

Use of the Omentum Flap as Additional Soft-Tissue Cover for Abdominal Wall Defects Reconstructed with Gore-Tex

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Background: Use of alloplastic materials such as Gore-Tex and locoregional flaps for reconstruction of large abdominal wall defects has been well described. The purpose of this article is to present a novel technique of using the omentum as an interpositional flap to protect the Gore-Tex repair of the abdominal wall.

Methods: Four patients with large abdominal wall defects underwent reconstruction with Gore-Tex and omentum flap. These defects resulted from tumor resection and recurrent incisional hernia. Their dimensions ranged from 15 × 10 cm to 25 × 27 cm. The Gore-Tex patch was inset using an underlay technique. The omentum was tunneled through a separate opening in the abdominal wall into the subcutaneous plane and used to cover the Gore-Tex. Skin coverage was accomplished by direct closure or myocutaneous flaps.

Results: The mean follow-up was 17 months. All wounds healed, with no hernias. One patient developed a subcutaneous abscess 6 months postoperatively, and this was treated successfully by percutaneous drainage, as the omentum had walled-off the abscess.

Conclusion: The omentum flap served as an additional soft-tissue cover over the Gore-Tex repair to prevent exposure in the event of

infection or flap breakdown. This technique is useful in situations in which delayed wound healing is anticipated or when large quantities of prosthetic material are used. (*Plast. Reconstr. Surg.* 116: 1715, 2005.)

The reconstruction of large, full-thickness abdominal wall defects is often a challenging undertaking. The lack of suitable musculofascial tissue in the proximity of the defect has led to the use of synthetic materials such as Gore-Tex (expanded polytetrafluoroethylene) (W. L. Gore and Associates, Flagstaff, Ariz.). However, complications such as seroma formation, infection, and extrusion are associated with the use of prosthetic materials. Such risks may be increased in situations where skin is deficient and when closure has to be achieved with wide skin undermining or flaps. To avoid such problems, adequate well-vascularized soft-tissue coverage of the alloplastic material is vital.^{1,2} The purpose of this article is to present our approach of using a combination of Gore-Tex and the omentum as an interpositional flap. This combination is used in addition to locoregional flaps needed for skin coverage. This additional, well-vascularized soft tissue facilitates wound healing and serves to protect the implant in the event of cutaneous wound/flap breakdown.

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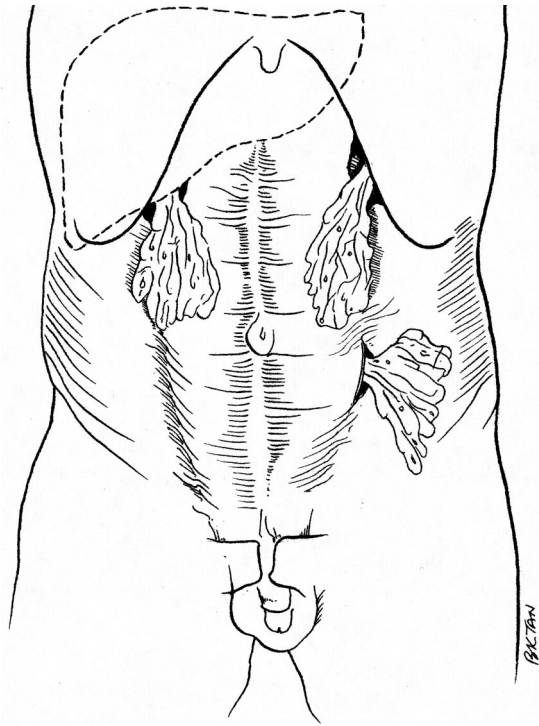


FIG. 1. Exit points of the omentum flap. In the subcostal region, the right side is preferred, as liver prevents herniation of bowel.

PATIENTS AND METHODS

Between January of 2002 and August of 2003, four patients (two men and two women) with large defects of the abdominal wall underwent reconstruction with Gore-Tex DualMesh (W. L. Gore and Associates, Inc.), and omentum flap. Defect size ranged from 15×20 cm (300 cm^2) to 25×27 cm (675 cm^2). Abdominal wall reconstruction was performed after tumor resection in three patients. In one patient, it was performed for repair of recurrent incisional hernia. Two patients had overlying skin defects that were closed with an anterolateral thigh myocutaneous flap and a vertical rectus abdominis myocutaneous flap.

