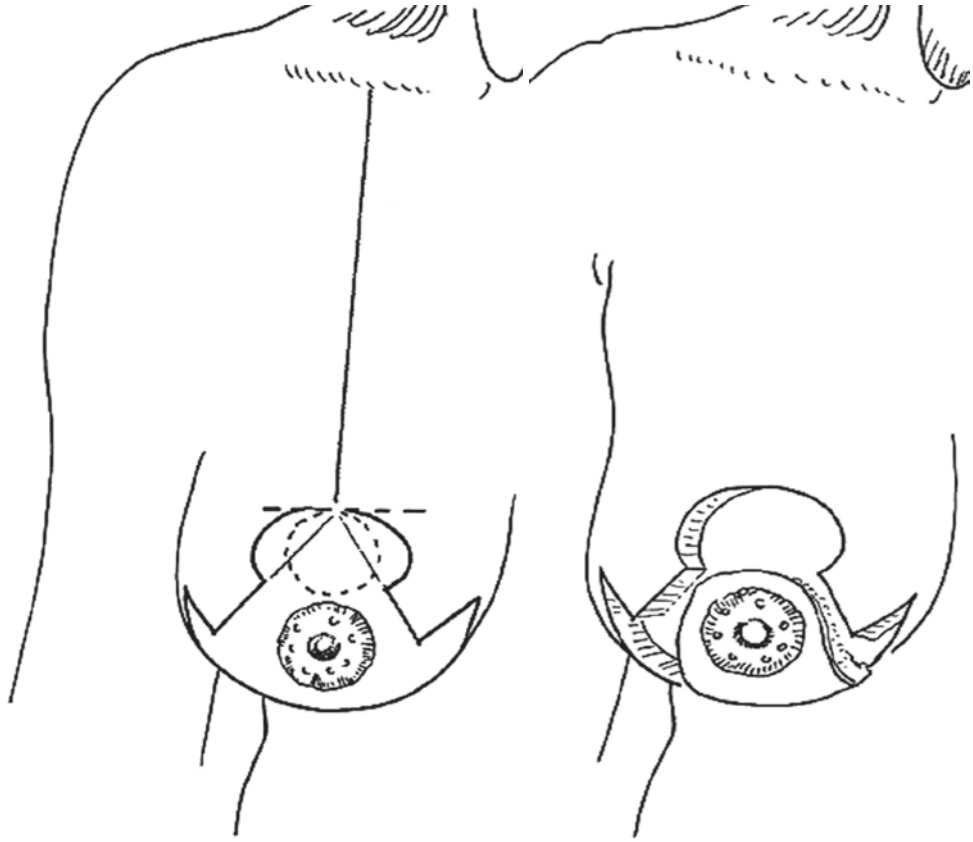


Fig. 26.14 Space for positioning the pedicle (Illustration D Gault)

