

THE RECTUS ABDOMINIS MYOCUTANEOUS FREE FLAP

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Since the first successful composite tissue transfer with microvascular anastomosis was performed by Harii and his colleagues in 1972, the list of available free flap donor sites has grown steadily. More recently the potential of myocutaneous flaps has been enhanced by their use as free flaps.

The pattern of distribution of bleeding points from the anterior rectus sheath noted during abdominal lipectomy, led us to speculate on their possible use in the free flap transfer of vascularised abdominal fat.

Two attempts to transfer vascularised abdominal fat to the face based on these perforating vessels stimulated us to investigate further the blood supply of the anterior abdominal skin and fat by injection studies. This study culminated in the successful transfer of a free rectus abdominis myocutaneous flap based on the inferior epigastric vessels.



FIG. 1. Case 1. Four months after a vascularised fat graft to left cheek, just prior to operation on the right side of the face.

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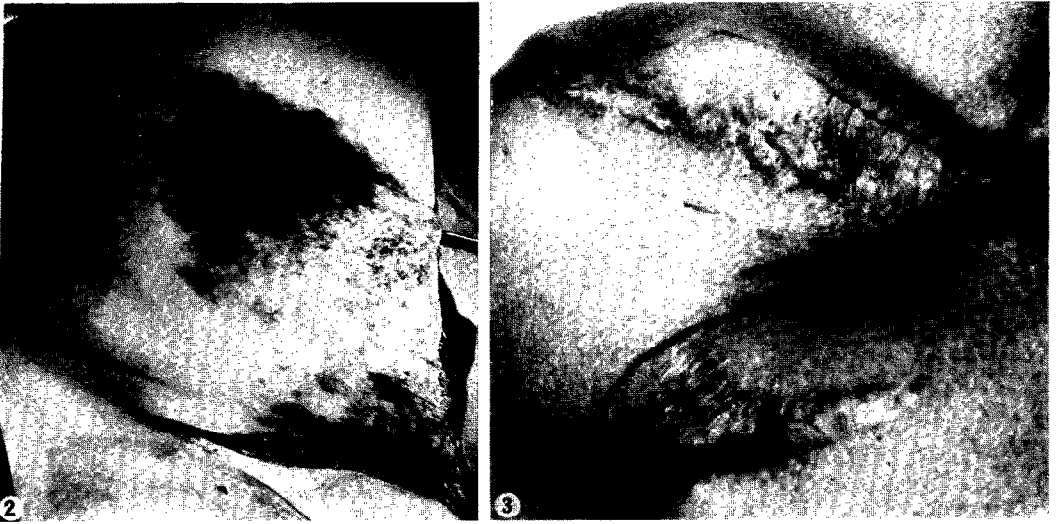


FIG. 2. Area of skin on the anterior abdominal wall stained after an injection of methylene blue into the right inferior epigastric artery.

FIG. 3. Case 2. Area of densely adherent scar in the right infraclavicular region.



FIG. 4. Right rectus abdominis myocutaneous flap marked out on the abdominal wall. Crosses indicate the site of two large perforators located with a Doppler probe.

CLINICAL OBSERVATIONS

Case 1. A 28-year-old woman with progressive atrophic lipodystrophy affecting the face and upper trunk was first operated upon in December 1978. A perforating artery and vein immediately to the left of the umbilicus was isolated as it emerged from the anterior rectus sheath. A piece of abdominal fat 12×12 cm was raised on this pedicle and transferred to the left side of the face through a facelift incision to fill out the contour defect. The perforating vessels, 0.5 mm in diameter, were anastomosed to the superficial temporal artery and vein. There was some doubt about the adequacy of the arterial input despite two revision anastomoses, but the fat transplant was left in place to act as a free graft, should the blood supply prove to be inadequate.

The result was good with no significant absorption after four months (Fig. 1) so the patient was readmitted and the opposite side of the face corrected in the same way. On this occasion the perforating vessels were traced well into the rectus muscle to gain extra vessel length. Again, after two revision anastomoses, only sluggish arterial input was seen, but the fat transplant survived, possibly as a free graft.

