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Staged management of the open abdomen and enteroatmospheric fistulae using split-thickness skin grafts

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Abdominal wall reconstruction;
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Abstract

BACKGROUND: Management of the open abdomen with polyglactin 910 mesh followed by split-thickness skin grafts allows safe, early closure of abdominal wounds. This technique can be modified to manage enteroatmospheric fistulae. Staged ventral hernia is performed in a less inflamed surgical field.

METHODS: A retrospective review was performed of 59 consecutive patients who underwent abdominal skin grafting for open abdominal wounds from 2001 to 2011.

RESULTS: The median length of follow-up was 215 days. Thirty-one percent of patients presented with preexisting enteroatmospheric fistulae, and 41% required polyglactin 910 mesh placement before skin grafting. Partial or complete skin graft failure occurred in 7 patients. Four patients required repeat skin grafting. All patients ultimately achieved abdominal wound closure, and none developed de novo fistulae.

CONCLUSIONS: With proper technique, skin grafting of the open abdomen with a planned ventral hernia repair is a safe and effective alternative to delayed primary closure.

Patients with abdominal sepsis, trauma, or massive fluid shifts, those requiring second-look laparotomy, and those at risk for abdominal compartment syndrome are sometimes managed with an open abdomen.[1,2] The open wound is treated initially with a temporary abdominal closure device that must contain the abdominal viscera and prevent evisceration, simultaneously protecting the bowel serosa from desiccation or traumatic injury. A recent review of the literature suggests a trend toward attempting delayed definitive repair of the abdominal wall within the same hospital stay.[3,4] This increasingly popular approach to the open abdomen has been largely fueled by the widespread application of negative-pressure wound therapy and the introduction of bioprosthetic repair materials, among other wound-closure devices. Despite good surgical technique and innovative thinking, attempts to achieve definitive abdominal wall closure must overcome ongoing visceral edema, an inflamed if not contaminated wound bed, and a nutritionally compromised patient. The resultant closure is thus at risk for perioperative complications, such as

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abdominal compartment syndrome or marginal tissue necrosis, as well as delayed complications such as hernia recurrence or enterocutaneous fistula formation.[5–11]

Although delayed primary closure of the open abdomen has been reported to be both efficient and efficacious,[12] we propose that a staged approach to the management of the open abdomen remains a safe and valuable alternative. From a conceptual standpoint, the open abdomen is viewed as 2 separate but related surgical problems: a wound and a myofascial defect. The open abdomen, viewed chiefly as an open wound, requires only that evisceration be prevented and the wound be stably covered in a manner that minimizes wound-bed inflammation. Our preferred technique involves a polyglactin 910 absorbable mesh to prevent evisceration and allow the abdominal viscera to freeze in a bed of adhesions. In the acute setting, usually within 2 weeks of the initial laparotomy or dehiscence, the wound is closed with the application of a split-thickness skin graft. Of all the wound-closure techniques available, skin grafting offers a simple, fast procedure that has low morbidity and can be performed effectively despite a contaminated wound bed or poorly conditioned patient. In fact, open abdominal wounds complicated by enteroatmospheric fistulae are handled in this same fashion.

Once obtained, early wound closure allows expeditious progression of the hospital course, with appropriate emphasis on rehabilitation or other pressing medical issues. Management of the myofascial defect is then addressed in a delayed manner, once the initial abdominal process has resolved and the resultant hernia has become symptomatic. In the interim, the patient and surgical site can be optimized, thus enabling the use of preferred hernia repair techniques and materials to minimize both hernia recurrence and surgical-site complications.

We present this consecutive, single-surgeon series to demonstrate the safety and efficacy of our technique as a strategy for management of the open abdomen.

Methods

This was a retrospective study of 59 patients who underwent abdominal skin grafting for open abdominal wounds at Northwestern Memorial Hospital by the senior author (G.A.D.) during a 10-year period (2001 to 2011). Institutional review board approval was obtained. Patients referred to the plastic surgery service were judged too ill or too swollen to undergo delayed primary closure by their managing service. Fewer than 5 patients referred to our service during the 10-year study duration had wounds small enough (<20 cm^2) to be managed with local wound care alone.

Patients with acute open abdominal wounds at risk for evisceration are treated with placement of polyglactin 910 mesh. The mesh is sutured to the edges of the separated abdominal fascia with a long monofilament and covered with moist dressings or a sub-atmospheric-pressure dressing. A modest amount of tension should be applied to the mesh to replace the majority of the bowel within the abdomen. Frequency of dressing changes depends on the type of dressing selected. After ≥ 2 weeks in the average patient or 3 weeks in an immunosuppressed patient, the mesh will develop wrinkles (Fig. 1). This signifies that the underlying viscera are frozen or have formed adequate adhesions and granulation tissue to safely remove the mesh without risking evisceration or bowel injury. Initially placed flat and under tension, the polyglactin 910 mesh develops filmy adhesions to the underlying viscera. As the bowel becomes less swollen over time, this can be appreciated as wrinkled mesh. Another clue that the wound is ready for mesh removal and skin grafting is that individual bowel loops become lost in a sea of granulation tissue.

When timed correctly, the mesh can be easily and safely removed before application of the skin graft. Mesh removal serves as one means to gently debride the surface of the

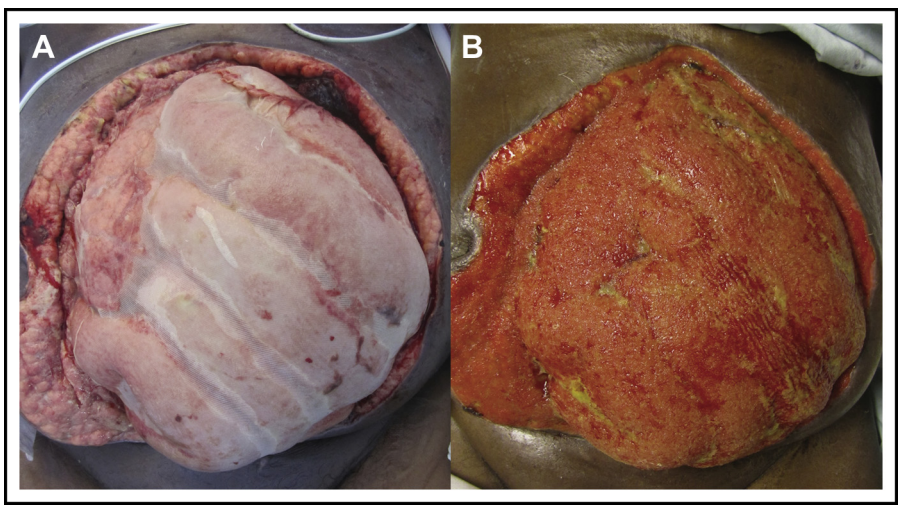

Figure 1 (A) Placement of polyglactin 910 mesh over distended loops of bowel helps prevent evisceration and allows the formation of a frozen abdomen. (B) Once the patient develops a frozen abdomen and forms enough granulation tissue over the bowel, individual loops of bowel are no longer discernible, and the mesh is ready to be removed. Wrinkles develop on the surface of the mesh as visceral swelling decreases and serve as an indicator that the mesh can be removed.