Novel treatment (new drug/intervention; established drug/procedure in new situation)

Tunnelled tensor fascia lata flap for complex abdominal wall reconstruction

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Summary

This study describes the treatment of two patients with recurrent, infected abdominal wall defects using bilateral delayed and tunnelled pedicled tensor fascia lata (TFL) myofascial flaps. TFL flaps were elevated and delayed for 4 weeks in both cases. In the second case, Parietex Composite mesh was positioned underneath the TFL flap and allowed to incorporate. After a delay of 4 weeks, the flaps were harvested and tunnelled subcutaneously to repair the abdominal wall defect. Both patients have stable repairs but had donor site seromas requiring drainage. Cadaver dissection was also performed to identify structures related to TFL flap harvest. We identified a variant of lateral femoral cutaneous nerve that traversed the TFL flap, necessitating meticulous dissection during surgery. In summary, we describe a new technique of incorporating mesh into the TFL prior to flap harvest for reconstruction of complex abdominal wall.

BACKGROUND

Defects of the abdominal wall that result from recurrent trauma, hernias, infection, radiation necrosis, decompressive laparotomy, or tumour resection are difficult and challenging to correct.¹ Small fascial defects up to 5 cm in width can be closed primarily² as long as abdominal wall tissues are not fixed by scar, but the tension under which the fascia must be approximated frequently leads to infection, necrosis and high rates of recurrence.^{3–4} Larger defects require the transposition of autologous material or the insertion of prosthetic material to bridge the fascial gap.^{5–6} Techniques used in these situations include the component separation method,^{2–7} reinforcement with autologous tissue^{8–9} or prosthetic mesh, and coverage with skin grafts, local or free flaps.¹⁰

Reconstructing large, contaminated abdominal wall defects poses a great challenge to surgeons due to the relative contraindication against using synthetic materials.¹ Successful management of these defects requires restoration of abdominal wall integrity under tension-free repair, and this goal is generally accomplished by using autologous tissues.¹ We present two cases of reconstructing recurrent and contaminated abdominal wall defects utilising bilateral delayed and tunnelled pedicled tensor fascia lata (TFL) myofascial flaps. In the second case, we incorporated synthetic Parietex mesh to strengthen the flap at the time of delay, prior to flap transfer and coverage of the abdominal wall defect. We demonstrate that it is possible to strengthen the autologous flap repair with mesh and transfer it safely to repair abdominal wall defects, even in the setting of previous infection.

CASE PRESENTATION

The first patient was a 69-year-old woman with three failed hernia repair attempts due to mesh infection and a 1-year history of multiple draining sinuses from the abdominal

wall. She was reconstructed with bilateral delayed pedicled TFL flaps alone. The second patient was a 68-year-old man with 15 failed repair attempts. In this patient, Parietex Composite (Covidien) mesh was incorporated into the bilateral delayed TFL flaps prior to transfer and inset of the flap to repair the abdominal wall defect.

TREATMENT

Surgical technique

In the supine position, a line was drawn from the anterior superior iliac spine (ASIS) to 8 cm superior to the midpoint of the lateral patella (LP) of each donor thigh.¹¹ A 30 cm incision was placed 6 cm inferior to ASIS to approximately 8 cm superior to LP (figure 1A). The TFL flap was exposed and elevated bilaterally in both cases. In the second case, Parietex Composite mesh was positioned so it extended past the distal edge of the fascia on the deep surface of the TFL flap and secured with 0 PDS (Johnson & Johnson) interrupted sutures (figure 1B). In this orientation, it becomes the superficial layer when the flap is flipped and transferred to repair the abdominal defect. The thighs were then closed for delay and the mesh was allowed to incorporate. After 4 weeks of delay, the thighs were reopened and the mesh-TFL flap complexes were raised. Ingrowth of vascularised tissue into the mesh was confirmed visually (figure 1C), and the flaps were tunnelled subcutaneously as pedicled flaps to the site of the abdominal defect (figure 1E). This technique avoids the lateral dog-ear seen when the skin island is used, and it also prevents injury to the superficial circumflex iliac artery (SCIA). The flap was inset so that fascia was oriented against the bowel. Suction drains were placed and the thigh wound was closed (figure 1F).

