Extended double pedicle free tensor fascia latae myocutaneous flap for abdominal wall reconstruction

Dorai A A, Halim A S

ABSTRACT

Extensive full thickness anterior abdominal wall defects pose a difficult challenge to the reconstructive surgeon. The objectives of reconstruction are the support of the intra-abdominal structures in order to preserve the functional integrity and achieve an aesthetically-acceptable appearance. Autologous tissues are versatile and provide the best reconstructive option in this type of defects. The tensor fascia latae myocutaneous flap provides identical abdominal wall musculofascial cover for full thickness defects. In extensive defects, the extended tensor fascia latae flap is a versatile option with a second microvascular anastomosis at the distal end of the flap. A total anterior abdominal wall soft tissue tumour resection defect was reconstructed with the use of the double pedicle extended free tensor fascia latae myocutaneous flap in a 60-year-old man. The patient however succumbed to the disease process six months post-reconstruction. During the follow-up period, there was no evidence of hernia at the anterior abdominal wall.

Keywords: abdominal wall reconstruction, double microanastomosis, extended tensor fascia latae flap, myocutaneous flap

Singapore Med J 2007; 48(5):e141–e145

INTRODUCTION

The anterior abdominal wall has a complex and unique musculofascial system. The functional integrity of the anterior abdominal wall can be compromised by previous surgery, tumour resection or trauma. Depending on the location, size, extent and aetiology of the defect, the method of reconstruction is planned. The objectives of abdominal wall reconstruction are to restore the structural support by providing stable soft tissue coverage and optimising the aesthetic appearance of the individual. Depending on the extent of the defect, various reconstructive options are available, such as skin grafts, free fascial grafts, component separation technique, tissue expansion, regional flaps, free flaps and prosthetic mesh repair. Skin grafts directly applied to the omentum or small bowel surface provide no structural support and frequently result in incisional hernias. In the presence of gross contamination, staged reconstructive options, such as skin grafting followed by repair with loco-regional flaps, have also been reported.[1] However, this produces severe disfigurement. The functional integrity of the anterior abdominal wall is also compromised.

Free fascial grafts are beneficial only for small defects where adequate skin cover is present.[2] Component separation technique is also another reconstructive option for small- to medium-sized defects but also requires sufficient skin cover. Various prosthetic materials have been used extensively for anterior abdominal wall reconstruction. However, problems such as infection, hernia, sinuses, fistulous tract formation and extrusion have discouraged their use. Removal of the mesh may cause damage to the underlying bowel if the mesh is inside the peritoneal cavity. Autologous tissues have the advantage of decreasing the incidence of infection in treating contaminated cases where mesh repair is contraindicated.

Various flaps have been reported for anterior abdominal wall defects. The tensor fascia latae myocutaneous flap has gained enormous popularity and is extremely versatile. In large full thickness anterior abdominal wall defects, the tensor fascia latae myocutaneous flap is used, as the fascial extension can be harvested together with the flap. However, when there is a large skin defect, the skin component of the tensor fascia latae flap is inadequate to resurface the defect. The restriction in harvesting the entire skin territory overlying the tensor fascia latae region is due to the peculiar anatomical vascular supply to the distal third of the cutaneous portion of the tensor fascia latae flap. The extended tensor fascia latae flap incorporates the distal vascular pedicle as a second pedicle, and hence a second microvascular anastomosis is performed to perfuse this distal territory. With double microvascular anastomosis, a large cutaneous defect can be easily resurfaced using the extended tensor fascia latae flap.