Surgical Technique

Surgery is performed by a team consisting of general and plastic surgeons. The primary pathologic conditions are addressed as follows: for tumor cases, the tumor is widely resected and completeness of clearance ascertained by frozen sections. In the sole case of recurrent incisional hernia, all attenuated tissues are excised, leaving behind healthy fascial margins, onto which the Gore-Tex patch is secured. The abdominal cavity is entered and any bowel that is adherent to the parietal peritoneum along the fascial margin is freed to create space for the underlying portion of the Gore-Tex. The greater omentum is evaluated with regard to its size, vascular pattern, and reach for a given defect. Only that which is needed is mobilized. For smaller lateral defects, mobilization from the transverse colon would suffice. The omentum is passed through a 4-cm slit in the linear semilunaris into the subcutaneous plane. The slit opens like a venetian blind and its overlapping layers of muscle reduce the risk of hernia formation (Figs. 1 and 2). If the defect is large, the omentum is mobilized fully and pedicized on either the right or left gastroepiploic vessels. The exit point is subcostal, located on the side ipsilateral to the defect. The right subcostal site is preferred, as the liver protects against herniation of bowel (Fig. 1).

The Gore-Tex patch is applied using an underlay technique described by McCarthy and Tweist.³ A 1-mm-thick Gore-Tex sheet is trimmed to size with the aid of a paper cut-out of the defect. An allowance of 3 cm circumferentially is given for the underlaid portion. Polypropylene interrupted horizontal mattress sutures are placed but left untied initially until all sutures are in position, to ensure even distribution of tension. The patch should be taut but not excessively tight. The omentum flap is

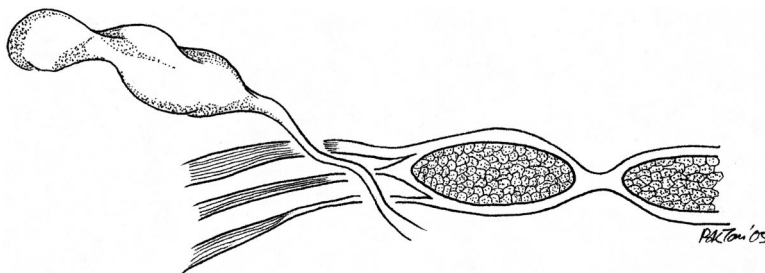


FIG. 2. Cross-section of the anterior abdominal wall showing the omentum passing through an oblique passage created by separating the oblique muscles and spreading the layers open like the slits of a venetian blind.

then gently spread over the Gore-Tex and loosely tagged down with absorbable sutures. The skin is closed directly or with myocutaneous flaps. Closed suction drainage is applied. All patients are given abdominal binders postoperatively for additional support for at least 6 months while the repair matures.

RESULTS

The mean follow-up of the patients was 18 months (range, 8 to 47 months). Table I summarizes the outcome. One patient developed a subcutaneous abscess 6 months postoperatively. On computed tomographic imaging, the omentum was seen to have contained the infection, and this was successfully treated by percutaneous drainage and systemic antibiotics. The others had uneventful postoperative recovery. The reconstructed areas manifested a slight bulge, but there was no hernia. No intra-abdominal complications related to the use of the omentum flap were noted.

CASE REPORTS

Case 1

A 57-year-old diabetic man presented with a large right iliac fossa incisional hernia (Fig. 3). He had had an appendectomy previously and subsequently developed an incisional hernia that failed multiple attempts at repair. Polypropylene mesh was used three times and, in all instances, infection developed, necessitating mesh removal. At the time of surgery, the hernia sac and overlying skin were excised. In addition, a length of small bowel measuring 150 cm was resected to reduce the volume of abdominal viscera. The resultant full-thickness defect measuring 22 × 18 cm was repaired with Gore-Tex and covered with the greater omentum based off the right gastroepiploic vessels (Fig. 4, *above*



FIG. 3. The patient in case 1, presenting with a large incisional hernia over the right iliac fossa. Multiple previous attempts at repair were unsuccessful.

and center). The omentum was brought into the subcutaneous plane by means of a 4-cm right subcostal incision. A pedicled anterolateral thigh musculocutaneous flap was used to reconstruct the skin defect (Fig. 4, *below*). The patient healed uneventfully and was discharged. However, 6 months later, the patient spontaneously developed an abdominal wall abscess over the reconstructed site because of poor diabetic control. A computed tomographic scan showed a collection below the anterolateral thigh flap that was walled off by the omentum. The abscess was successfully treated by percuta-

TABLE I

Summary of Patients with Abdominal Wall Defects Repaired with Gore-Tex and Omentum Flap

