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Breast reconstruction with gluteal artery perforator flaps☆

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Summary *Background*: Several alternatives exist for breast cancer reconstruction with perforator flaps. For those patients in whom the buttock is the best choice as a source for autologous tissue, the IGAP and SGAP flaps are an excellent option. These flaps allow the reliable transfer of skin and soft tissue from the buttock without the associated donor site morbidity of a muscle flap.
Indications: Most women requiring tissue transfer to the chest from the buttock for breast reconstruction or other reasons are candidates for IGAP or SGAP flaps. Do to an improved donor site contour and scar, we now prefer to use the IGAP to the SGAP flap. Absolute contraindications specific to perforator flap breast reconstruction in our practice include history of previous liposuction of the donor site or active smoking (within 1 month prior to surgery).
Anatomy and technique: IGAP and SGAP flaps are based on perforators from either the superior or inferior gluteal artery. These perforators are carefully dissected free from the surrounding gluteus maximus muscle, which is spread in the direction of the muscle fibres and safely preserved. The vascular pedicle is anastomosed to recipient vessels in the chest and the donor site closed primarily.
Conclusions: IGAP and SGAP flaps allow the safe and reliable transfer of tissue from the buttock for breast reconstruction as an alternative to soft tissue transfer from an abdominal donor site or even as a first choice in selected patients.

Breast reconstruction with the use of autologous tissue allows the creation of a new breast which looks and feels most like a normal breast. The abdomen is the most commonly used soft tissue donor site. However, in patients in which the abdomen is not a viable site to provide soft tissue for a free flap, or in patients with a greater availability of tissue in the buttock than the in the abdomen, the IGAP and SGAP flaps provide an excellent option.

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The gluteal artery perforator flap was first introduced by our group in 1993.[1] As with other perforator flaps, donor site morbidity is minimal and no sacrifice of muscle is required. Initially, we used the superior gluteal artery perforator (SGAP) flap when the buttock was needed as a donor site. Recently, the inferior gluteal artery perforator (IGAP) flap has become our flap of choice because of an improved donor site contour and scar.[2,3]

Indications

Women who require tissue transfer to the chest for breast reconstruction or other reasons may be candidates for IGAP or SGAP flaps. Those in whom the abdomen cannot be used as a donor site for site-specific reasons, or who have more tissue in the buttock area than in the abdomen, are the best candidates. A significant amount of tissue usually may be harvested and, in our experience, the average final inset weights of our GAP flaps were slightly greater than weights of the mastectomy specimens removed.

As with abdominal perforator flaps, we prefer to have the patient complete any radiation therapy to the chest prior to surgical breast reconstruction. While the perforator flaps usually tolerate radiation well, a superior long-term result is obtained typically in reconstructions performed after rather then before chest wall radiation. This spares the flap the damaging effects of radiation and allows the removal of any thick and stiff irradiated chest wall skin and its replacement with soft and unradiated abdominal skin and soft tissue.[4]

Absolute contraindications specific to GAP flap breast reconstruction in our practice are similar to those for abdominal perforator flaps, and include history of previous liposuction at the donor site or active smoking (within 1 month prior to surgery).

Anatomy

The SGAP and IGAP flaps are based on perforators from the superior and inferior gluteal arteries and veins, respectively.

The superior gluteal artery arises from the internal iliac artery and exits the pelvis superior to the piriformis muscle. It enters the gluteus maximus muscle approximately one third of the distance along the line between the posterior superior iliac spine and the greater trochanter (Fig. 1).

The inferior gluteal artery is a terminal branch of the internal iliac artery and leaves the pelvis through the greater sciatic foramen inferior to the piriformis muscle. The artery is accompanied by the greater sciatic nerve, the internal pudendal vessels and the posterior femoral cutaneous nerve. The course of the inferior gluteal vessels is more oblique through the gluteus maximus muscle substance than the course of the superior gluteal vessels. Therefore, the length of the IGAP pedicle is typically longer than that of the SGAP. Between