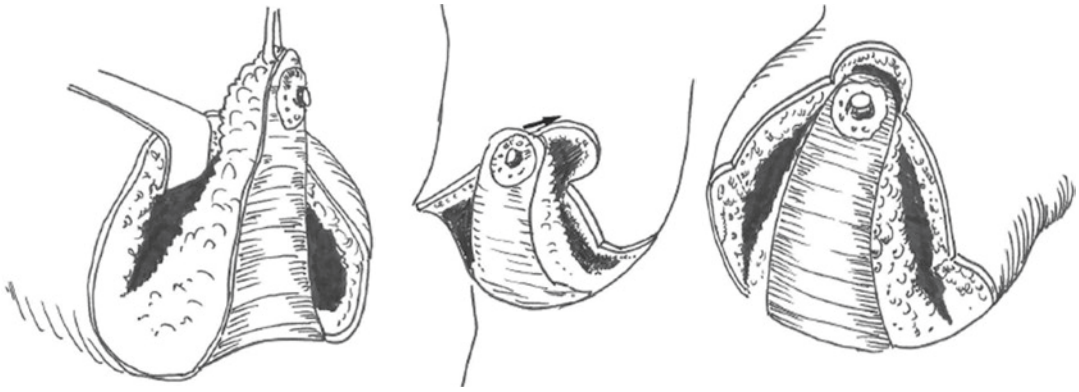


Fig. 26.15 Insetting the pedicle D Gault

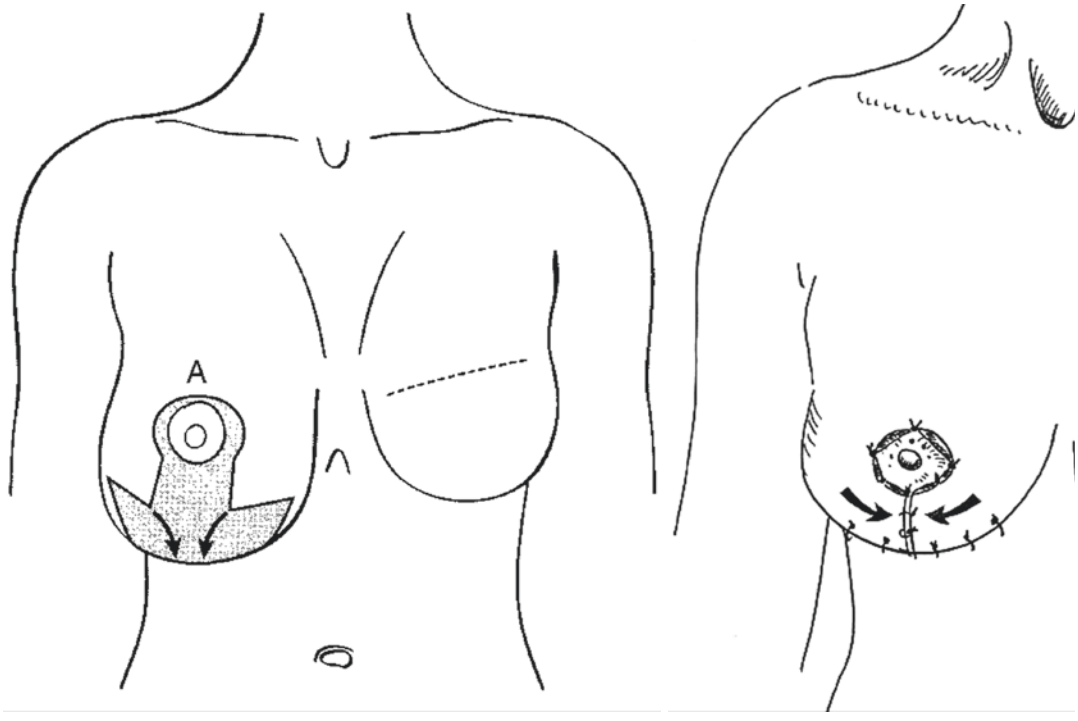


Fig. 26.16 Closure of skin flaps over pedicle (D Gault)

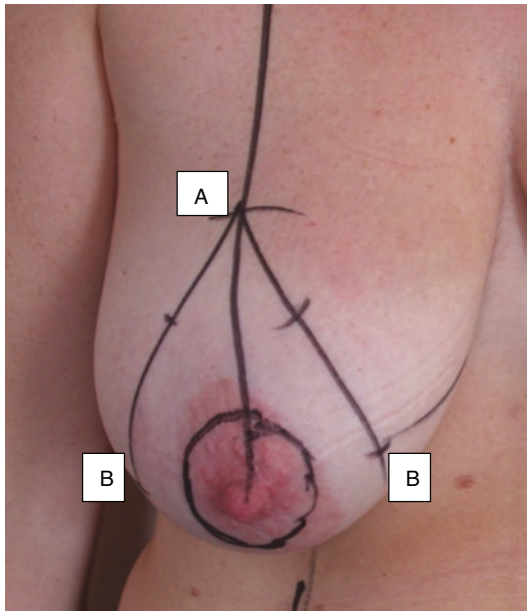


Fig. 26.17 Right breast markings (anterior view)

26.5.2 Operative Stages

The right breast is shown from anterior, with points "A" and both points "B" marked. The margin of the areola has been drawn to a diameter of 4.5 cm (or to match the other areola, if reconstruction has already taken place [Fig. 26.18].

The markings "A and B" are shown on the lateral and medial sides of the breast. Depending on the patient's build, the distance between A and B is usually 7–10 cm but when the procedure is being performed for symmetrization, should be drawn to match the proportions of the reconstruction on the opposite side (Fig. 26.19).

These views of the right breast (Fig. 26.20) demonstrate the outer keyhole resection markings and the markings for the inferior pedicle. The base width should normally be about 8 cm. As the intercostal perforators to the gland should be preserved, it is important to maintain a tissue bridge behind the pedicle—hence it may be considered a central/inferior pedicle.

The incisions (Fig. 26.21) have been made through the skin, along the keyhole markings (note the lateral "x" and medial "y" lines, and around the top of the pedicle (as in Fig. 26.11). These are followed by the peri-areolar incision (Fig. 26.22).

The process of de-epithelialization is made easier by preliminary subdermal infiltration of dilute local anesthetic solution (e.g., 30 mL of 0.25% bupivacaine with adrenaline in 500 mL saline). The breast is compressed by the application of a circumferential tourniquet or clamp around its base. If an assistant is available, the tension can be enhanced by squeezing the breast within the assistant's cupped hands. The dissection proceeds leaving the deep dermis (and therefore the subdermal plexus) intact, though occasional perforations do not jeopardize viability (Fig. 26.22).

The tourniquet has been released after the completion of de-epithelialization. Brisk bleeding is seen from the dermis. Note that at this stage, only skin-deep incisions have been made: if the gland is incised deeply, the breast tissue becomes too floppy to handle (Fig. 26.23).

In the left-hand picture, the flap has been incised deeply, maintaining its inferior connection. Note however that the broad posterior tissue bridge (shown by the white arrow in the right-hand picture) has been maintained, to preserve the intercostal perforators. The color and bleeding from the flap indicate good preservation of vascular supply (Fig. 26.25).

