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Simplified Repair of Traumatic Iliac Crest Flank Hernias with Mesh Strips

Aaron M. Kearney, MD
Gregory A. Dumanian, MD

Background: Traumatic abdominal wall hernias are rare injuries resulting from blunt abdominal trauma. Traditional approaches have included both open and laparoscopic approaches, with placement of large meshes with giant overlaps. Perhaps the most technically difficult aspect of these repairs is fixating the abdominal wall to the iliac crest. The senior author has developed a method of repair using 2-cm strips of mesh. In this article, we present a description of 4 patients treated with this technique.

Methods: We included 4 adult patients who underwent traumatic flank hernia repairs by the senior author. We excluded incisional hernias and patients who received a planar sheet of mesh. Demographics and outcomes collected included length of stay, follow-up time, and complications.

Results: The average age was 38.5 years. Three hernias were due to motor vehicle collision injuries, and 1 was a crush injury at work. No planar meshes or bone anchors were used. No patients required component separation. There were no instances of surgical site infection, hematoma, or wound breakdown. All repairs were intact at the time of last follow-up (average, 24.3 months; range, 4–48.7 months).

Conclusions: Traumatic flank hernias are rare injuries that can be difficult to address. Here, we describe a technique of primary repair with mesh strips that distribute the forces of repair across a greater surface area than can be achieved with sutures. Placing drill holes through the iliac crest avoids the cost and complexity of suture anchors. *(Plast Reconstr Surg Glob Open 2020;8:e2970; doi: 10.1097/GOX.0000000000002970; Published online 15 July 2020.)*

INTRODUCTION

Traumatic abdominal wall hernias are rare injuries resulting from blunt abdominal trauma, first reported by Selby in 1906.[1] In a series of 1459 patients who underwent abdominal/pelvic computed tomography (CT) scans for blunt trauma, 14 patients (0.96%) were found to have a defect of all 3 abdominal musculofascial layers, with or without herniation of abdominal contents.[2] Described mechanisms of injury include handlebars,[3–15] seatbelts,[16–20] falls,[21,22] bullhorns,[21,23] and other blunt injuries.[24–27]

In any patient with an acute traumatic abdominal wall hernia, there must be a high suspicion for associated intra-abdominal injuries,[8,11,27–33] as well as pelvic fractures,[27,34,35] as a high force is required to cause this herniation. These high-energy injuries have a high incidence of associated operative intra-abdominal injuries and thus the risk of a contaminated field. In 2003, Lane et al[36] presented a series of 6 of such cases, all of which were repaired primarily in the acute setting. They noted a 50% incidence of postoperative wound infections, which they attributed in part to the contaminated fields. Due to these associated injuries and delays in diagnosis, most of these traumatic flank defects are diagnosed and repaired in delayed settings.[27]

Traditional surgical approaches have included both open and, more recently, laparoscopic[37–44] approaches, with placement of large meshes with giant overlaps. A few repairs have been described elsewhere.[7] Meshes used in repair have included both synthetic[45] and biologic varieties. Porcine acellular dermal matrix remains an option for this problem,[20,46] but human acellular dermal matrix has demonstrated a 100% one-year failure rate.[47]

Perhaps the most technically difficult aspect of these hernia repairs is fixating the abdominal wall to the iliac

From the Division of Plastic Surgery, Northwestern Memorial Hospital, Chicago, Ill.

Received for publication April 2, 2020; accepted May 11, 2020.

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DOI: 10.1097/GOX.0000000000002970

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

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crest when the blunt trauma "rips" the lateral 3 muscles off their origin. Methods described for this study include the use of bone anchors[43,44,48,49] and direct suture fixation.[50] The senior author has developed a method of hernia repair using 2-cm strips of macroporous polypropylene mesh[51,52] that are used as sutures. A strip of mesh has the advantage of a larger surface area and, thus, a greater force distribution across the closure when compared with a single strand of suture.[53] Fibrovascular ingrowth around the filaments distributes the force of closure across a strip of mesh and results in a less chance of suture pull-through, or cheese-wiring through the tissues, compared with the traditional monofilament suture.[54] We have combined this mesh suture technique with a previously described technique to secure the mesh to the bone[50] to achieve a targeted mesh placement repair of traumatic flank hernias. In this article, we present a case series of 4 consecutive patients.

