

A New Extraperitoneal Method for Entero-atmospheric Fistula Closure Using a Free Muscle Flap

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Summary: Treatment of an entero-atmospheric fistula (EAF) is challenging and associated with significant morbidity and mortality. For an EAF with protrusion of mucosa, chances for spontaneous closure are minimal. Standard surgical procedures may be associated with a high risk for complications in patients with a hostile abdomen. This article describes a new method for extraperitoneal closure of an EAF in a patient with a hostile abdomen. A free segmental latissimus dorsi musculocutaneous flap was harvested on its thoracodorsal pedicle, leaving the remaining muscle innervated. The flap was anastomosed to the internal mammary vessels. The muscle was sutured into the fistula opening using a parachute technique and temporarily immobilized with a negative wound pressure device. The skin of the flap was used for monitoring and later replaced by a skin graft. The postoperative course was uneventful. At 24 months follow-up, there were no signs of recurrences. The patient had no pain and had no defecation problems. Extraperitoneal closure of an EAF with a segmental free latissimus dorsi muscle flap sutured into the fistula opening with a parachute technique may be a new promising technique in patients where standard surgical procedures are associated with too high a risk for complications and where a local pedicled muscle flap is not available. The advantages of this method are that no laparotomy is required, the intestinal lumen is not reduced in diameter, and that no bowel resection is performed, which is a particular advantage in cases with a short bowel syndrome. (*Plast Reconstr Surg Glob Open* 2021;9:e3918; doi: [10.1097/GOX.0000000000003918](https://doi.org/10.1097/GOX.0000000000003918); Published online 11 November 2021.)

INTRODUCTION

An entero-atmospheric fistula (EAF) is a pathological opening in the intestinal lumen that is in direct contact with the atmosphere and differs from an enterocutaneous fistula (ECF) as there is no fistula tract.¹ This rare complication usually follows abdominal surgery or trauma and causes significant morbidity and mortality.^{1,2} The incidence of EAF is rising due to the increasing use of damage control surgery and open abdomen.² Absence of a fistula tract and protrusion of mucosa reduces dramatically the chances of spontaneous healing. Surgical treatment of an

EAF is challenging despite recent improvements in supportive patient care.¹ This article describes a new, extraperitoneal EAF closure technique where standard procedures are associated with too high a risk for complications.

CASE PRESENTATION

A 50-year-old-man was referred for treatment of an EAF that had not closed spontaneously with conservative treatment over a 2-year period. Due to an umbilical vein thrombosis at birth, he suffered from portal hypertension and esophageal varicosis. He had had over 20 abdominal operations, including splenectomy, mesocaval shunting, and ileus. A laparotomy in 1988 was complicated by severe hemorrhage and a completely hostile abdomen. A traffic accident in 2017 required a trauma laparotomy due to a rift in the transverse colon, which was sutured. Severe intraoperative hemorrhage and a hostile abdomen made further surgery impossible. Postoperatively, two ECFs and an EAF developed, all three draining through the laparotomy wound. The ECFs closed spontaneously. The low productive colonic EAF with visible mucosa did not require total parenteral nutrition but caused considerable discomfort

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and pain to the patient as abdominal scars made effective containment of fistula effluent difficult (Fig. 1). Computed tomography revealed no abdominal abscesses. Computed tomography and colonoscopy revealed no distal bowel obstruction. The patient consented to extraperitoneal fistula closure with a free microvascular segmental latissimus dorsi (LD) muscle flap.

SURGICAL TECHNIQUE

A lateral segment of the right LD muscle was harvested as a musculocutaneous flap on its thoracodorsal pedicle, leaving the innervation to the remaining muscle intact. The flap was anastomosed to the internal mammary vessels at the fourth intercostal space. At the distal flap end, the subcutaneous tissue was separated from the muscle. The skin surrounding the

Takeaways

Question: Can a recalcitrant entero-atmospheric fistula be closed using a free microvascular muscle flap sutured into the fistula opening with a parachute technique?