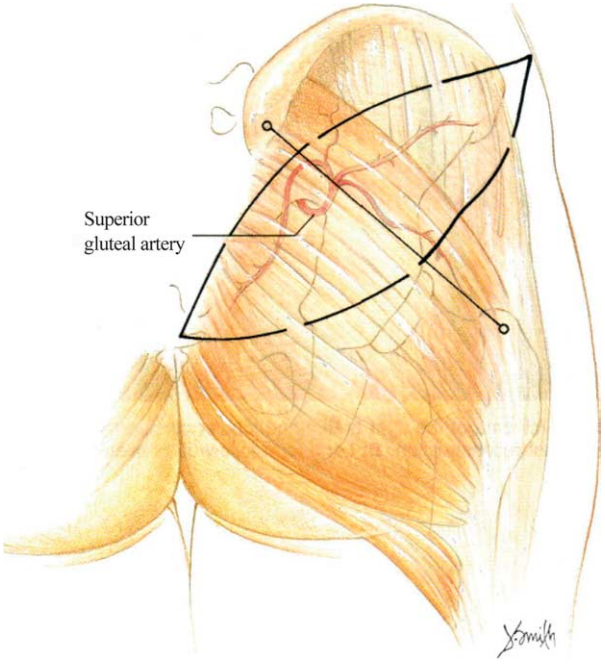


Figure 1 Skin island location of the SGAP flap. The superior gluteal artery may be found one third of the distance from the posterior superior iliac spine to the greater trochanter.

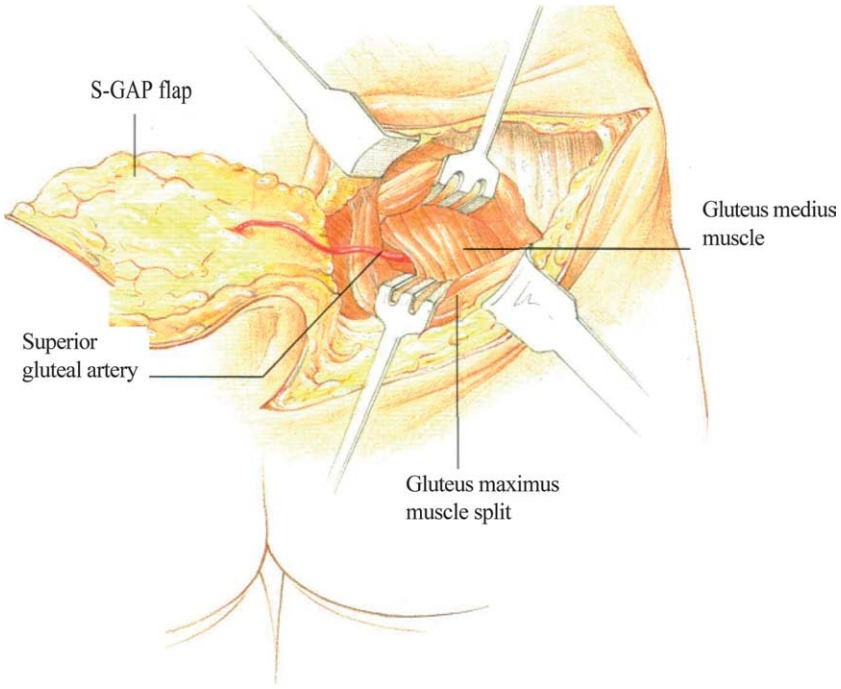


Figure 2 Superior gluteal vessel dissection through the retracted gluteus maximus muscle.