Cadaveric dissection

Cadaver dissection was used to confirm prior studies and to identify anatomic variations that could complicate the

Figure 1 Operative technique. (A) Surgical markings. (B) Parietex mesh is placed on the deep surface of the TFL myofascial flap and secured with 0 PDS interrupted sutures. (C) After a delay of 4 weeks, the thigh is reopened and there is vascular and tissue ingrowth into the mesh. (D) Open abdominal wound prior to flap reconstruction. (E) The mesh-TFL flap flipped and tunneled subcutaneously to reach the site of the abdominal wall defect. (F) Insetting of the mesh-TFL flap places the TFL on the deep surface adjacent to bowel while the Parietex mesh is superficial.

Figure 2 Cadaver dissection. (A) 'Straight line' drawn from ASIS to lateral patella (ASIS-LP line). LCFN entering thigh (red arrow). (B) TFL muscle body and total length. (C) SCIA to inguinal ligament (red line) versus SCIA to ASIS (green line). Relationship of LCFN (orange arrow) relative to the course of the SCIA (dotted red line) is also observed. MFCN (red arrow) and LCFN (green arrow) marked as they enter the thigh relative to the ASIS (star). (D) TFL pedicle (ascending branch of LCFA) entering TFL muscle body (red arrow) enters medial muscle border 5–10 cm inferior to ASIS. (E) Distances from ASIS to the LCFN (green line) and MFCN (red line) at the inguinal ligament were recorded. (F) X – distance at which LCFN crosses ASIS-LP line (star).

Table 1 Measurements for TFL flap harvest obtained from cadaver dissection

Cadaver	1	2	3	4	5
TFL muscle body length (cm)	14	20	21	18	29
TFL total length (cm)	40	46	40	36	40
SCIA distance from ASIS (cm)	8.5	8	7.5	8	9
SCIA distance from IL (cm)	1.5	1	1.5	1.2	1.3
TFL pedicle distance from ASIS (cm)	5/6	7/10	7/8	6/7	9
ASIS to LCFN at IL (cm)	2	4	6	3	5
ASIS to MFCN at IL (cm)	8.5	7	8	6	6.5
MFCN – LCFN at IL (cm)	6.5	3	2	3	1.5
Distance at which LCFN crosses 'straight line' (cm)	29	25	10	3	30

harvest of the TFL flap. Relevant anatomic structures were exposed and identified. The measurements used to characterise the results of the dissection were as listed (table 1) and as demonstrated (figure 2). Two separate measurements of TFL pedicle distance from ASIS were listed when two branches were observed during the dissection.

OUTCOME AND FOLLOW-UP

Both patients have been followed up for more than 1 year. They have stable abdominal wall repairs with no recurrence of hernia or infection (figure 3). The main complication was the development of donor site seromas in the thigh wounds requiring suction drainage, which resolved

Figure 3 Stable reconstruction with Parietex mesh-TFL flap. (A) Preoperative photo demonstrates the abdominal wall defect. (B) Postoperatively, the patient has a stable hernia repair. (C) Left leg donor site scar. (D) Right leg donor site scar.

after 1 month. Both patients also experienced temporary numbness of the lateral thigh and have regained full sensation except at the site of their scars (figure 3).

The anatomic measurements obtained from five cadaver dissections were as described (table 1). The vascular pedicle (the ascending branch of the lateral circumflex femoral artery) consistently enters the muscle body of the TFL medially between 5 and 10 cm inferior to the ASIS. The SCIA is located between 1–1.5 cm inferior to the IL and 7.5–9 cm from the ASIS, and care during dissection can prevent injury to this artery. When the course and anatomy of the lateral femoral cutaneous nerve (LFCN) was mapped, two of five specimens crossed the 'straight line' less than 10 cm from the ASIS; in the other specimens, the LFCN remained medial to the 'straight line' for at least 25 cm.