The incision lines marking the areas of excess tissue, comprised of the lateral triangles, and the upper part of the keyhole are incised deeply down to the fascia, being careful to preserve the connection between the broadly based central pedicle and the chest wall (Fig. 26.25).

Resection of the keyhole-shaped cut-out is not necessarily en bloc, but the upper part and two lateral triangles have been brought together to demonstrate the pattern of tissue resection.

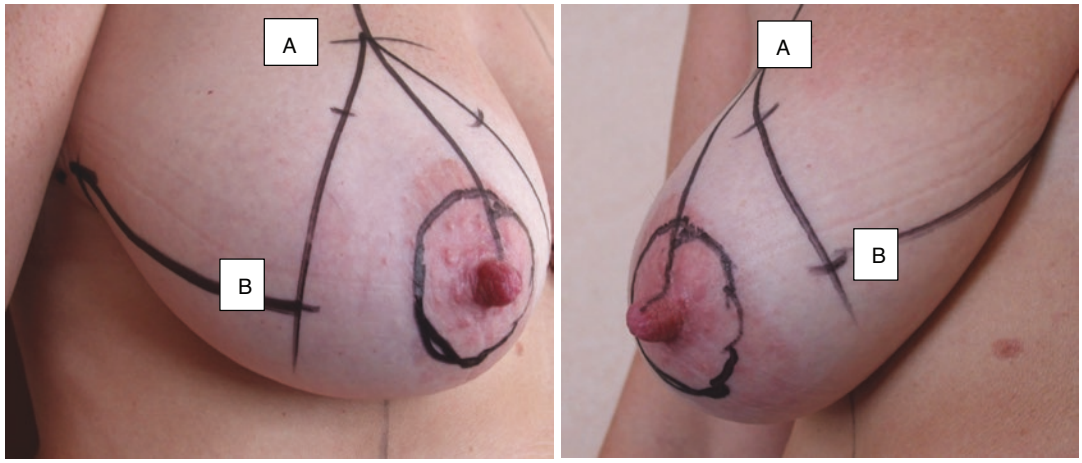


Fig. 26.18 Right breast markings, lateral and medial views

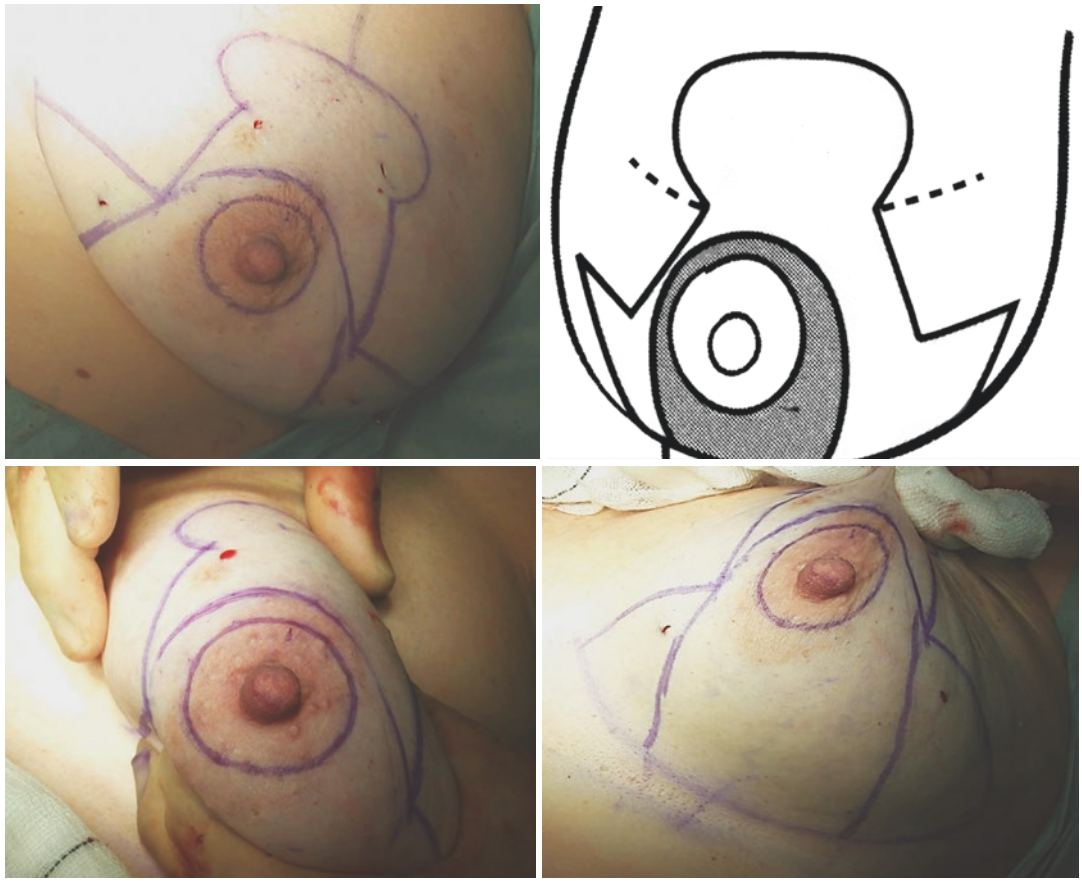


Fig. 26.19 Markings for the Inferior pedicle (right breast)