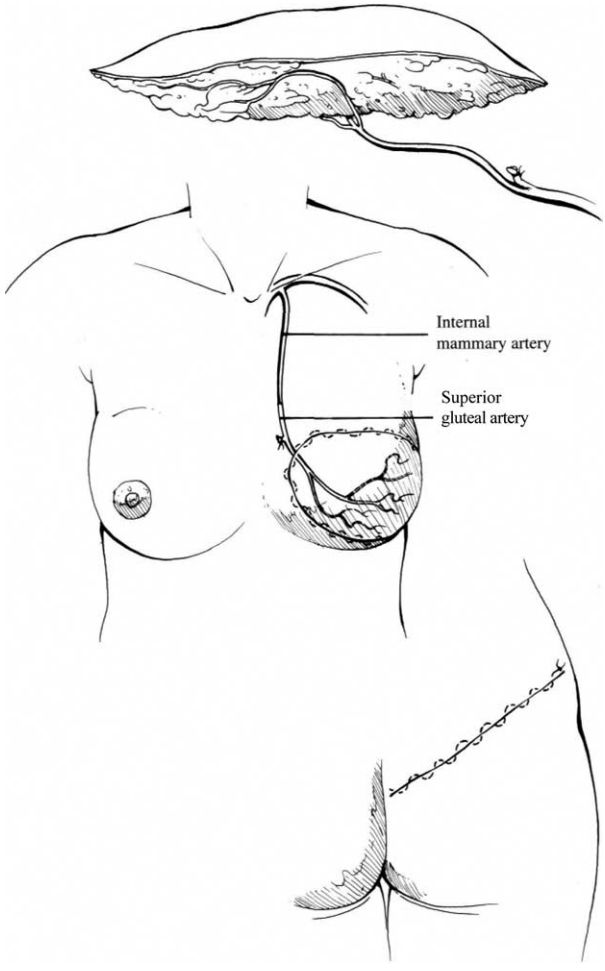
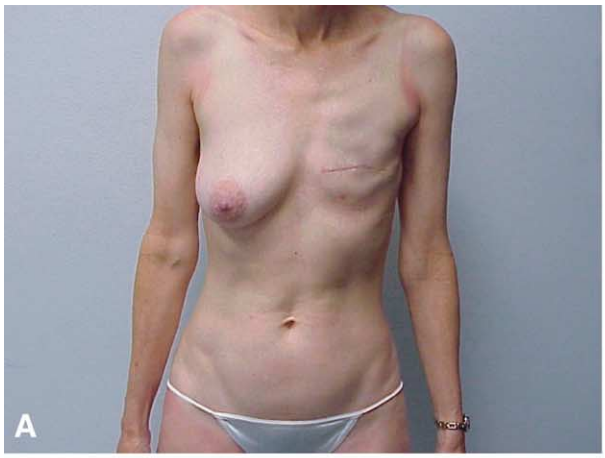


Figure 3 SGAP flap. (A, B) Preoperative views and markings. (C, D) Intraoperative views of flap and superior gluteal artery perforator vessels. (E, F) Postoperative views of patient approximately 21 months after initial surgery.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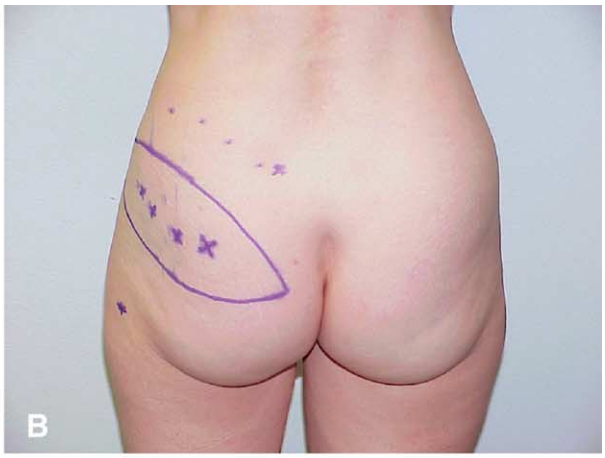
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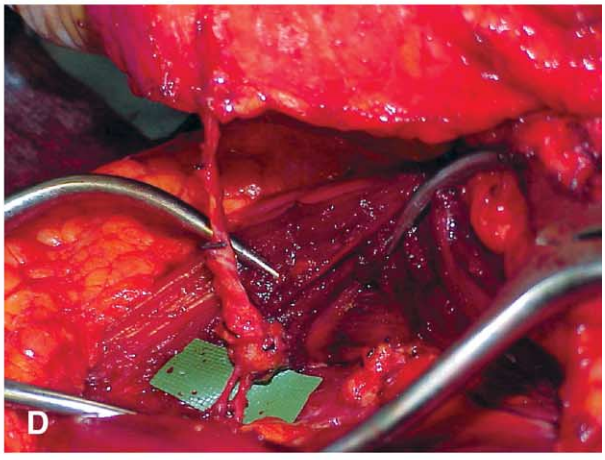
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E


F

two and four perforating vessels from the inferior gluteal artery will be located in the lower half of each gluteal muscle (Fig. 2).

Perforating vessels that nourish the medial portions of the buttock have relatively short intramuscular lengths while perforators which nourish the lateral portions of the overlying skin paddle must travel through the muscle in a more oblique manner. Therefore, pedicles based on perforators from the lateral aspects of the skin paddle tend to be longer than those based on more medial perforators.