Reconstructive Sciences Department, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian 16150, Malaysia

Dorai AA, MBBS, MS
Plastic Surgeon

Halim AS, MD, FCCP
Consultant

Correspondence to:
Dr A Ananda Dorai
Tel: (60) 9 766 3141
Fax: (60) 9 764 5126
Email: adorai@kb.usm.my

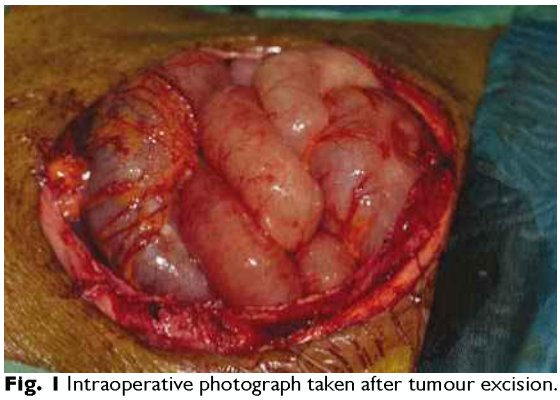

Fig. 1 Intraoperative photograph taken after tumour excision.

Fig. 2 Clinical photograph shows planning of the tensor fascia latae flap.

Fig. 3 Operative photograph shows harvesting of the tensor fascia latae flap and the second pedicle (arrow).

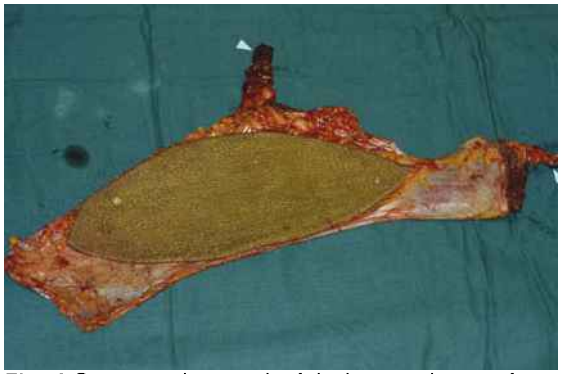

Fig. 4 Operative photograph of the harvested tensor fascia latae flap shows the two pedicles (arrowheads).

CASE REPORT

A 60-year-old man presented with a right paraumbilical swelling for the past five years. The swelling started as a small nodule and progressively increased in size. Four months earlier, the abdominal swelling was excised by a general practitioner. The wound did not heal and the wound edges ulcerated. The ulcer progressively increased in size and another swelling developed in the left inguinal region. Examination revealed an ulcerating and fungating mass on the right paraumbilical region, involving the umbilicus with rolled-out irregular edges. The mass measured 6.5 cm × 6.5 cm, was rounded in shape, had raised margins, and was firm in consistency with contact bleeding. The left inguinal lymph nodes were enlarged, mobile, firm and measured 4 cm × 4 cm. An incisional biopsy was performed and the histopathological examination confirmed the diagnosis to be leiomyosarcoma.

Computed tomography of the abdomen showed a soft tissue tumour in the subcutaneous region with infiltration into the right rectus abdominis muscle and rectus sheath. The swelling enlarged rapidly, and reached a size of 10 cm × 10 cm before surgery. Wide excision of the tumour together with excision of the left inguinal lymph nodes was performed. The tumour invaded the right and left rectus abdominis muscle. There was no extension into the peritoneal cavity. The posterior rectus sheath was closed using non-absorbable suture material. The skin defect was 14.5 cm × 10 cm and the fascial defect was 16 cm × 11 cm (Fig. 1). An extended free tensor fascia latae myocutaneous flap was used for reconstructing the anterior abdominal wall defect. The skin paddle measuring 26 cm × 11 cm and fascia 20 cm × 12 cm was harvested by placing the distal end of the skin paddle at the junction of the middle and distal third of the tensor fascia latae territory (Fig. 2).

The donor vessels were the ascending branch of the lateral circumflex femoral and perforators of the profunda femoris arteries (Fig. 3). Recipient vessels were both deep inferior epigastric vessels. The donor site was closed primarily and a small area required a split skin graft (Fig. 4). Postoperatively, there was no flap or donor morbidity. The surgical margins were tumour-free, with inguinal nodes being positive for tumour. The patient was subsequently started on chemotherapy. No evidence of hernia was detected five months post-reconstruction (Figs. 5 & 6). Unfortunately, the patient succumbed to the disease process during chemotherapy six months post-reconstruction.