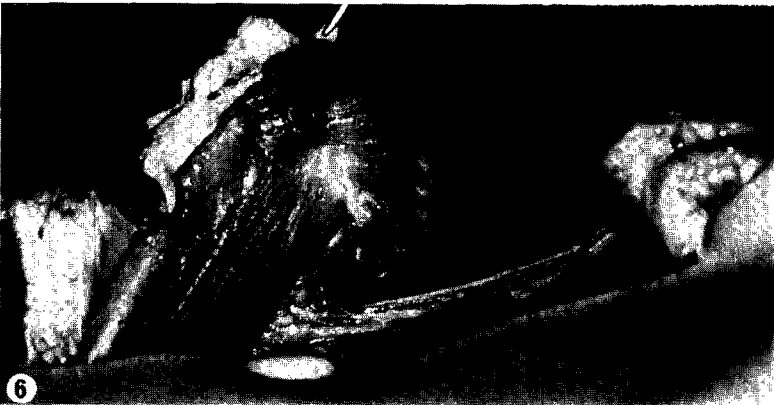


FIG. 5. Flap raised and the upper rectus incision completed (view from lateral aspect).

FIG. 6. Flap raised: beginning of the lower rectus incision. Clamps on superior epigastric vessels (view from medial aspect.)

A series of cadaver injection studies was then performed. The superior epigastric artery was clamped 5 cm above the umbilicus and the inferior epigastric artery injected with methylene blue. This perfused a large area of abdominal skin from the umbilicus to a point just lateral to the anterior superior iliac spine. A similar injection performed during the course of an abdominal lipectomy produced an identical picture (Fig. 2).

Case 2. A 27-year-old man presented with a contour defect in the right infraclavicular region, the result of a shotgun wound sustained four years earlier. The clavicular head of pectoralis major had been destroyed by the injury (Fig. 3) and the residual tender scar was adherent to the subclavian artery.

In March 1979, an area of scarred skin measuring 15×5 cm was excised and the subclavian artery explored. An acromiothoracic artery 5 mm in diameter arising directly from the subclavian was prepared. As no suitable local veins could be found the external jugular vein was mobilised and brought into the infraclavicular wound. A rectus abdominis myocutaneous flap, measuring 15×8 cm was marked out (Fig. 4). A midline abdominal incision passing to the right of the umbilicus was made to expose the right rectus sheath. This was divided longitudinally at its medial edge and the rectus abdominis muscle raised with the anterior sheath and

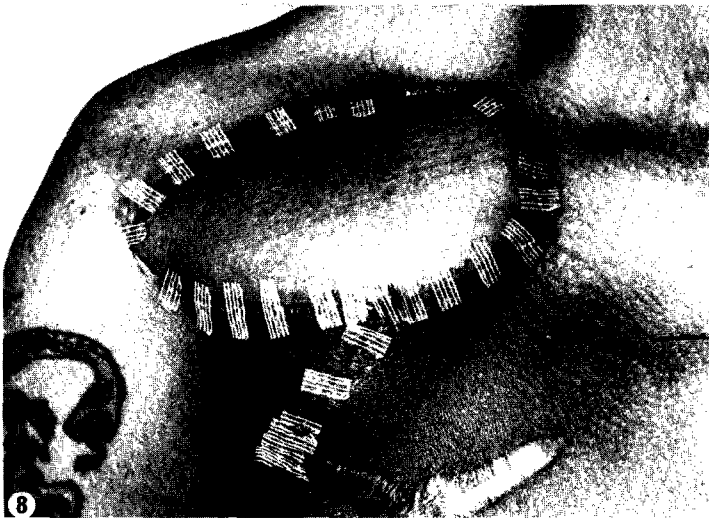


FIG. 7. Flap isolated on an inferior epigastric vascular pedicle.

FIG. 8. Viable flap two weeks after insertion and vascularisation in the right infraclavicular region.

overlying skin. The inferior epigastric vessels were isolated and several perforating vessels were noted entering the deep surface of the rectus muscle.

The rectus muscle and its anterior sheath were then divided level with the upper border of the flap and the flap raised from lateral to medial just superficial to the deep fascia (Fig. 5). When the lateral margin of the anterior rectus sheath was encountered it was incised sagittally and the rectus muscle lifted out of its sheath attached to the flap (Fig. 6). The rectus muscle and anterior sheath were then transected just above the lower border of the skin flap leaving the flap attached only by its vascular pedicle (Fig. 7). The circulation in the flap was excellent and gave no cause for anxiety.

The composite myocutaneous flap was then transferred to the right infraclavicular defect with a vascular pedicle, 5 cm in length. Microvascular anastomoses of the 3 mm inferior epigastric artery to the 5 mm acromiothoracic artery and a 3 mm vena comitans to the external jugular vein were then performed.

The defect 6 × 6 cm in the anterior rectus sheath was repaired with Marlex gauze mesh. The abdominal wound was then closed directly by skin advancement and a suction drain inserted.