Patient No.	Age (yr)/Sex	Diagnosis	Defect Dimensions (cm)	Omentum Exit Points	Additional Flap Used	Outcome
1	57/Male	Recurrent incisional hernia over the right lower quadrant	22 x 18 cm	Right subcostal	Pedicled anterolateral thigh myocutaneous flap; vertical rectus abdominis myocutaneous flap	Subcutaneous abscess at 6 mo.; resolved with percutaneous drainage; vertical
2	36/Female	Recurrent sarcoma of the lateral abdominal wall	15 x 20 cm	Lateral abdominal wall at the linea semilunaris	Latissimus dorsi muscle flap, used internally with the omentum flap	Excellent
3	53/Male	Osteosarcoma of the lower rib involving the diaphragm and lateral abdominal wall	25 x 18 cm	Lateral abdominal wall at the linea semilunaris	Direct skin closure	Excellent
4	45/Male	Lateral abdominal wall sarcoma	15 x 10 cm	Lateral abdominal wall at the linea semilunaris	Direct skin closure	Excellent

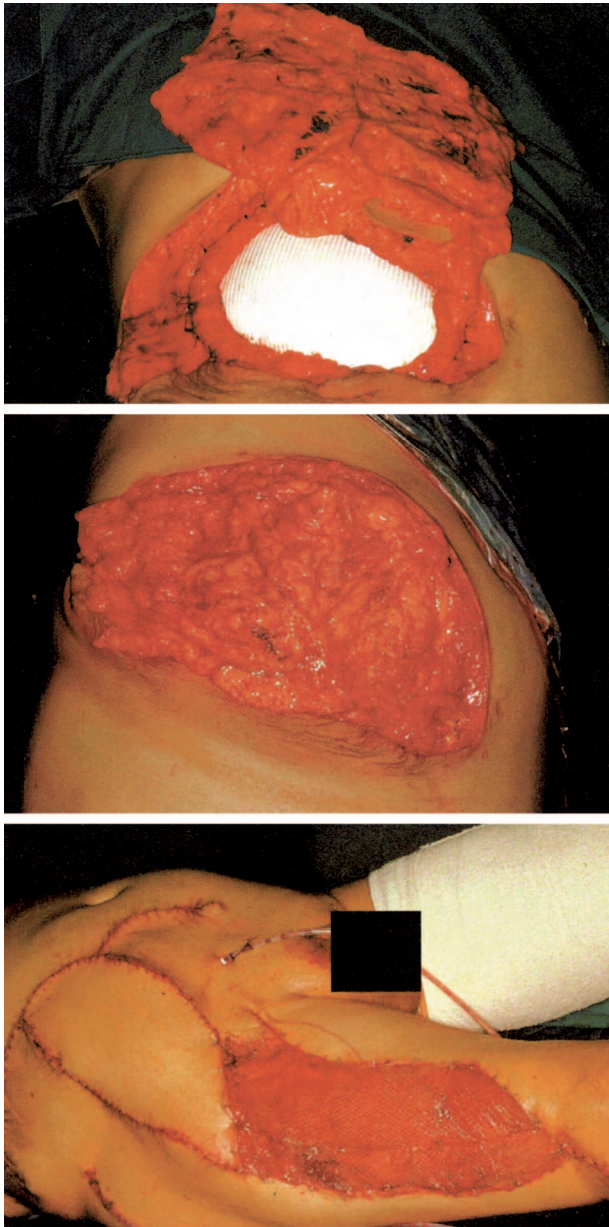


FIG. 4. (Above) Reconstruction with Gore-Tex placed in an underlay fashion. The greater omentum was pedicled based on the right gastroepiploic vessels and brought into the subcutaneous plane by means of a 4-cm subcostal incision at the right linea semilunaris. (Center) The Gore-Tex was completely covered by the omentum flap. (Below) A right pedicled anterolateral thigh fasciocutaneous flap was raised to cover the skin defect.

neous drainage and systemic antibiotics. At 9-month follow-up, the reconstructed abdominal wall was intact and there was no recurrence of the hernia (Fig. 5).