METHODS

Following institutional review board approval, an enterprise data warehouse search was performed of the senior author's (G.A.D.) cases. We included all adult patients who had flank hernia repairs by the senior author. All hernias were due to a traumatic mechanism. We excluded incisional hernias and patients who received a planar sheet of mesh for repair. Patient demographics collected included age, body mass index, smoking status, chronic steroid use, hernia defect size on computed tomography (CT), and Ventral Hernia Working Group (VHWG) classification[55] [Grade I, low risk of complications; Grade II, comorbidities present (eg, smoker, chronic obstructive pulmonary disease, and diabetes mellitus); Grade III, potentially contaminated (stoma present and prior infection); Grade IV, frank infection]. Outcomes collected included length of stay, follow-up time (date of last clinic visit or most recent abdominal CT or magnetic resonance imaging), and complications (including wound breakdown, infection, hematoma, and hernia recurrence). Iliac crest drill holes were used when there was insufficient muscle on the inferior aspect of the hernia defect to support a repair.

Description of Procedure

Preoperative view of a representative patient is demonstrated in Figure 1. CT image is routinely obtained to define the defect (Fig. 2). The patient is placed in a lateral decubitus position on a beanbag. A generous incision is made over the midportion of the hernia sac. Dissection is carried down through the skin and subcutaneous tissues to identify the abdominal musculature. Often, the entire operation can be done in the retroperitoneal space. If the peritoneum is entered, it is closed with a 2-0 polydioxanone suture. The iliac crest is exposed with a monopolar electrocautery, completing exposure of the defect (Fig. 3). Next, a 2.5-mm drill is used to drill through the iliac crest from anterior to posterior, using a malleable retractor to protect the viscera. The drill is oriented as perpendicular to the bone as possible. If needed, the outer aspect of a standard 3-ml syringe with the Luer lock end removed can

Fig. 1. Preoperative anteroposterior (AP) view of a 57-year-old man with a traumatic left flank hernia as a result of a motor vehicle collision seatbelt injury 18 months before presentation. He had no prior operations for the hernia.

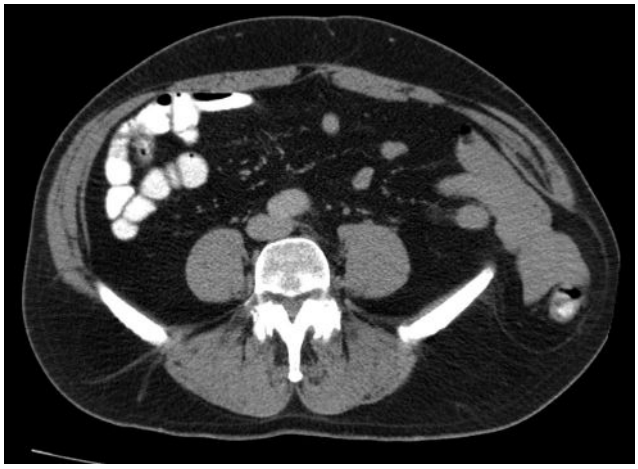

Fig. 2. Representative image of abdominal computed tomographic (CT) scan demonstrating a 5.8 cm hernia.

be used as a protective trocar to protect the soft tissues during drilling. Next, a sheet of soft macroporous polypropylene mesh (Soft Prolene Mesh; Ethicon, Somerville, N.J.) is cut along the blue lines into 2-cm-wide strips. The end of the strip is tied to a No. 1 polypropylene suture. (**See Video 1 [online]**, which displays tying a No. 1 polypropylene suture to a mesh strip.)