Postoperatively the circulation in the flap was "hyperdynamic" for 48 hours, perhaps due to the large calibre of the arteries used, but soon settled to give a normal appearance to the skin (Fig. 8). A small haematoma was evacuated through the inferior suture line on the tenth day. Otherwise healing was uneventful. The abdominal wound healed well and when reviewed three months later, there was no functional disability (Fig. 9).

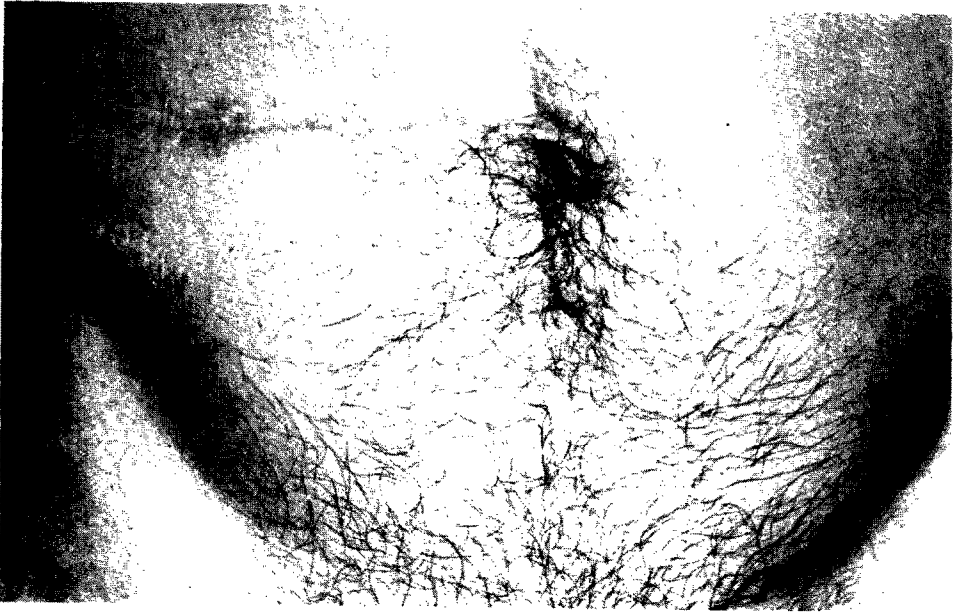


FIG. 9. Soundly healed abdominal incision, closed primarily, with no disability and no distortion.

DISCUSSION

Traditionally, flaps based on the midline have been considered hazardous. However, demonstration of the reliability of the anterior perforating system of vessels in the thoracic region by Bakamjian (1965) when developing his delto-pectoral flap, led others to explore similar flaps in the abdomen.

Tai and Hasegawa (1975) described a medially based flap of upper abdominal skin to reconstruct the breast and stressed the need to preserve the perforating branches of

the superior epigastric vessels in the base of the flap. Brown *et al.* (1965) described the use of this flap to cover a defect of the cubital fossa and further elucidated its blood supply. Mathes and Bostwick (1977) described its use as an island flap based on the superior epigastric vessels. McCraw *et al.* (1977) tabulated 26 cases of its use as an island flap commenting on the large area of skin attainable. Recently Holmstrom (1979) reported on the use of the "abdominoplasty flap" in which he appears to have used both paired inferior epigastric vessels with their perforating systems and the overlying lower abdominal skin as a free flap to reconstruct the breast after radical mastectomy.

THE ADVANTAGES OF THE RECTUS ABDOMINIS MYOCUTANEOUS FREE FLAP

- (i) Large vessels: an artery of 2.5 to 3.0 mm and two venae comitantes of 3 mm diameter.
- (ii) A long vascular pedicle: up to 15 cm in length if the vessels are taken at their origins.
- (iii) Ease of raising without fear of damaging the pedicle.
- (iv) Aesthetic and functional acceptability.

DISADVANTAGES OF THE RECTUS ABDOMINIS MYOCUTANEOUS FREE FLAP

- (i) The need to reconstruct the anterior rectus sheath to prevent hernia formation, particularly below the umbilicus.
- (ii) The sheer bulk of the flap may be aesthetically unacceptable, but some atrophy of this muscle segment can be expected.
- (iii) A long warm ischaemia time is poorly tolerated by muscle and must be avoided.

The problems of abdominal wall support could be minimised by taking the muscle segment *above* the lowest fibrous intersection of the rectus where the posterior sheath is very strong and possibly by using a turnover flap of contralateral anterior rectus sheath instead of Marlex mesh to repair the anterior sheath defect.

SUMMARY

The successful transfer of a free rectus abdominis myocutaneous flap based on the inferior epigastric vessels is reported. The preliminary experimental investigations leading to the design of this flap are described.

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