

# Potential problems with the transverse rectus abdominis myocutaneous flap in breast reconstruction and how to avoid them

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**Summary**—The transverse rectus abdominis myocutaneous flap offers a versatile and reliable technique of repair provided certain anatomical, physiological and surgical principles are closely followed. The operative technique and technical details are described and discussed.

A recent innovation in breast reconstruction is the use of a transverse rectus abdominis myocutaneous flap (Gandolfo, 1982; Hartrampf *et al.*, 1982a,b; Scheflan and Dinner, 1983a,b). The advantages of this method include an ideally positioned donor site scar, a breast completely reconstructed with autogenous tissue and the convenience of operating on a patient lying supine on the operation table. There is also the added benefit of an abdominoplasty. This flap, however, is not without complications, particularly if certain clinical and technical details are neglected.

## Operative procedure

The transverse abdominal skin paddle is incised, beveling the incision upwards along its superior margin to avoid cutting nearby perforating vessels. The skin paddle is then raised from the contralateral abdominal wall superficial to the fascia. The dissection is extended medially to the midline, noting the location of the myocutaneous perforators coursing through the anterior rectus sheath as they are cauterised and cut. The pedicle side of the flap is then elevated from lateral to medial until the myocutaneous perforators are identified approximately 4 cm medial to the lateral border of the rectus muscle. The dissection stops here. The upper abdominal apron is then elevated to approximately 2–3 cm above the costal margin. The anterior rectus sheath is then incised vertically over the midportion of the rectus muscle that will be used as the carrier from the costal margin above to the superior border of the flap below. The incision is extended down medial and lateral to the subcutaneous pedicle preserving 3–5 cm of fascia laterally and 1 cm medially. The incised edges of the anterior rectus sheath are next elevated off the

muscle medially and laterally. The anterior rectus sheath is firmly attached to the tendinous intersections in the muscle: indeed the muscle may be inadvertently transected easily at these points. The rectus muscle is then freed inferiorly.

The deep inferior epigastric vessels are identified under the lateral edge of the muscle roughly 3–4 cm above the pubic ramus. It is important not to separate the loose attachments of these vessels to the deep surface of the rectus muscle and to prevent venous stasis in the flap, these vessels should not be ligated until the complete flap is ready for transfer. The rectus muscle, the edges of the fascia and the overlying skin are sutured with interrupted 3/0 Vicryl sutures to prevent separation while manipulating the flap.

The mastectomy wound is now prepared by incising along the new inframammary line, releasing any scar tissue and forming an adequate tunnel to allow the flap to be brought up without any risk of constriction.

The deep inferior epigastric vessels are ligated and divided. The flap is tunnelled to the mastectomy wound and is orientated on the chest with the distal portion of the flap (Zone 4) placed at the highest point. A portion of Zone 4 is usually discarded and a segment of Zone 3 is de-epithelialised to reconstruct any infra-clavicular or anterior axillary fold contour defect. Alternatively, this segment may also be folded on itself to add bulk and contour to the breast mound. The breast wound is closed in two layers and a drain is brought out through a separate stab incision.

The fascial defect on the abdominal wall is repaired in two layers using Marlex mesh sutured to the deep surface of the anterior rectus sheath both laterally and medially. The incised edges of the anterior rectus sheath are then closed. Primary

closure of the anterior rectus sheath over the Marlex mesh is usually possible when the flap is based on a single rectus abdominis muscle.

The operating table is flexed to 40°. A Y-shaped incision is made at the new location of the umbilicus. The umbilical stalk is now relocated and sutured to the fascia in the midline before it is brought through the skin. Two suction drains are placed in the depths of the wound. The abdominal skin wound is closed with 3/0 Vicryl sutures between the deep surface of the panniculus and the underlying fascia, to reduce deadspace, followed by interrupted 2/0 and 3/0 Vicryl deep dermal sutures and 3/0 Prolene pull-out suture for the skin.

The patient is nursed post-operatively in a "semi-Fowler's" position with the legs wrapped in Ace bandages and a urinary catheter retained for 24 hours. The patient is allowed to walk within 2-5 days of operation.

