



Weighted abdominal traction for assistance in abdominal closure

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ABSTRACT

Introduction: Loss of abdominal domain is an unsolved problem in many complex abdominal procedures. We report three patients who underwent weighted traction and use of retention sutures to prevent fascial retraction. **Cases:** Our first patient had esophageal metaplasia and a recalcitrant esophageal stricture after having esophageal atresia repair as an infant. Due to vascular congestion of his new conduit, his abdomen was left open. Respiratory compromise was noted on attempted closure, so the patient's abdominal fascia was placed on 20 pounds of traction to prevent fascial retraction. His abdomen was able to be closed after 7 days. Our second patient had a caustic ingestion and underwent a jejunal interposition. Due to the length of the procedure, the abdomen was left open. The fascia was sutured to a silastic silo and placed on 30 pounds of traction. After 8 days, the patient's abdomen was able to be closed primarily. Our third patient presented with persistent aspiration after esophageal atresia repair. Due to concern for her jejunal conduit, her abdomen was left open and placed on weighted traction. Once the abdomen was suitable for closure, an abdominal vac was placed, and continuous fascial tension was applied using #5 Ethibond sutures. Her abdomen was fully closed 10 days later.

Discussion: One of the concerns with temporary abdominal closure is retraction of the fascia. We report three cases where the fascia and abdominal wall were placed on weighted traction, which allowed for retention of abdominal domain and delayed primary closure without grafts or mesh. This approach adds to the options available to aid in closure of the complex abdomen.

1. Introduction

Temporary abdominal closure, once considered a failure in the surgical world, has now become the standard of care for multiple abdominal misfortunes, including trauma, peritonitis, vascular emergencies, and abdominal compartment syndrome [1–3]. This paradigm shift occurred after Rotondo et al. published a study showing that outcomes were better in trauma patients that underwent damage control laparotomy with resuscitation in the ICU compared to completing a full repair when the patient was coagulopathic, hypothermic, and acidotic [4]. Third-spacing from sepsis or shock, multiple blood products and fluids, and edema from injury or ischemia can all lead to significant thoraco-abdominal competition and ultimately abdominal compartment syndrome (with impaired cardiac function, blood flow, and pulmonary excursion) when trying to close the fascia. To prevent respiratory compromise, delayed fascial closure with management of the open abdomen is undertaken; the best technique, however, with which to achieve primary closure has yet to be determined.

Early techniques focused on packing of the injured areas for hemorrhagic control and prevention of desiccation of the bowel [2]. Since then, many different methods of closure have been entertained, with options ranging from loose packing, to mesh placement, and now negative pressure therapy (NPT) [2,3]. Eventual closure of the abdomen can then be facilitated by techniques such as mesh-mediated fascial traction (examples including a Wittmann patch) [3,5] and definitive closure aided with mesh, skin grafting, or component separation [1,6,7]. Current systems of fascial/muscle traction, however, are associated with increased abdominal compression, intra-abdominal pressure, and impaired ventilation. In this case report, we illustrate using weighted abdominal traction to facilitate continuous fascial tension and to prevent retraction without increasing abdominal pressure or compromising ventilation until the abdomen is suitable for closure. In three patients, we describe two similar, but distinctly different techniques, in how to approximate the abdominal wall without using mesh or artificial skin covering.

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2. Case #1

Our first patient is a fourteen-year-old male with long-gap esophageal atresia who initially underwent a Foker procedure as an infant to re-establish esophageal continuity. He was found to have metaplasia of his distal esophagus during workup for a recalcitrant esophageal stricture.

A jejunal interposition was proposed as the best means to remove the esophageal metaplasia as well as the esophageal stricture. Unfortunately, due to venous congestion of the jejunal interposition, multiple surgeries were required, and the patient's abdomen was left open with a VAC sponge. Upon attempted closure of the abdomen, it was noted that patient's tidal volumes and ventilator pressures changed drastically, despite having close to 10 cm between fascial edges. In order to prevent further fascial retraction until the abdomen could be closed, the edges of the fascia were sutured to a reinforced silastic silo with #1 Prolene sutures and large felt pledgets, creating a watertight closure. Further 0 Prolene sutures were then attached to the silo and to the skin of the abdomen; this was placed on 20 pounds of traction, using a pulley system similar to orthopedic traction. Using this system, we were able to prevent further competition with the thoracic cavity by containing the abdominal viscera in a silo, yet still allowing tension on the fascia to prevent retraction. The patient's abdomen was able to be closed primarily after 7 days in traction and aggressive diuresis.

3. Case #2

This technique was later duplicated in a nineteen-year-old female, who suffered a caustic ingestion at three years of age, requiring esophageal dilations and a gastric pull-up. Due to persistent aspiration and reflux, she presented to Boston Children's for a jejunal interposition in hopes of regaining adequate oral nutrition.