Surgical technique

The patient is usually seen in the office 1 day prior to surgery. The surgical plan again is reviewed with the patient, and any remaining questions answered.

The chest is marked in the standard fashion. The midline and the inframammary crease on both sides are marked. For patients undergoing immediate breast reconstruction, suggested skin markings for the surgical oncologist are drawn on the breast, which include marks around the nipple areolar complex and previous biopsy site. For patients with large breasts, marks may be made which are similar to those of a vertical breast reduction. For patients with smaller breasts, a circle around the nipple areolar complex with a small lateral extension may suffice (Fig. 3).

For the SGAP flap markings, the patient is placed in prone position and the Doppler probe used to find perforating vessels from the superior gluteal artery. These are usually found approximately one third of the distance on a line from the posterior superior iliac crest to the greater trochanter. Additional perforators may be found slightly more lateral from above. The skin paddle is marked in an oblique pattern from inferior medial to superior lateral to include these perforators (Fig. 4(A) and (B)).

For the IGAP flap, the gluteal fold is noted with the patient in a standing position. The inferior limit of the flap is marked 1 cm inferior and parallel to the gluteal fold. The patient is then placed in the prone position and the Doppler probe used to find perforating vessels from the inferior gluteal artery. An ellipse is drawn for the skin paddle to include these perforators, which roughly parallels the gluteal fold with dimensions of approximately 8×18 cm (Fig. 5(A)–(C)).

The operating room table is turned 180° to allow the surgeons to sit comfortably with legs under the table during the microvascular anastomosis. The patient is placed in the lateral decubitus position and the patient is prepped such that the sterile field includes the side of the chest to be reconstructed, the ipsilateral buttock, and the entire ipsilateral lower extremity. This permits a two team approach and allows greater movement of the lower extremity during the procedure to provide better exposure as needed during the operation.

The chest vessels are prepared in the standard fashion. The internal mammary artery (IMA) and vein (IMV) are almost always used as recipient vessels to allow better medial flap placement for GAP flaps due to the relatively shorter pedicle length of the flaps. It is possible to use the thoracodorsal vessels for primary anastomosis of the IGAP flap due to its slightly longer pedicle length. However, the pedicle length is variable and medial placement of the flat may be limited in some cases if the thoracodorsal vessels are used. The thoracodorsal vessels may also be preferred as recipients in some cases of partial breast reconstruction for lateral lumpectomy defects or in other specific circumstances.

We approach the IMA in the second or third interspace. Occasionally, a large perforating artery and vein from the internal mammary vessels may be found and these vessels used as the recipients in the chest. The IMA and IMV are usually between 2.5 and 3 mm in size. Sometimes a second vein between 1.5 and 3 mm may be encountered. In the case in the narrow interspace, a small portion of the rib cartilage above and below may be removed for better exposure and insetting of the pedicle. Care must be taken to preserve at least small lengths of the side branches of the IMA and IMV, which may be used for improving any size mismatch, which may occur with the flap vessels. This is especially important with the IMV, as the gluteal vein is often very large and may measure 4 mm or even 5 mm in diameter.

The skin incisions are made and bovie electrocautery is used to divide the flap down to the muscle of the gluteus maximus. Significant bevelling is used as needed in the superior and inferior direction to harvest enough tissue for a good breast reconstruction. The flap is elevated from the muscle in the subfascial plane and the perforators approached beginning from lateral to medial. It is preferred to use a single large perforator, if it is present, but several perforators which lay in the same plane and the direction of the gluteus maximus muscle fibres can be taken together as well. Subfascial elevation is also performed from

Figure 4 (A) and (B) Preoperative marking of patient to undergo left breast reconstruction with SGAP flap. (C) and (D) Intraoperative views of SGAP flap and pedicle. (E) and (F) Views of patient 3 months following second stage and nipple creation.