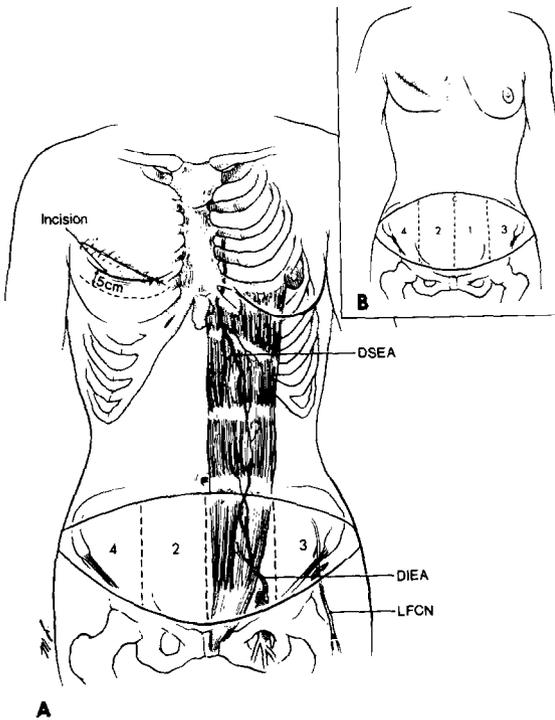


Fig. 1

Figure 1—(A) A skin paddle below the umbilicus is designed suitable for reconstruction of a small breast in a woman with minimal skin laxity. Note the Zones (numbered 1-4), the location of the deep epigastric vessels, (DIEA DSEA), the lateral femoral cutaneous nerve, (LFCN) and the incision for the new inframammary crease (5 cm higher than the opposite side). (B) A skin paddle extending above the umbilicus is obligatory in the presence of a previous Pfannenstiel incision or when a large breast must be reconstructed.

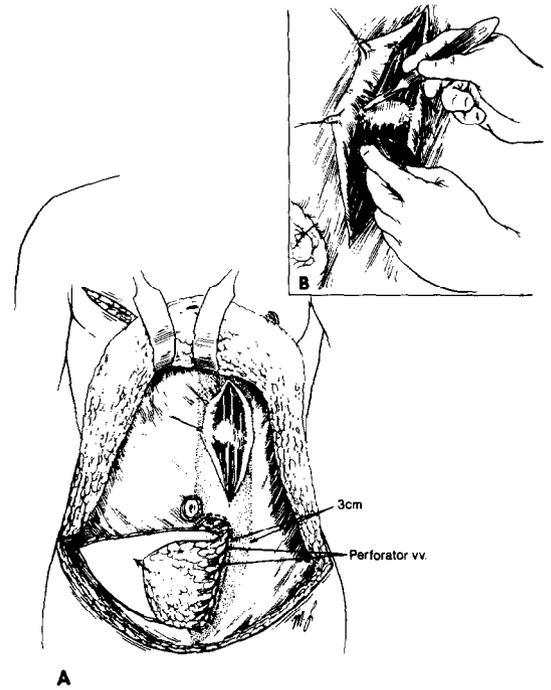


Fig. 2

Figure 2—(A) The skin paddle has been elevated and the anterior rectus sheath is partially opened. (B) Careful dissection is required at the tendinous intersections and is best done by scalpel dissection.

**Technical details which reduce unsatisfactory results**

*Pre-operative evaluation*

Patients with an obese abdominal panniculus are poor candidates for this procedure since the myocutaneous perforators may be an inadequate size for the size and thickness of the skin paddle. Obese patients also face an increased risk of wound complications such as infection, haematoma, hernia and deep vein thrombosis. Moderately obese patients should follow a weight reduction programme and pre-operative abdominal exercises will benefit all patients. It is possible that patients who smoke may be at greater risk from flap necrosis (Scheflan and Dinner, 1983a). Severe irradiation injury of the chest wall may probably be a contraindication, since this flap does not have an over-generous blood supply (Scheflan *et al.*, 1982).