Case 2

A 36-year-old woman presented with recurrent sarcoma over her upper lateral abdominal wall. She had a history of eleventh rib fibromyxoid sarcoma excised 13 years previously. Intraoperatively, tumor was noted to involve the entire thickness of the abdominal wall. However, there was no invasion

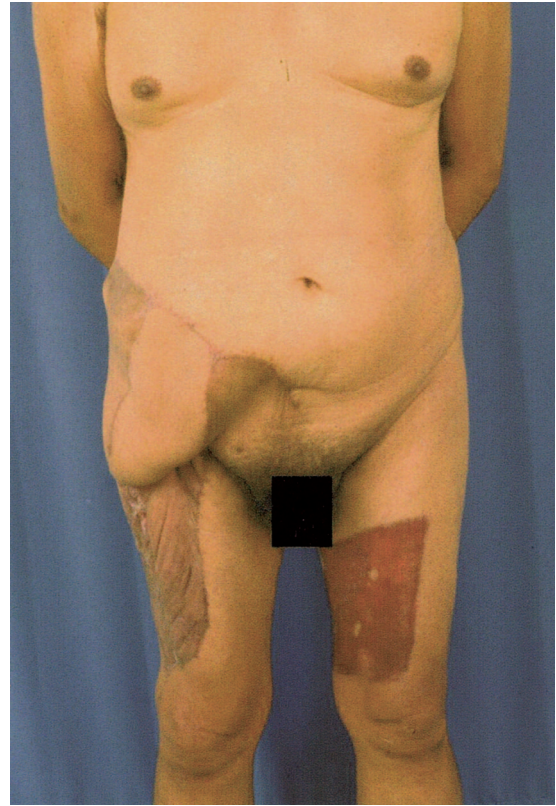


FIG. 5. The patient in case 1 at 9 months postoperatively. All wounds had healed completely and there was no recurrence of the hernia.

of the peritoneum or the pleura space. Wide excision resulted in a full-thickness lateral abdominal wall defect measuring 15×20 cm (300 cm^2). Reconstruction was performed using Gore-Tex in the usual fashion (Fig. 6, above). The omentum was transposed extraperitoneally through a 4-cm opening over the lateral abdominal wall (Fig. 6, center). An inferiorly based vertical rectus abdominis myocutaneous flap was fashioned for skin coverage (Fig. 6, below). She recovered uneventfully. At 3-year follow-up, the repair was noted to be intact and she had no complications (Fig. 7).

DISCUSSION

The main rationale for using the omentum flap as an additional cover over the Gore-Tex was to prevent exposure of the prosthesis in the event of flap breakdown, given that in two of the four cases, myocutaneous flaps were used for skin cover because of accompanying skin defects. Had there been flap necrosis, we would have been able to perform skin grafting over the omentum. The value of the interposed omentum was realized in the patient in case 1, who developed a suppurative infection over the prosthesis 6 months after the initial operation. Although there was skin breakdown, the prosthesis was not exposed. Thus, the infection was treated conser-

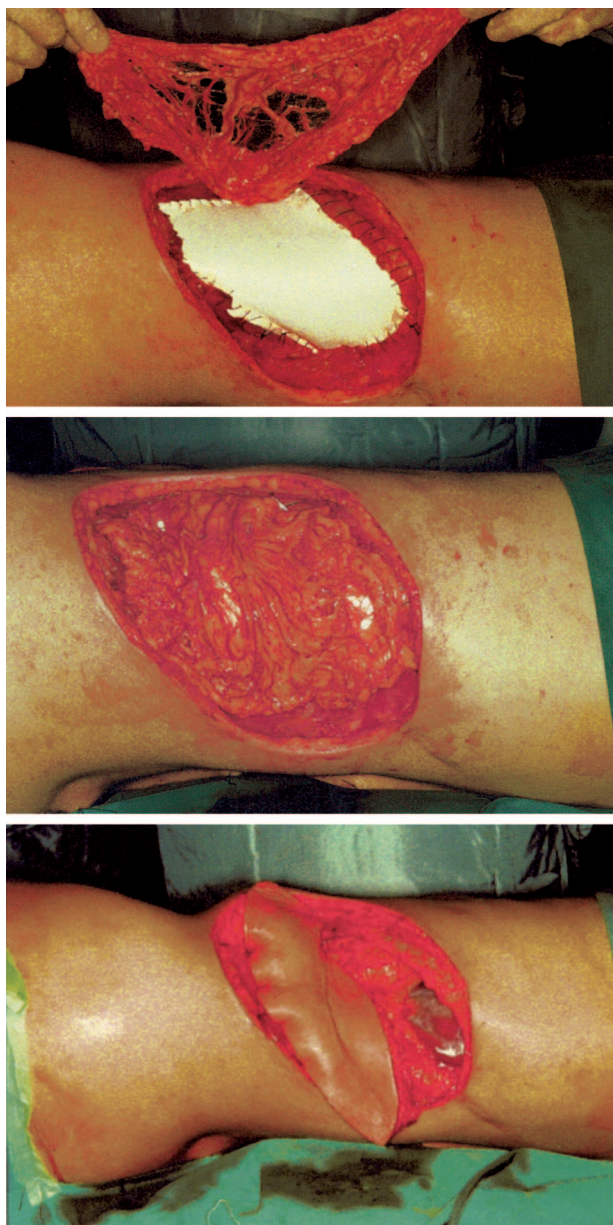


FIG. 6. (Above and center) The patient in case 2 after sarcoma resection. The abdominal wall was reconstructed with Gore-Tex, and an omentum flap was used to line it. (Below) A vertical rectus abdominis myocutaneous flap was used for skin cover.

vatively by percutaneous drainage without dismantling the repair.