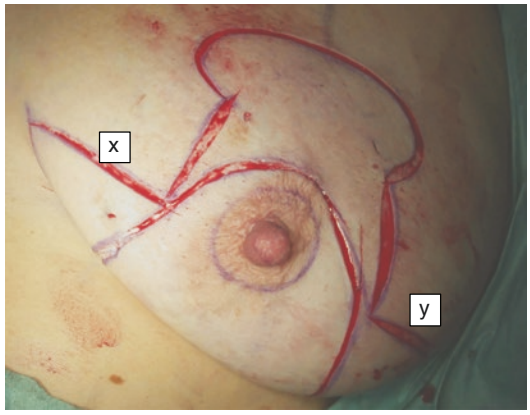


Fig. 26.20 Initial skin incisions: The keyhole and the flap (right breast)

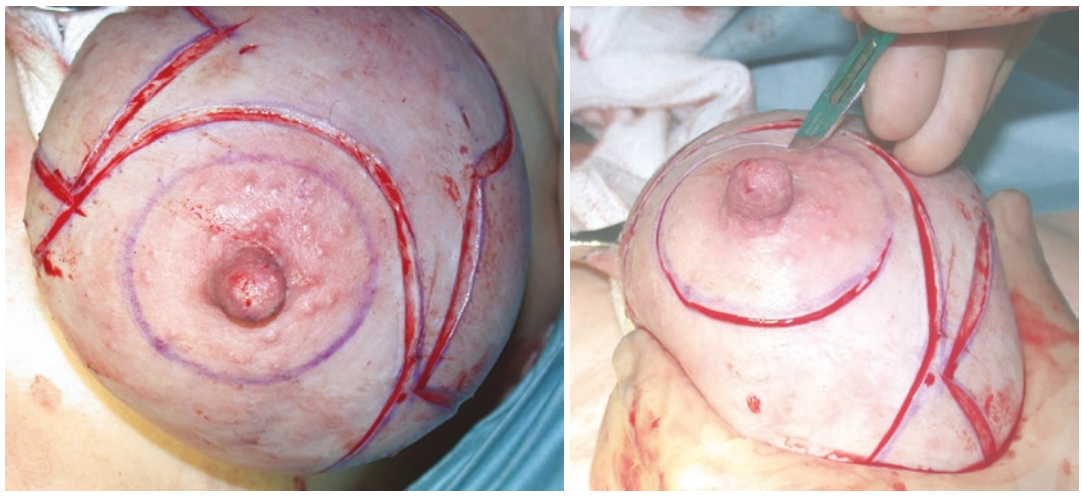


Fig. 26.21 The peri-areolar incision

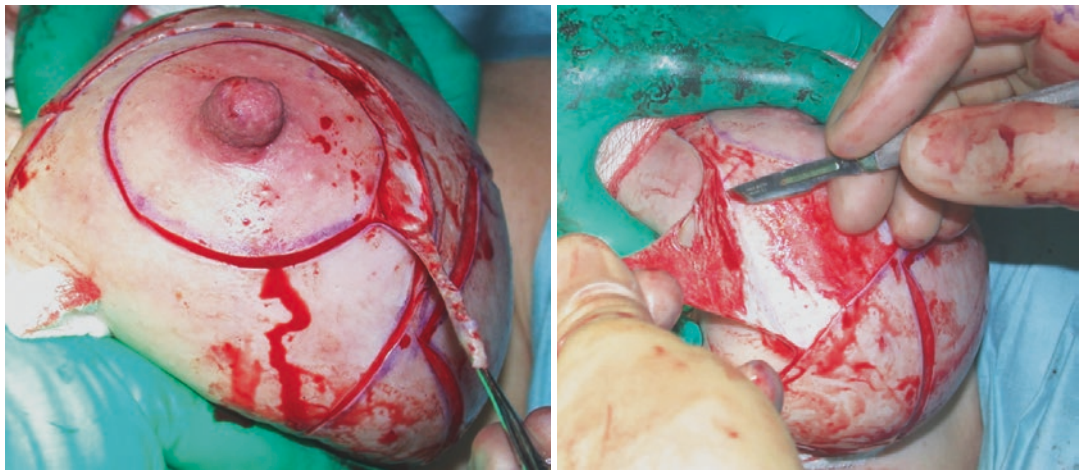