The procedure included resection of the gastric conduit and a jejunal interposition with roux-en-y reconstruction. Due to the length of the procedure and fluid resuscitation, the abdominal contents were too edematous for adequate closure. Upon return to the operating room, fascial closure was unable to be obtained due to respiratory compromise. Similar to the previous patient, the edges of the fascia were sutured to a reinforced silastic silo with 0 Prolene sutures and large felt pledgets, and another layer of 0 Prolene sutures were attached to the silo and to the skin of the abdomen (Fig. 1).

The patient was placed on 30 pounds of traction and brought back to the ICU. After 8 days of continuous traction, the patient's abdomen was able to be closed primarily with #1 interrupted PDS sutures without any difficulty or respiratory embarrassment.

4. Case #3

Our third patient is a twenty-five year old female with a history of esophageal atresia. Her surgical history included a jejunal interposition and subsequently a colonic interposition to restore adequate gastrointestinal continuity. Despite these interventions, she was unable to tolerate oral intake; she was also found to have severe gastro-colonic-esophageal reflux despite multiple Nissen funduplications, which lead to continued aspiration and chronic lung disease, requiring BiPAP.

She was taken to the operating room, where a laparotomy and sternotomy were performed, the colonic interposition was taken down, and a new jejunal conduit was put in place. Due to the extensive nature of the surgery and concern for health of the new conduit, both her sternum and abdomen were left open; she was taken to the ICU with negative pressure therapy in place over her sternum and a silo dressing that was placed on 30 pounds of traction covering her abdominal cavity (Fig. 2).

Unfortunately, after closing her sternum 3 days later, her esophagojejunal anastomosis leaked due to ischemia of the conduit, which required resection and a cervical esophagostomy. She required multiple

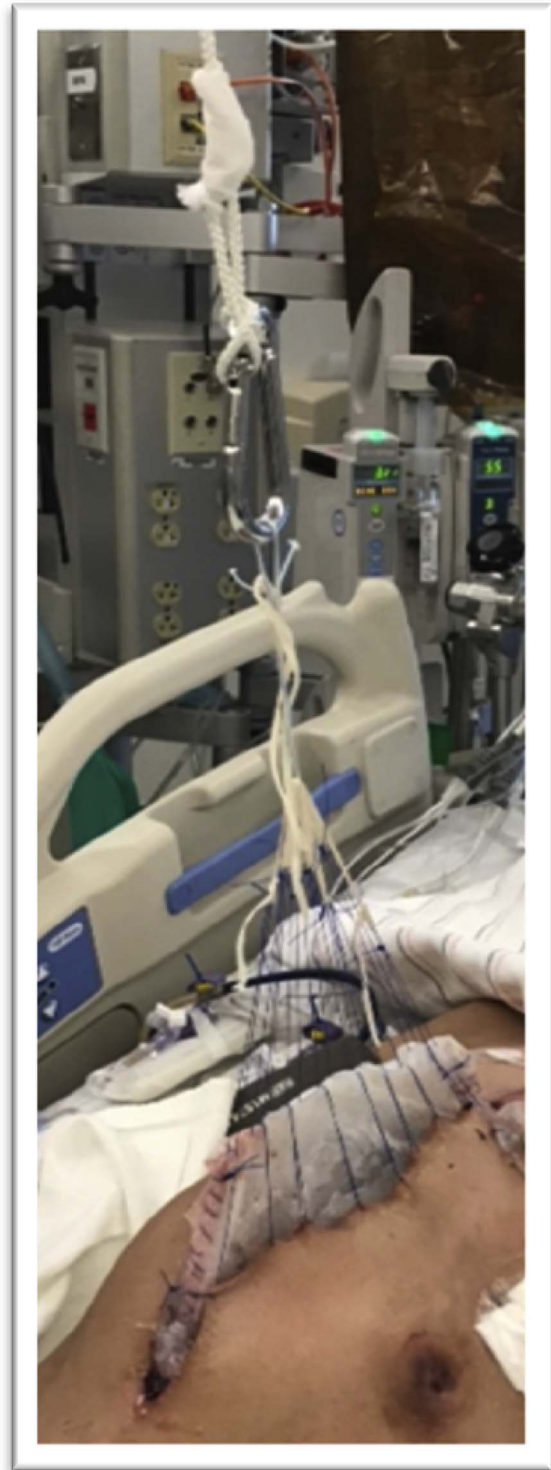


Fig. 1. A silastic silo was used for bowel protection, while the fascia and skin were suspended under 30 pounds of weighted traction.

wash-outs and remained with an open abdomen until the infection resolved. Upon trying to close the abdomen, it was noted that she had significant thoraco-abdominal competition, with tidal volumes of only 2 cc/kg. Her initial gap between fascial edges was 18 cm. To allow for the best chance at a primary fascial closure, relaxation of the abdominal wall was achieved with a Botox injection (110 units on each side) into the bilateral abdominal musculature; a NPT system with continuous fascial tension was constructed using #2 Ethibond sutures with felt

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