DISCUSSION

Reconstruction of composite abdominal defects that include the skin, rectus abdominis muscle and fascial

Fig. 5 Clinical photograph shows the donor site five months after skin grafting.

Fig. 6 Clinical photograph shows the postoperative result after five months with no evidence of herniation.

sheath with visceral organ exposure is a challenge. The ideal reconstruction restores both the functional and aesthetic integrity of the abdominal wall. The use of autologous tissue for definitive reconstruction of large abdominal wall defects minimises the risk of hernia and avoids problems associated with synthetic materials. Multiple stage reconstruction is time consuming and tedious. A single stage reconstruction with free tissue transfer offers the advantages of minimal morbidity, reduced cost and improved social impact. The advantages of using a composite free flap with vascularised fascia include rapid healing, high resistance to infection and decreased scarring and adhesions.

The tensor fascia latae flap was first described by Wangensteen in 1934 as a pedicled flap for large defects of the lower abdominal wall. Subsequently, Hill et al demonstrated that the tensor fascia latae flap had great potential as a flap for microsurgical transfer.[3] Nahai et al also commented on the usefulness of the superior portion of the tensor fascia latae flap if an iliac crest bone graft was incorporated, and demonstrated in cadaver specimens the vascular anatomy of two or three vessels entering the iliac crest through the origin of the tensor fascia latae muscle.[4] Nahai et al reported 54 cases of pedicled tensor fascia latae flaps with four flaps used for abdominal wall reconstruction with no complications.[4] O'Hare and Leonard reported four patients with pedicled tensor fascia latae flaps for large abdominal defects. Three patients had extended pedicled flaps (within 5 cm from the knee joint) without delay and two of them developed distal tip necrosis.[5]

Williams et al reported their series of 15 tensor fascia latae flaps in abdominal wall reconstruction, with 50% of their cases developing distal tip necrosis. It was suggested that the distal third of the vascularised tensor fascia latae flap should not be used unless a delay procedure is employed.[6] This complication was avoided in our case by performing a second microvascular anastomosis at the distal end of the flap. The vascularity of the distal third of the tensor fascia latae flap has been reported as questionable.[5,6] When dealing with extensive large anterior abdominal wall defects, the size of the flap can be expanded by either using tissue expansion or a delay procedure. However, these procedures need to be staged and hence some form of temporary cover will be necessary. The other alternative for a single stage reconstruction is to use an extended tensor fascia latae flap.[7]

Cadaveric studies have shown that the distal third of the tensor fascia latae flap is supplied by the superior lateral genicular artery. If the extended tensor fascia latae flap is required, a second microvascular anastomosis is needed to reperfuse the distal third of the flap. Gosain et al demonstrated that the skin paddle over the middle third of the tensor fascia latae flap is supplied by the perforators of the profunda femoris artery.[7] To prevent distal tip necrosis of the skin paddle (placed over the middle and distal third), a second microvascular anastomosis is required. In our case, since the distal portion of the skin paddle was placed at the junction of the middle and distal third of the tensor fascia latae territory, a second microvascular anastomosis was performed with the second pedicle originating from the perforators of the profunda femoris. The other alternative was to incorporate the anterolateral thigh flap together with the tensor fascia latae flap in extensive anterior abdominal wall defects.

Sasaki et al and Kimata et al successfully reconstructed large anterior abdominal wall defects using a combination of anterolateral thigh and tensor fascia latae flaps.[8,9] Kuo et al used the anterolateral thigh flap along with the vascularised fascia latae for successful reconstruction of large midline abdominal wall defects in seven patients.[10] The consistency of the anterolateral thigh flap perforators was noted to be