*Pre-operative flap design*

The flap should be based on the contra-lateral rectus muscle to allow a more gentle arc of rotation, requiring only two 180° flips (Fig. 4). If

the ipsi-lateral muscle is used the risk of kinking increases as the flap must be rotated 180° after it has been flipped 180°.

The dimensions of the skin paddle should be determined pre-operatively with the patient standing. A flap outlined entirely below the umbilicus will usually be adequate to reconstruct a small breast (Fig. 1A). The dimensions of the flap are determined primarily by the size of the contra-lateral breast, but the amount of tissue taken should never be so great as to make it impossible to close the donor wound primarily.

Earlier abdominal scars may dictate the dimensions of the skin paddle and the muscle chosen as the carrier. A patient who has had a classic

4, therefore, only a hemi-elliptical paddle may be used. The presence of a subcostal incision or paramedian incision forces one to use the opposite rectus muscle.

The new inframammary crease should be placed 2.5-5 cm above that on the contra-lateral side, since the new crease will be lowered to a greater extent by closure of the abdominal wound (Fig. 1A).

*Identification and protection of the myocutaneous perforating vessels*

The incision along the superior edge of the skin paddle in Zone 1 (overlying the rectus muscle carrier) should be bevelled superiorly to encompass as many perforators as possible (Fig. 2A). The subcutaneous pedicle over the anterior rectus sheath will usually be about 2 cm wide below and about 5 cm wide above to include the maximum number of perforating vessels. The major perforators lie along both sides of a line about 2-3 cm lateral to the midline (Fig. 2A). Zones 4 and 2 are

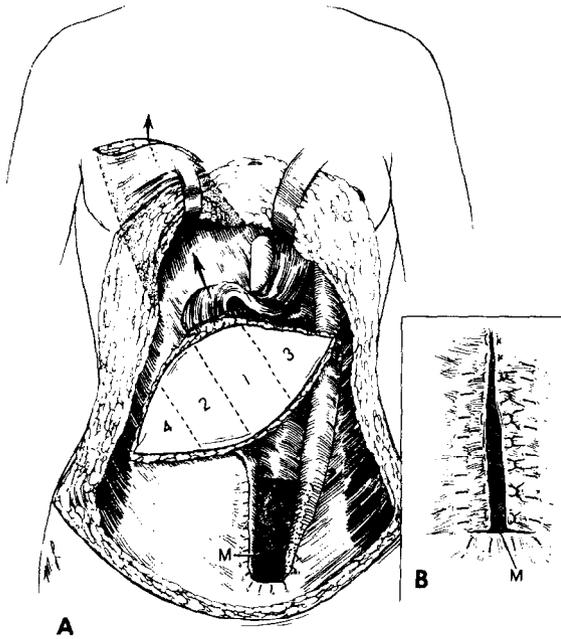


Fig. 3

Figure 3—(A) A large subcutaneous tunnel connects the donor and recipient wounds. A sheet of Marlex mesh is inserted under the cut edges of the anterior rectus sheath and sutured in position. (B) Closure of the anterior rectus sheath over the Marlex mesh just before the sutures are tied.

Pfannenstiel incision must have the superior edge of the skin paddle placed above the umbilicus (Fig. 1B) because the anterior rectus sheath would have been incised transversely and elevated off the rectus muscles almost to the umbilicus. The myocutaneous perforators immediately around the umbilicus thus become critical to the survival of the skin paddle, since they may be the only intact perforating vessels. A lower abdominal midline incision prevents the use of the skin in Zones 2 and