Fig. 26.22 De-epithelialisation of the surface of the flap

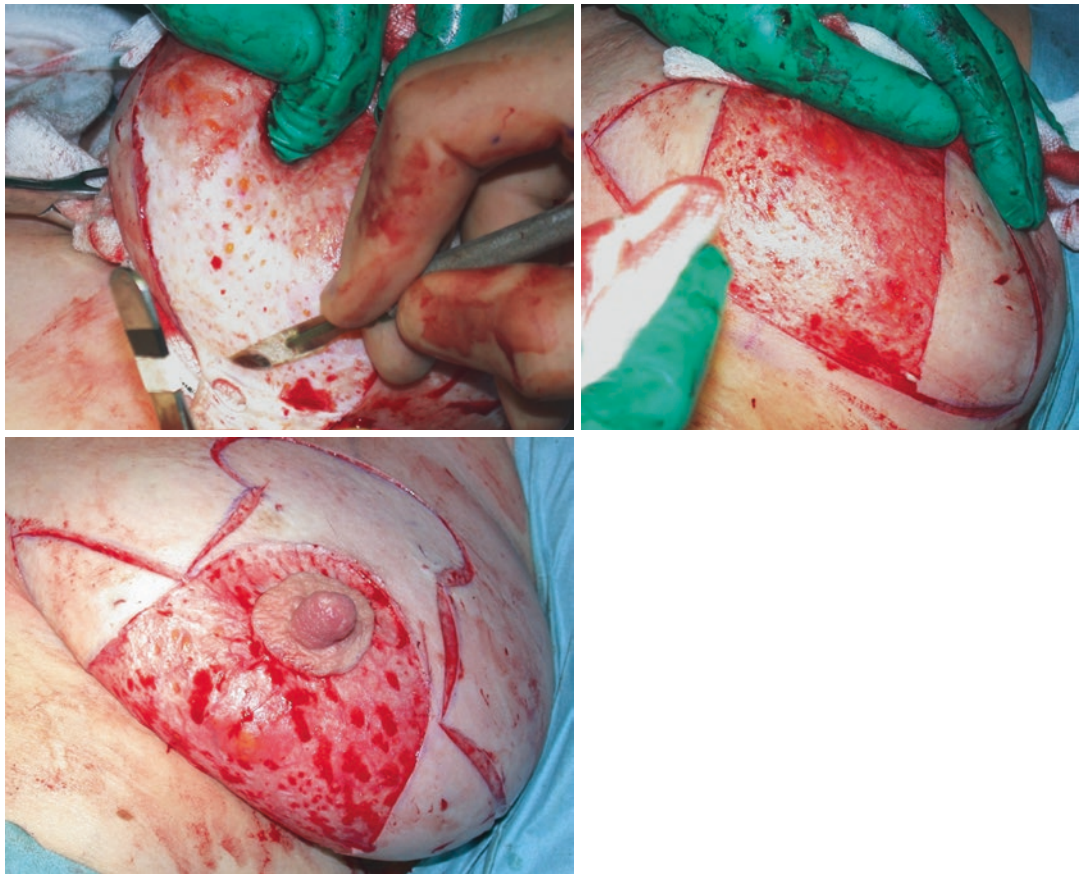


Fig. 26.23 Completion of de-epithelialisation of the surface of the flap

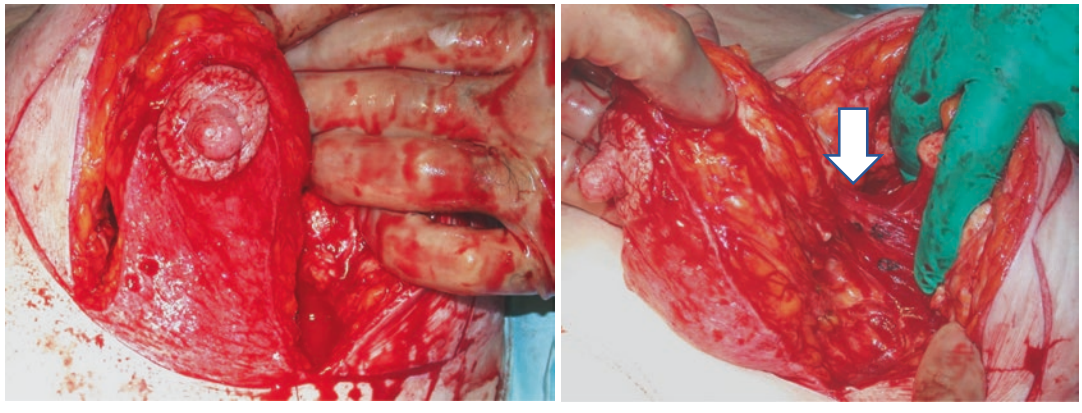
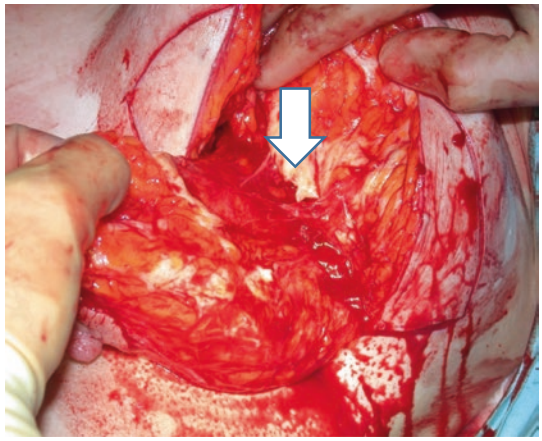