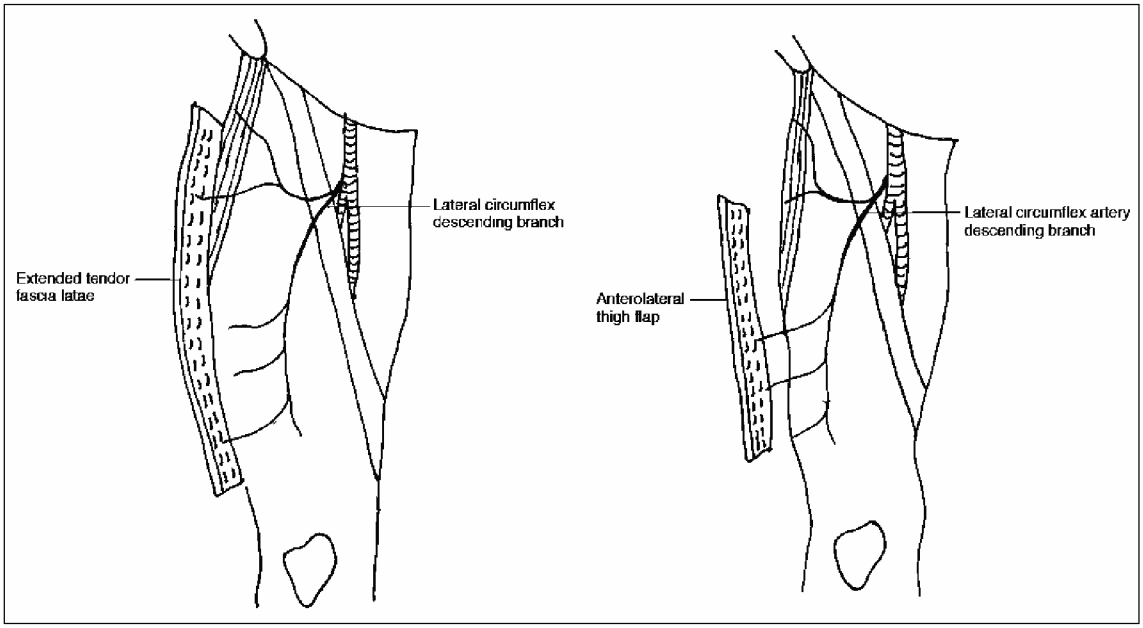

Fig. 7 Diagrammatic representation of the donor vessels of the extended tendor fascia latae (left) and anterolateral thigh (right) flaps.

99.1% in 672 flaps by Wei et al.[11] Additional benefits of the tensor fascia latae flap are that if a small segment of bone is required, the iliac crest from which the tensor fascia latae muscle originates can be harvested.[12] If required, the tensor fascia latae muscle can also be innervated to contribute motor or cutaneous sensory function.[8] The incidence of hernia after tensor fascia latae flaps used for anterior abdominal wall reconstruction has been drastically reduced, with better understanding of the vascular basis of this flap.[6,13,14]

Component separation is another technique used for reconstruction of midline abdominal wall defects.[1,15] However, the presence of an intact rectus abdominis muscle is necessary for this technique. In our case, both rectus muscles were resected together with the tumour and therefore, this technique was not applicable. Mathes et al compared various methods of closure in complex abdominal wall defects.[16] The recurrence rate was highest in the direct closure method (27%), followed by the combination method using flap and mesh repair (11%), flap (6%) and mesh repair (5%). The recurrence in the flap group was higher than the mesh repair group, due to the selection of inappropriate flaps. The free extended tensor fascia latae myocutaneous flap provides the freedom to position the flap in any area of the abdomen without any restrictions.

The free extended tensor fascia latae myocutaneous flap is a versatile flap for reconstructing extensive large anterior abdominal wall defects. The presence of the second distal pedicle is an added advantage for perfusing the compromised distal territory of the tensor fascia latae flap with a second microvascular anastomosis. With the second microvascular anastomosis, the territory of the perfused area is enhanced significantly. The distal pedicle which originates from the profunda system has been reported in other series to be reliable and consistent.[11] The anterolateral thigh flap is not the first choice for these defects as the donor site morbidity needs to be considered. Fig. 7 is a diagrammatic representation of the comparison of the extended tensor fascia latae flap and the anterolateral thigh flap. The recipient area is also well suited whereby the deep inferior epigastric vessels can be used for the microvascular anastomosis. By choosing the extended tensor fascia latae myocutaneous flap for large extensive anterior abdominal wall defects, identical musculofascial defects can be reconstructed, providing sufficient bulk and contour.