Even with intact skin, the presence of a large synthetic sheet may still result in seroma formation, infection, and extrusion.¹ These complications could be attributed to factors such as the presence of dead space, lymphatic disruption, and subcutaneous fat, which integrates poorly with prosthetic material. The omentum, consisting of abundant blood vessels, fat, and lymphatics, is known for its unique immunologic and

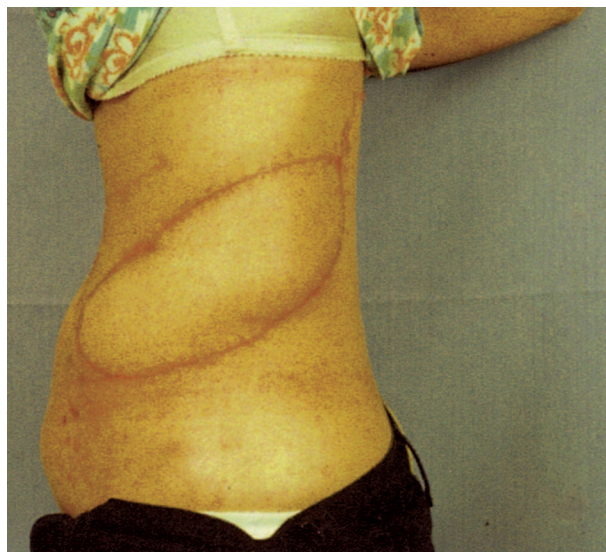


FIG. 7. The patient in case 2 at 3 years after surgery. There were no complications or contour abnormalities.

angiogenic properties. By using it as an interpositional flap, we harness such properties to facilitate wound healing^{4,5} and promote soft-tissue integration with Gore-Tex. Muscle has similar qualities, and it was used to supplement the omentum in the patient in case 3 (Table I). In this patient, the Gore-Tex sheet had extended from the flank to the chest, and the latissimus dorsi muscle flap was used to cover the chest portion.

The use of alloplastic material for fascial reconstruction has the advantages of avoiding donor-site morbidity and reducing operation time. We prefer the Gore-Tex DualMesh over other synthetic materials for its dual surface properties. The smooth inner surface is nonadhesive to bowel and reperitonealizes over time.⁶ Its corduroy outer surface promotes tissue integration.⁷ Because it is biocompatible and has low infectability, the risk of implant extrusion is low.⁸⁻¹¹

From a technical standpoint, the underlay placement technique offers a mechanical advantage because the forces generated by intraabdominal pressure tend to hold the patch in place. Pedicled omentum flaps will usually reach defects over all quadrants of the abdominal wall. When additional length is needed, the omentum is elevated from the transverse colon and transposed based on both gastroepiploic vessels. Yet further reach is obtained when one set of the gastroepiploic vessels is ligated. The flap will survive on collateral circulation from the arch of Barkow.^{5,12-14} The right gastroepiploic vessel is usually the larger of the two vessels. The exit point of the flap in each patient was carefully designed to reduce the risk of hernia formation

(Figs. 1 and 2); however, the opening should be adequate to avoid constricting the flap. We could have passed the omentum through the main defect, where a small opening is created by leaving the Gore-Tex unstitched. However, this was avoided, as it could have compromised the repair. Indications for our described technique include abdominal wall reconstruction in immunocompromised patients such as diabetics and in patients who have had previous mesh infection or radiation therapy to the vicinity. This technique is also useful in patients for whom large quantities of prosthetic materials were used for repair.

Some potential drawbacks of the technique are as follows: Gore-Tex, as is the case with all alloplastic materials, cannot be used in contaminated fields, although in theory, the omentum wrap may protect against infection. The omentum is not always available; previous omentectomy from procedures such as colectomy or gastrectomy would mean that this "life boat" is missing and an alternative has to be sought. Although not seen in this series, there was a theoretical risk of herniation through the exit points of the omentum flap. Also, having been exteriorized, the omentum is no longer present to protect the abdominal viscera. This may be a potential problem in children or in patients in whom there are critical bowel reconstructions.

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