DISCUSSION

There are few options for the repair of complex abdominal wall hernias associated with contamination.³ There is no 'gold standard', and factors influencing the choice of surgical procedure include size, site, amount of viable tissue and degree of contamination.² When full-thickness abdominal wall defects become larger than 6 cm in diameter, closure often requires the application of synthetic mesh,^{12–14} but synthetic materials have demonstrated increased complication rates, especially in contaminated wounds.¹⁵

The TFL flap is a myofasciocutaneous flap first described by Wangenstein in 1934 for abdominal wall reconstruction.¹⁶ This flap was utilised more extensively after further description by Nahai *et al*.^{17 18} As a pedicled flap with a strong fascial layer,¹⁹ it has been extremely useful for contaminated abdominal wounds in the past. While some consider the TFL to be an effective tissue that negates the use of mesh with its potential complications, Shestak *et al*¹² and Koshima *et al*²⁰ found that myofascial pedicled flaps are denervated with subsequent atrophy of the muscle.¹⁹

These flaps may become too thin to tolerate high abdominal pressures, increasing the risk of recurrent abdominal wall hernias. Carlson *et al*²¹ reported that the recurrence rate for herniation after repair with the TFL flap was around 45%. To strengthen the repair, Shestak *et al* advocated reinforcement with synthetic mesh.^{12 19} Therefore, we believe that strengthening the flap repair by incorporating mesh into the flap enhances the effectiveness of this repair.

There have been several prior reports of using mesh to reinforce reconstruction of the abdominal wall with the TFL flap. Rifaat *et al* reported placing synthetic Prolene mesh between omentum and flap to reinforce bilateral island TFL flaps in four out of five cases of repairing large abdominal wall defect. No herniations were reported postoperatively, and no complications of infection, extrusion or fistula occurred.¹⁹ These results compare favourably with the work of Mathes *et al*¹⁰ in which the combined use of mesh and flap for full thickness defects in six cases resulted in no hernia recurrences.

While we still believe the risks of using synthetic mesh in the setting of infection are great, there have been several reports of utilising synthetic mesh to repair infected abdominal wall hernias. Depuydt *et al* described the salvage of infected abdominal mesh using the pedicled TFL flap in 1998. All three cases presented had successful outcomes with no infection or recurrent hernia at 2 years of follow-up.²² Bulic *et al* recently described the reconstruction of a patient with a large infected abdominal defect who was treated successfully with a polypropylene mesh reinforcement and free latissimus dorsi muscle flap coverage suggesting that it may be possible to repair these defects using prosthetic mesh as fascial replacement and free muscle flaps as a cover.¹

We describe a new technique of integrating a polypropylene mesh with a pedicled TFL flap prior to flap harvest and tunnelling it subcutaneously to correct contaminated abdominal wall defects. The incorporation of the synthetic

mesh into the tissue allows it to become vascularised prior to its transfer to the contaminated area. Therefore, we are able to use the mesh to reinforce our repair with the TFL flap while minimising the risk of complications of dealing with synthetic materials in an infected area.

In conclusion, we have demonstrated that a mesh-incorporated TFL flap is a viable option for the reconstruction of complex infected abdominal wall hernias. Additionally, we identified a variant of LFCN that crossed the 'straight line' less than 10 cm from the ASIS, demonstrating that precise knowledge of groin and thigh anatomy and meticulous dissection are necessary to avoid complications of neurovascular injury during TFL flap harvest and inset.

Learning points

- Complex abdominal wall hernias are difficult to manage.
- Parietex mesh incorporates well into the distal portion of the TFL flap during the delay period of 4 weeks.
- The mesh-incorporated TFL flap is a viable option for reconstructing complex abdominal wall hernias.
- Meticulous dissection to identify and preserve the LFCN is vital to avoid neurovascular injury in this operation.

Competing interests None.

Patient consent Obtained.

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Please cite this article as follows (you will need to access the article online to obtain the date of publication).

Wang F, Buonocore S, Narayan D. Tunnelled tensor fascia lata flap for complex abdominal wall reconstruction. *BMJ Case Reports* 2011; 10.1136/bcr.08.2010.3236, date of publication

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