REFERENCES

1. Hultman CS, Pratt B, Cairns BA, et al. Multidisciplinary approach to abdominal wall reconstruction after decompressive laparotomy for abdominal compartment syndrome. Ann Plast Surg 2005; 54:269-75.
2. Disa JJ, Klein MH, Goldberg NH. Advantages of autologous fascia versus synthetic patch abdominal reconstruction in experimental animal defects. Plast Reconstr Surg 1996; 97:801-6. Comment in: Plast Reconstr Surg 2004; 113:673-5.
3. Hill HL, Nahai F, Vasconez LO. The tensor fascia lata myocutaneous free flap. Plast Reconstr Surg 1978; 61:517-22.
4. Nahai F, Hill HL, Hester TR. Experiences with the tensor fascia lata flap. Plast Reconstr Surg 1979; 63:788-99.
5. O'Hare PM, Leonard AG. Reconstruction of major abdominal wall defects using the tensor fascia latae myocutaneous flap. Br J Plast Surg 1982; 35:361-6.
6. Williams JK, Carlson GW, deChalain T, Howell R, Coleman JJ. Role of tensor fasciae latae in abdominal wall reconstruction. Plast Reconstr Surg 1998; 101:713-8. Comment in: Plast Reconstr Surg 1998; 102:2515.

7. Gosain AK, Yan JG, Aydin MA, Das DK, Sanger JR. The vascular supply of the extended tensor fasciae latae flap: how far can the skin paddle extend? Plast Reconstr Surg 2002; 110:1655-61.
8. Sasaki K, Nozaki M, Nakazawa H, Kikuchi Y, Huang T. Reconstruction of a large abdominal wall defect using combined free tensor fasciae latae musculocutaneous flap and anterolateral thigh flap. Plast Reconstr Surg 1998; 102:2244-52.
9. Kimata Y, Uchiyama K, Sekido M, et al. Anterolateral thigh flap for abdominal wall reconstruction. Plast Reconstr Surg 1999; 103:1191-7.
10. Kuo YR, Kuo MH, Lutz BS, et al. One-stage reconstruction of large midline abdominal wall defects using a composite free anterolateral thigh flap with vascularized fascia lata. Ann Surg 2004; 239:352-8.
11. Wei FC, Jain V, Celik N, et al. Have we found an ideal soft-tissue flap? An experience with 672 anterolateral thigh flaps. Plast Reconstr Surg 2002; 109:2219-26. Comment in: Plast Reconstr Surg 2003; 111:2481.
12. Zetrenne E, Wirth GA, Evans GRD, et al. Reconstruction of traumatic transposition of the penis and scrotum and associated complex open abdominoperineal pelvic deformity with free innervated tensor fascia latae osteomyocutaneous flap. Ann Plast S urg 2005; 54:657-61.
13. Gruen RL, Morrison WA, Vellar ID. The tensor fasciae latae myocutaneous flap closure of major chest and abdominal wall defects. ANZ J Surg 1998; 68:666-9.
14. Chevray PM, Singh NK. Abdominal wall reconstruction with the free tensor fascia lata musculofasciocutaneous flap using intraperitoneal gastroepiploic recipient vessels. Ann Plast Surg 2003; 51:97-102.
15. Rohrich RJ, Lowe JB, Hackney FL, Bowman JL, Hobar PC. An algorithm for abdominal wall reconstruction. Plast Reconstr Surg 2000; 105:202-16.
16. Mathes SJ, Steinwald PM, Foster RD. Complex abdominal wall reconstruction: A comparison of flap and mesh closure. Ann Plast Surg 2000; 232:586-96.