Fig. 26.24 Raising of the flap, preserving essemtial vascuilarity



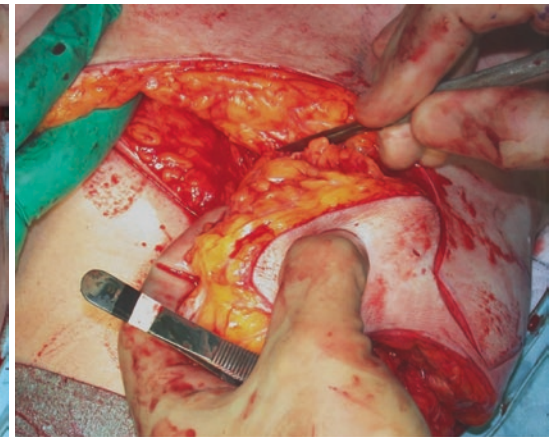
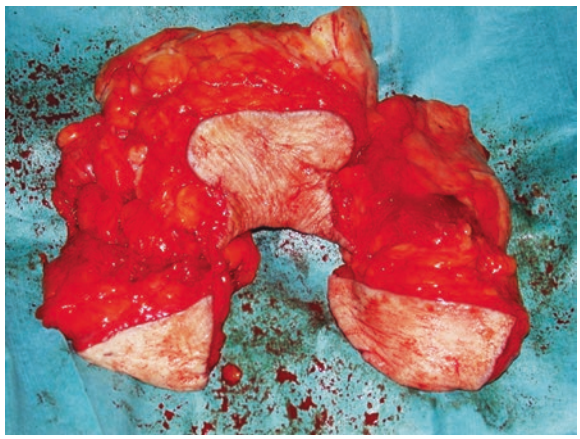


Fig. 26.25 Resection of excess tissue. The pedicle is protected



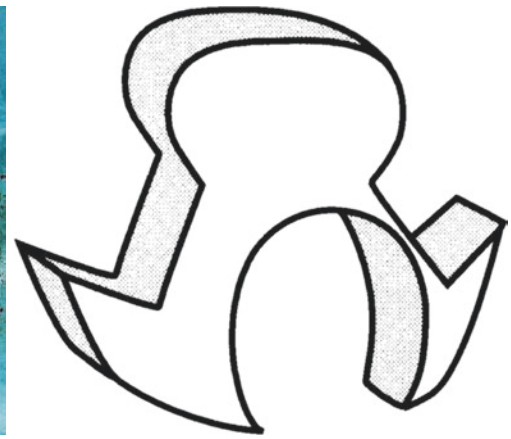


Fig. 26.26 The excised tissue

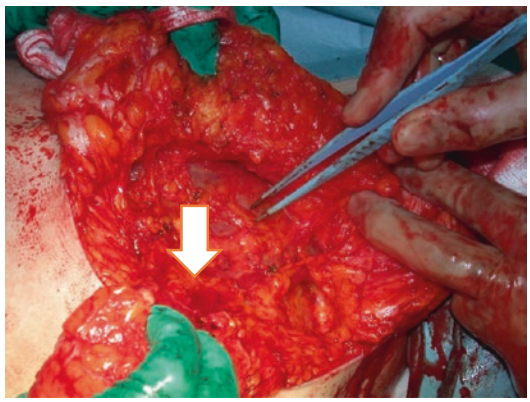


Fig. 26.27 Management of the upper breast flap

The upper part of the breast is released deeply from the fascia, so that it can be elevated on the chest wall and the lateral pillars can be brought together. There is an opportunity for hemostasis on the fascia. The pedicle of the flap (arrowed) is protected at all times, most straightforwardly being held gently by the assistant's fingers (seen here in green gloves) (Fig. 26.27).

The dermo-glandular flap can be moved upwards to position the nipple and areola higher on the chest wall, achieving the necessary uplift.

The lateral flaps are brought together in the midline, where the edges overlap the anterior de-epithelialised surface of the dermo-glandular pedicle (Fig. 26.29).