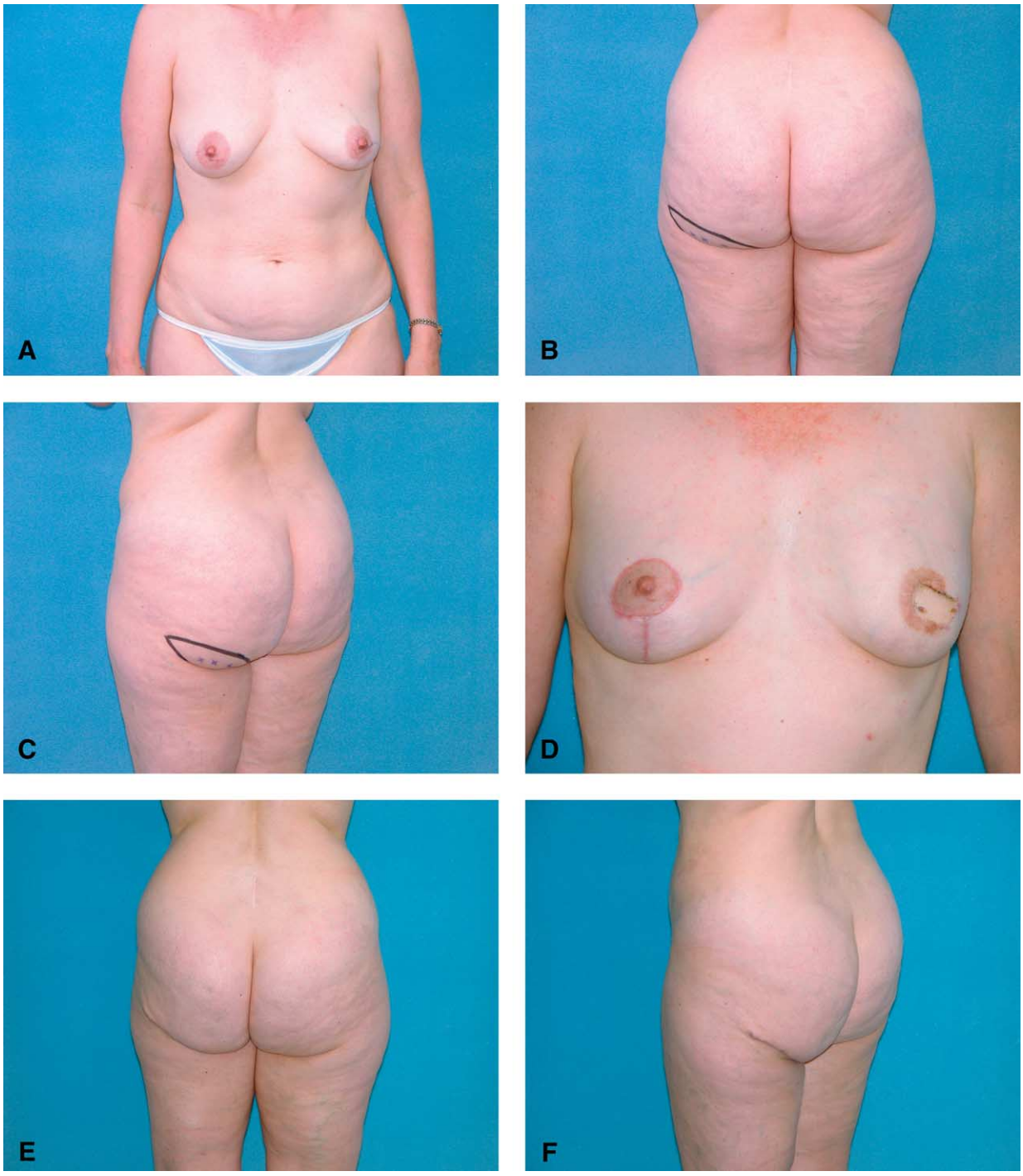

Figure 5 (A)–(C) Preoperative markings of patient to undergo left breast reconstruction with left IGAP flap. (D)–(F) Views of patient 3 months after reconstruction of left breast with IGAP flap.

medial to lateral to ensure that the largest perforator is found until the flap is islanded out. The muscle is then spread the direction of the muscle fibres in the perforating vessels are meticulously dissected free (Fig. 2). The dissection continues until both the artery and the vein are of sufficient size to be anastomosed to the recipient vessels in the chest. The artery is the limiting factor in this dissection. The arterial perforator is visualised and preserved as it enters the main superior or inferior gluteal artery. The arterial and venous diameters for anastomosis are usually 2.0–2.5 and 3.0–4.5 mm, respectively.

When harvesting the IGAP flap, care must be taken to preserve the lighter coloured medial fat had which overlies the ischium. Preservation of the

fat pad will prevent possible donor site discomfort when sitting.