Findings: Successful closure of a recalcitrant entero-atmospheric fistula could be obtained by suturing a free microvascular segmental latissimus dorsi muscle flap into the fistula opening and when the flap is temporarily immobilized to the fistula wall and abdominal wall with a negative pressure device.

Meaning: Extraperitoneal entero-atmospheric fistula closure can be obtained by suturing a free muscle flap into the fistula opening



Fig. 1. The abdomen with multiple scars from previous operations. The entero-atmospheric fistula from the transverse colon drained through the old laparotomy wound.

EAF was de-epithelialized over a width of 3 cm. The colonic serosa was dissected free over a 0.5–1.0 cm length. Using a parachuting technique, the muscle flap was sutured into the fistula opening. Biosyn 3-0 sutures (Metronic Limited, Walford, United Kingdom) were passed through the muscle and fistula wall into the bowel lumen and then brought out through the fistula wall and muscle in a U-shaped manner, taking care not to damage the flap circulation. The sutures were loosely tied to prevent cutting through the muscle (Fig. 2). A vacuum-assisted closure (VAC) system (KCI, San Antonio, USA) was used to immobilize the muscle flap to the fistula wall and abdominal wall. A semiadhesive (Duoderm, ConVatec, Sandvika, Norge) was applied to the abdominal skin surrounding the muscle flap. A sponge was placed over the muscle flap and semiadhesive and covered with a transparent adhesive (Fig. 3). The VAC system was set at 100 mm Hg negative pressure. The skin of the musculocutaneous

flap was used for flap monitoring. After 5 days the sponge was changed. At 10 days postoperatively the skin and subcutaneous part of the flap were removed and replaced by a skin graft that was immobilized to the muscle flap for 5 days using VAC. Oral intake was resumed on the second postoperative day. Except for a small wound revision, the postoperative course was uneventful. There were no signs of recurrence at 24 months follow-up and the LD muscle function was preserved (Fig. 4). The patient had no pain and no defecation problems.

DISCUSSION

EAF management is a difficult problem as the control of output can be considerably problematic.^{1,3} A poorly controlled EAF is a source of embarrassment, pain, and discomfort, but also results in high costs due