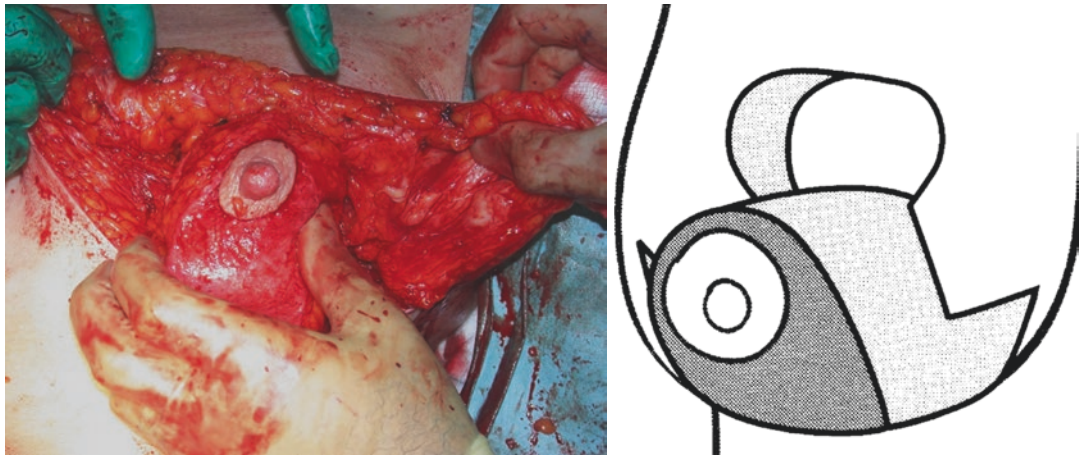


Fig. 26.28 Positioning of the dermo-glandular flap (Illustration With permission, from C Khoo, Step by step mark-up for an Inferior pedicle breast reduction and mastopexy, Royal College of Surgeons of England 2000)

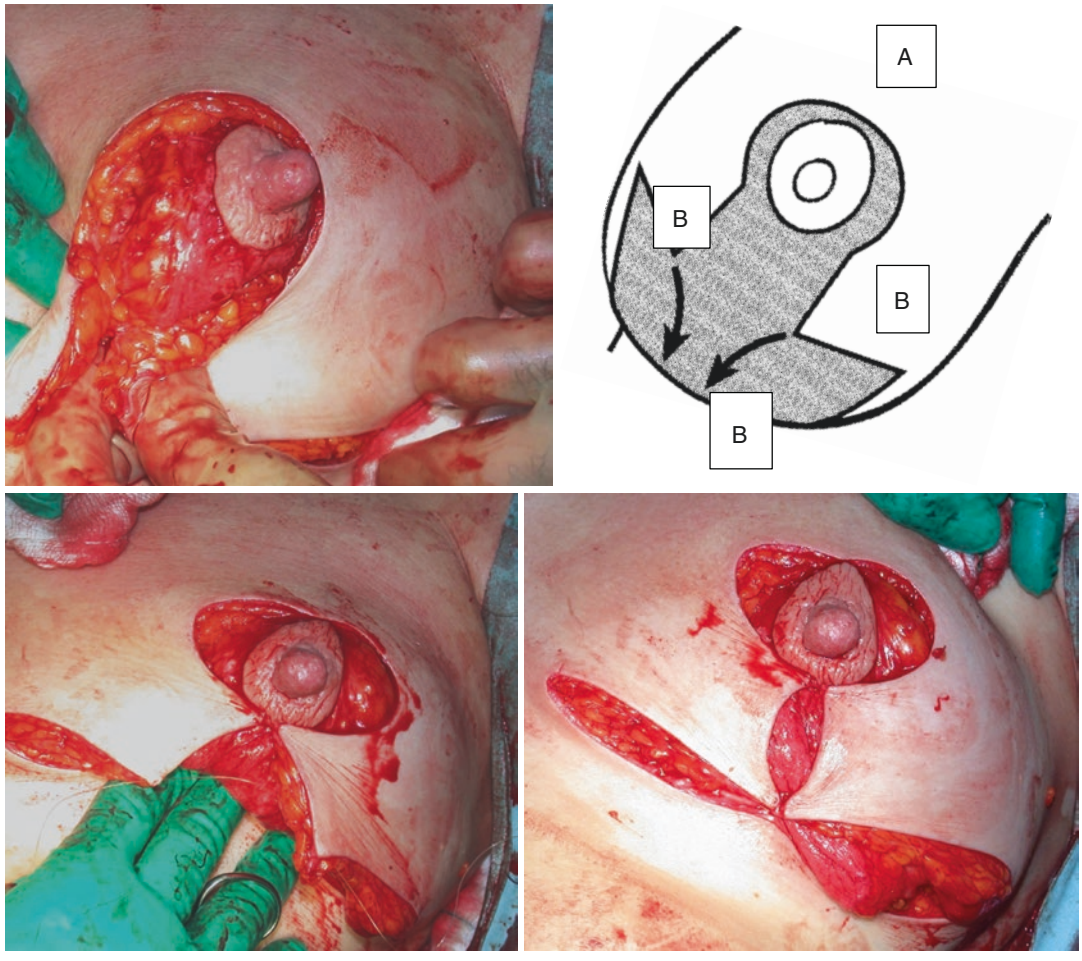


Fig. 26.29 Positioning of the lateral flaps (Illustration D Gault)