If the chest vessels are ready the recipient site is stapled closed temporarily and a sterile Op site dressing used to cover the wound. The gluteal artery and vein are divided and the flap harvested and weighed. The skin and fat overlying the gluteus maximus muscle are elevated superiorly and inferiorly to allow solid advancement of the soft tissues and approximation of the fascia of the donor site. The donor site is closed in layers over a suction drain, approximating the fascia and skin separately (Fig. 4(C) and (D)).

The patient is then placed in the supine position on the operating table and the recipient site is again prepped and draped. The staples are removed from the chest wound and the anastomosis performed under the operating microscope. The flap is inset over a suction drain into the defect with attention taken to place the flap as far inferiorly and medially as possible and care taken not to twist or kink the pedicle.

Postoperative care

The postoperative care is the same as with the DIEP flap. Postoperatively, the patient is observed in the SICU overnight and transferred to the floor on the morning of the first postoperative day. As the postoperative pain is similar to that with other perforator flaps and is significantly less than with a TRAM flap reconstruction,[5] oral pain medications are given also beginning on postop day 1. The patient ambulates on postoperative day 2 and is discharged home on postoperative day 4.

A second stage revision and nipple creation are performed under local anaesthesia with intravenous sedation in the operating room between 8 and 12 weeks after the initial surgery to further refine and finish the appearance of the breast. Any revisions at the donor site, such as dog ear removal or liposuction, are also performed at this time.

The drain at the donor site usually must be left in place for several days longer than with an abdominal donor site.

Results

A review of 31 consecutive IGAP flaps was undertaken by our group.[2] Of these flaps, 20 (65%) were performed secondary to inadequate abdominal tissue. Six (19%) were performed due to patient choice of the donor site over abdominal donor site, two (6%) were second reconstructions after previous DIEP flap, two (6%) were performed after previous failed TRAM flap, and one (3%) was performed in a patient with a history of abdominal liposuction. Sixteen (52%) of flaps were for primary reconstruction, six (19%) were for secondary (delayed) reconstruction, and nine (29%) were performed after previous implant reconstruction.

The average IGAP flap harvest weight was 425 g for the initial flap and 407 g after the flap was trimmed and inset. The IGAP flap average weight was 124% of the mastectomy specimen average weight.

Eighty-two percent of the anastomoses were performed to the IMA and vein, 8% were performed to an internal mammary perforator, and 10% were performed to thoracodorsal vessels as recipients. The average time of operation was 5.3 h (range 3.0–9.5 h), and the hospital length of stay was an average of 4.2 days (range 4–7 days).

Complications

In a review of 170 GAP flaps performed by our unit, the incidence of complications was low. The overall take-back rate was approximately 8% with a 6% rate of vascular complications. The total flap failure rate was approximately 2%. Donor site seroma occurred in 2% of patients and approximately 4% of patients required revision of the donor site.[6]

In the review of 31 consecutive IGAP reconstructions, there was one flap loss secondary to venous thrombosis which occurred on postoperative day 4. This patient had undergone staged, bilateral in-the-crease IGAP reconstructions because the abdomen was deemed insufficient to provide enough tissue for two breast reconstructions. A successful DIEP flap was subsequently performed for the unilateral reconstruction, with an initial weight of 589 g reduced to 473 g after inset. This compared to the final inset weights of 495 and 530 g with the in-the-crease IGAP flaps from each buttock with this particular patient.

Two additional patients were returned to the operating room after the completion of the initial reconstruction for successful treatment of venous insufficiency. These were both thought to be secondary to twisting or kinking of the flap vein away from the site of anastomosis. One patient developed a haematoma, which resolved without intervention. Two patients had problems with wound healing and wound breakdown at the recipient site. Both patients had undergone previous radiation therapy to the chest wall and both eventually healed their wounds. One patient suffered wound breakdown at the donor site which

healed with conservative wound care. Some patients have reported initial minor adjustments to their sitting position, although all such complaints have resolved by 3 months postop.

Summary

Breast reconstruction using autologous tissue can be performed in a safe and reliable fashion with perforator flaps. Donor site morbidity may be minimised, and the muscle at the donor site preserved. The buttock is an excellent choice as a donor site and can provide ample tissue in most patients. Due to the improved donor site contour and scar, the IGAP has become our flap of choice when tissue from the buttock is required.

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