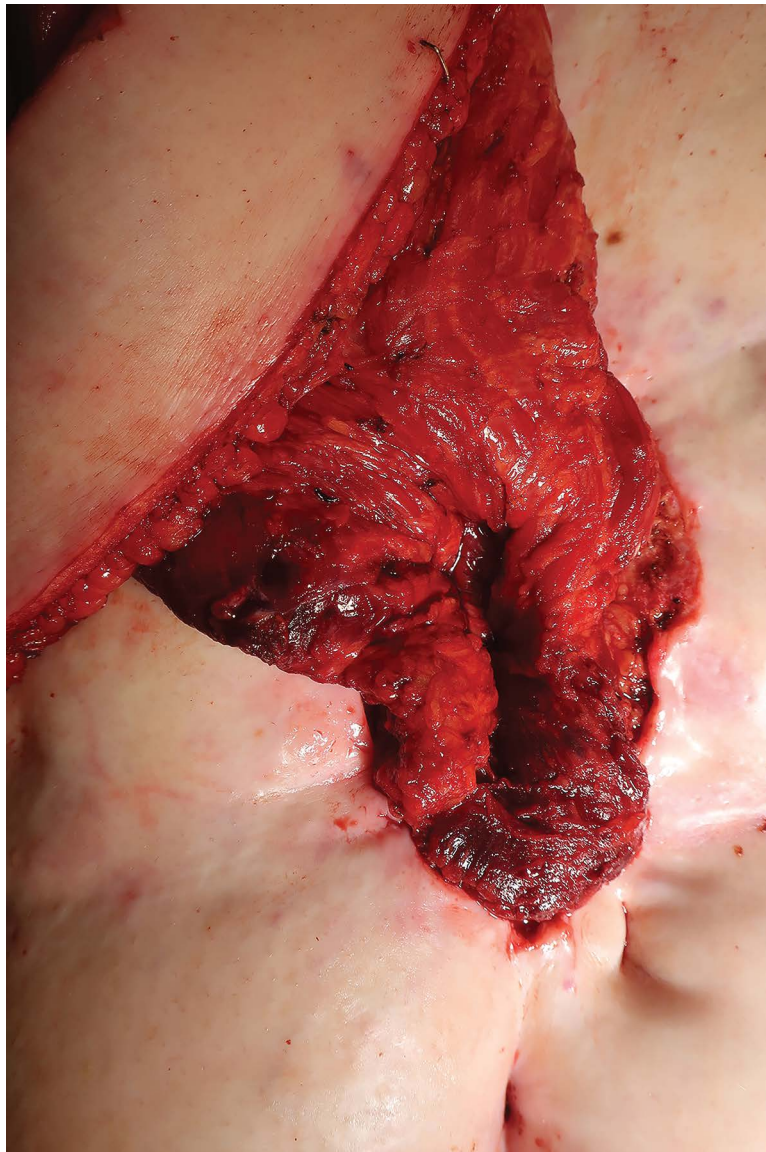


Fig. 2. The segmental LD muscle flap was sutured into the fistula wall using a parachute technique.



Fig. 3. The sponge of the negative wound pressure device was placed over the distal muscle part of the musculocutaneous LD flap to immobilize the muscle to the fistula wall and abdominal wall. The adipocutaneous part of the free LD flap was placed over the sponge and was used for monitoring flap perfusion after the flap had been anastomosed to the internal mammary vessels.

to a tremendous use of disposable medical equipment.³ Absence of overlying skin or soft tissue precludes spontaneous closure.² Definitive surgery is not advised until 3–6 months after resolution of sepsis, malnutrition, and other injuries as this is associated with lower recurrence.^{4,6} Successful surgery requires exclusion of distal bowel obstruction. Standard surgery involves resection of the bowel segment involving the EAF, restoration of intestinal continuity, and coverage of the bowel with well-vascularized soft tissue.⁴ In our patient, such a procedure was associated with a high risk of failure due to the “frozen abdomen.”² Although variable results have been obtained with the use of negative wound pressure therapy, spontaneous EAF closure appears impossible to

achieve once mucosal protrusion has occurred as in our patient.^{1,2}

Earlier, we published on the use of a parachute technique for extraperitoneal ECF closure with a pedicled rectus abdominis muscle flap.⁷ We have evolved this technique by using a free microvascular musculocutaneous flap to treat such severe cases where rectus abdominis musculocutaneous flaps are not available.

Using the parachute technique, the LD muscle flap was sutured into the fistula opening and became part of the bowel wall (Fig. 2). Therefore, this technique does not narrow the intestinal lumen. The VAC system immobilized the flap to the fistula wall and abdominal wall, thereby promoting wound healing (Fig. 3).



Fig. 4. The postoperative result after 24 months. The adipocutaneous part of the musculocutaneous LD flap was replaced with a skin graft on the tenth postoperative day.

Sudden increases in intraabdominal pressure, such as with coughing, were effectively counteracted with VAC and reduced the risk for leakage. This new technique does not require a laparotomy, which is an advantage in cases of a hostile abdomen, as inadvertent bowel lesions may easily occur during a laparotomy. Although the technique requires microsurgical skills, it is associated with minimal donor site morbidity, as only an LD muscle segment is used while the remaining LD muscle stays functional.

CONCLUSIONS

We present a new extraperitoneal EAF closure with a segmental free LD muscle flap sutured into the fistula opening with a parachute technique. The main

advantages are 1) the extraperitoneal approach, 2) the diameter of the bowel is not reduced, and 3) no bowel is resected.

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