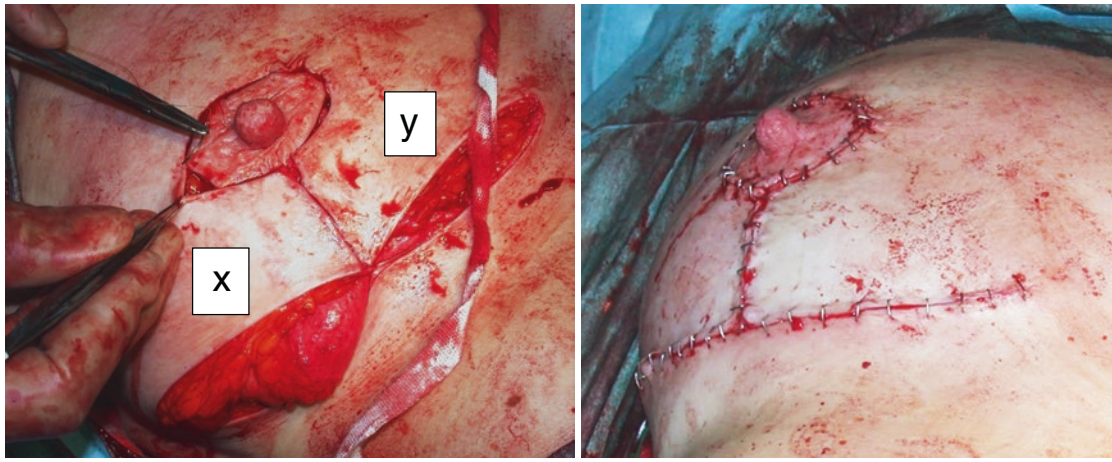


Fig. 26.30 Insetting of the nipple and areola and final closure

Strong subcutaneous sutures (e.g., 3-0 absorbable monofilament) are inserted at key points: at "12 o'clock" and "6 o'clock" on the areolar margin, taking in the upper meeting point of the two lateral flaps, and at the lower end of the vertical suture line (point "B") where the lower edges of both lateral flaps meet the new inframammary crease. If care has been taken to ensure that the upper and lower lateral flap margins "x" and "y" are the same length as the matching margins on the inframammary crease, there will be no disproportion or dog ears (Fig. 26.29).

The closure continues with interrupted subcutaneous 4-0 absorbable monofilament sutures. Before the final closure, a vacuum drain may be placed, according to the surgeon's wishes.

For exact apposition having been strongly achieved with subcutaneous sutures, final closure may be readily and rapidly achieved according to preference: e.g., tissue glue, sutures, or skin staples as shown here, which do not mark if removed at 5–7 days and replaced with adhesive skin tapes.

Fig. 26.31 Early postoperative appearance

26.6 Complications

The inferior pedicle technique gives reliable results, with excellent preservation of tissue viability and sensation. The inferior pedicle and inverted T technique have been reported to be the preferred technique of 56% of surgeons responding to a survey in 2002 [8]. However, as with all breast reduction and mastopexy techniques, complications may occur.

A 10-year review [9] revealed an overall complication rate of 11.4% but with a low incidence of specific complications (e.g., hematoma 0.3%, nipple or pedicle loss 0.8%, wound dehiscence 4.6%, sensory loss 1.3%, hypertrophic scars 3.3%). It is effective for large volume reductions, over 1000 g, with no increase in complications compared with smaller resections [10].

Seventy-two percent of patients who became pregnant were able to lactate [9], and a systematic review found that techniques that keep the column of subareolar breast parenchyma intact

appear to provide a greater likelihood of breastfeeding success [11]. However not all studies use the WHO definition of being able to breastfeed exclusively for 6 months.

Minor complications include temporary circulatory embarrassment, delayed healing, stitch abscesses, wound infection, and hematoma. Fat necrosis should hopefully be avoided if vascularity has been preserved, and likewise careful preoperative measurement and planning will avoid the creation of dog ears.

Significant complications are fortunately relatively uncommon with this technique. Major tissue loss and nipple necrosis and sensory loss may however occur and should be managed expectantly allowing natural recovery to occur.

Patients should be adequately counseled preoperatively and should understand that perfect symmetry cannot be guaranteed with regard to the final shape, volume, or projection. Despite the surgeon's best efforts, secondary surgery may be needed to correct asymmetry, dog ears, or problem scars. A recognized longer-term concern however is the "bottoming out" of the inferior part of the breast for which proposed solutions include the use of dermal slings or synthetic material, such as biocompatible mesh [12, 13].

26.7 Conclusion

The popularity of the inferior pedicle for both breast reduction and mastopexy is related to its dependable vascularity and innervation to the nipple which preserve viability, sensation, and in a large proportion of cases, lactational function. The technique is straightforward to learn and perform, with dependable results even for large volume resections. It is indicated for breast reduction and symmetrization procedures after contralateral post-mastectomy reconstruction. Familiarity with the blood and nerve supply of the parenchyma, which is the basis of the inferior/central pedicle, enables the surgeon to design oncoplastic resection of some cancers with good cosmetic results (Figs. 26.30 and 26.31).

Tips and Tricks

It is not necessary to depend on a standard pattern for preoperative planning and marking: the step-by-step technique described here allows the procedure to be individualized to each breast, without the need for a pattern. In contralateral symmetrisation after breast reconstruction match the intended position of the nipple and areolar complex to the best position for the nipple on the reconstructed side.

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Additional illustrations were specially drawn by David Gault FRCS. All the photographs are the author's own.

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Selected Further Reading

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