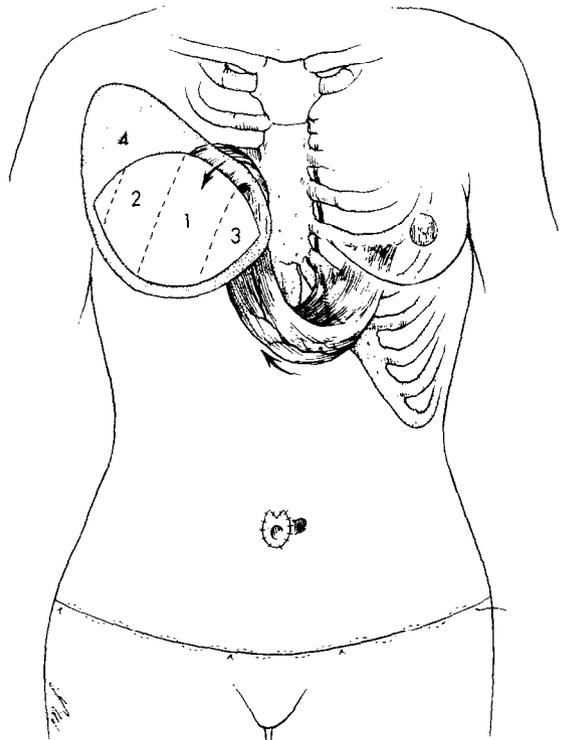


Fig. 4

Figure 4—The final position of the flap is shown. Note the orientation of the skin paddle and muscle carrier. The position of the umbilical skin is shown in relation to the base of the stalk that deviated to the donor muscle side.

elevated first to help identify the site of these myocutaneous perforators as their location will be almost identical on the muscle-carrier side.

The subcutaneous tunnel between the abdominal and chest wounds must be wide enough to allow easy passage of the flap without shearing the skin paddle from the muscle-carrier (Fig. 3). The skin paddle should also be temporarily secured to the underlying fascia and muscle to prevent shearing (Fig. 2A).

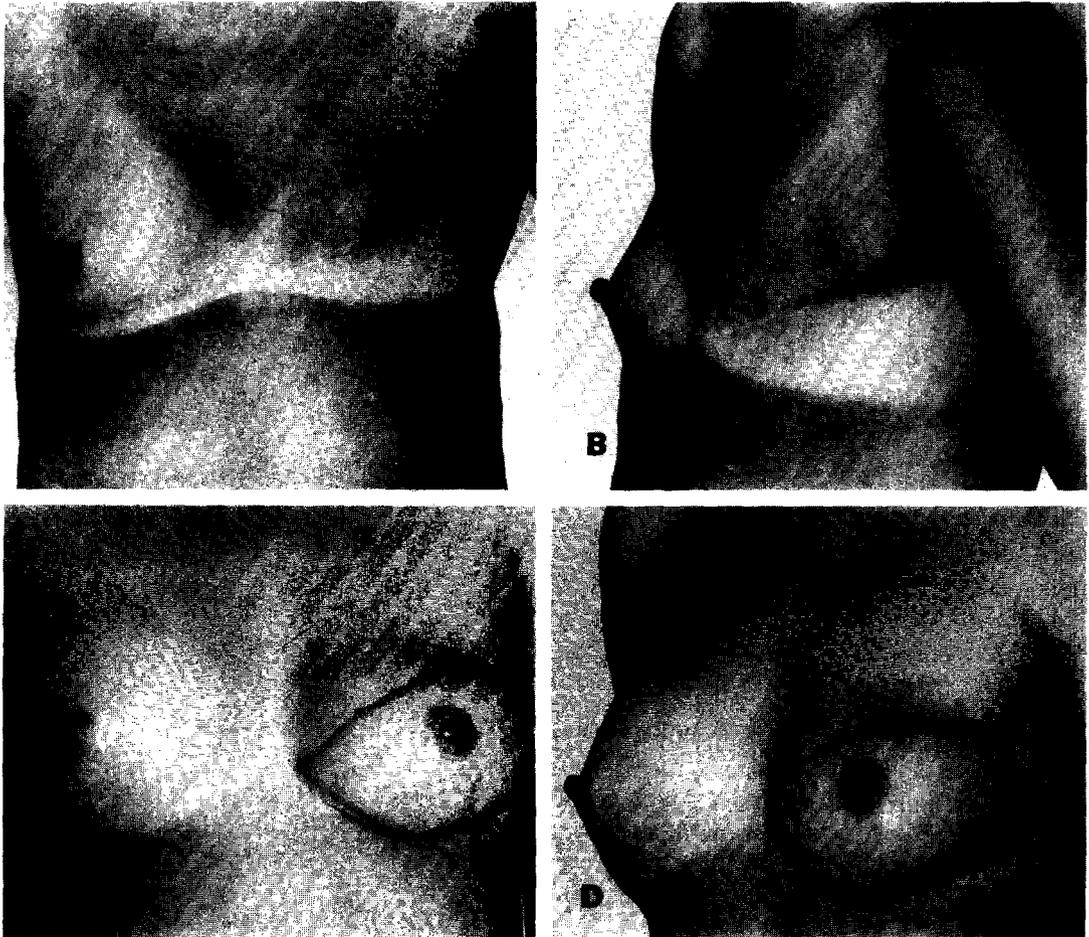
#### *Protection of the cutaneous nerves*

The lateral femoral cutaneous nerve lies just beneath the fascia of the external oblique muscle and courses downwards around the anterior aspect of the anterior superior iliac spine (Fig. 1A). Injury

to this nerve is avoided by dissecting superficial to the fascia until the dissection is beyond the anterior superior iliac spine and by judicious use of the cautery.

#### *Abdominal wall closure*

To reduce the risk of a post-operative abdominal wall hernia, an adequate margin of the anterior rectus sheath should be preserved both medially and laterally. This requires accurate localisation of the myocutaneous perforators so that only a narrow strip of fascia is carried with the flap. In most cases, about 3–5 cm of fascia laterally and 1 cm medially are preserved, which allows a two-layer fascial closure with a sheet of Marlex mesh in between (Fig. 3B). Schefflan and Dinner



**Fig. 5**

Figure 5—(A, B) Pre-operative photographs illustrating the contour defect following a modified radical mastectomy on the left side. (C, D) Late post-operative result following a contra-lateral transverse rectus abdominis myocutaneous flap reconstruction. The areola was reconstructed with a full-thickness skin graft from the upper inner thigh and the nipple is a shared composite graft from the contra-lateral side. An augmentation mammoplasty was also performed on the contra-lateral normal breast.

(1983a) reported a high incidence of abdominal wall hernia in their early cases that was completely corrected with the use of Marlex. Closure of the anterior rectus sheath over Marlex mesh may also prevent exposure of the Marlex in cases of a superficial wound infection. Should both muscles be used for bilateral reconstruction, the Marlex mesh must be used as a single layer closure.

#### *Identification and protection of the vascular pedicle*

The deep inferior epigastric vessels are located beneath the lateral edge of the rectus muscle 3–4 cm above the pubic symphysis (Fig. 1A). The vessels lie in the pre-peritoneal fat beneath a thin layer of fascia and may be inadvertently separated from the deep surface of the rectus muscle. The superior epigastric vessels need not be identified in the majority of cases but they should be protected as they course medially beneath the costal margin (Fig. 1A).

#### *Rectus muscle protection*

The anterior rectus sheath receives fibrous contributions from tendinous intersections of the rectus muscle. Care must be taken while elevating the anterior rectus sheath since the rectus muscle may easily be transected at a tendinous intersection (Fig. 2B). A scalpel is preferred to divide carefully these fibrous contributions flush with the rectus sheath.

#### *Prevention of venous stasis in the flap*

The deep inferior epigastric vessels are not ligated and divided until just prior to transfer of the entire flap to its new position on the chest wall.

The distal portion of the flap (Zone 4) should be placed in the most superior position of the mastectomy wound to minimise venous stasis in this portion of the skin paddle (Fig. 4). Perhaps more important, the rectus muscle is only slightly rotated to minimise torsion of the muscle pedicle (Fig. 4).

#### *Prevention of a poor abdominoplasty*

The base of the umbilicus is distorted as a consequence of the fascial repair and this must be

adjusted when relocating the umbilicus in its new site (Fig. 4).

To minimise dead space under the abdominal flap the deep surface of the abdominal panniculus is sutured to the abdominal fascia, suction drainage is instituted and the operating table is flexed to 40°.

When meticulous attention to detail is given, the final result can be very rewarding (Fig. 5).

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