The needle is used to guide the mesh strip through the iliac crest and then through the full thickness of the abdominal wall (Figs. 4, 5). (**See Video 2 [online]**, which displays using a No. 1 polypropylene suture to pass a mesh strip through a drill hole in the iliac crest.) Once all the strips have been placed, the table is placed in a reflex position and the mesh strips are each tied with 3 knots under direct vision (Figs. 6, 7). One subcutaneous drain is placed and removed when the output is <30 ml per 24 hours for 2 consecutive 24-hour periods. If there is a significant dead space, 2-0 polydiaxanone quilting sutures may be used. The patient is admitted to the floor postoperatively for

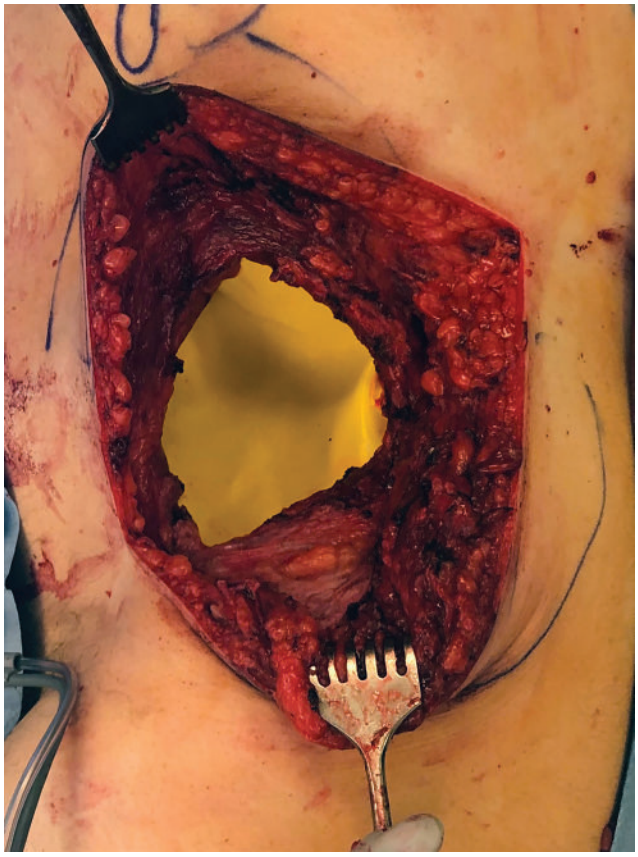

Fig. 3. Hernia exposure and defect preparation. The abdominal musculature could be approximated to the iliac crest with finger tension, suggesting that mesh-sutured repair would suffice.

pain control, with strict instructions for no heavy lifting. Patients are discharged home with adequate oral analgesia after observing that they could tolerate a diet and ambulate.

RESULTS

After applying inclusion and exclusion criteria, 4 patients were identified (3 men and 1 woman) (Table 1). The average age was 38.5 years (range, 30–57 years) and the average body mass index was 27.8 (range, 22–31). No patients had a history of smoking or of chronic steroid or immunosuppressant use. Three of 4 patients had had prior abdominal surgery, though only one had undergone a prior traumatic flank hernia repair. Three hernias were due to motor vehicle collision (MVC) injuries, and 1 was due to a crush injury at work. All hernias involved all 3 layers of the abdominal wall. No planar (flat sheet) meshes or bone anchors were used for these patients. Hernia dimensions were available for 2 patients and were an average of 6.1 cm transverse by 6.1 cm vertical. Ventral Hernia Working Group was 1 for 3 patients and 2 for the remaining patient. No patients required component separation. Average operating room time (incision to close) was 114 minutes (range, 78–130 minutes).

Average length of hospital stay was 3.25 days (range, 2–5 days). There were no instances of surgical site infection, hematoma, or wound breakdown. All repairs were intact at the time of last follow-up. Average follow-up time was 24.3 months (range, 4–48.7 months).

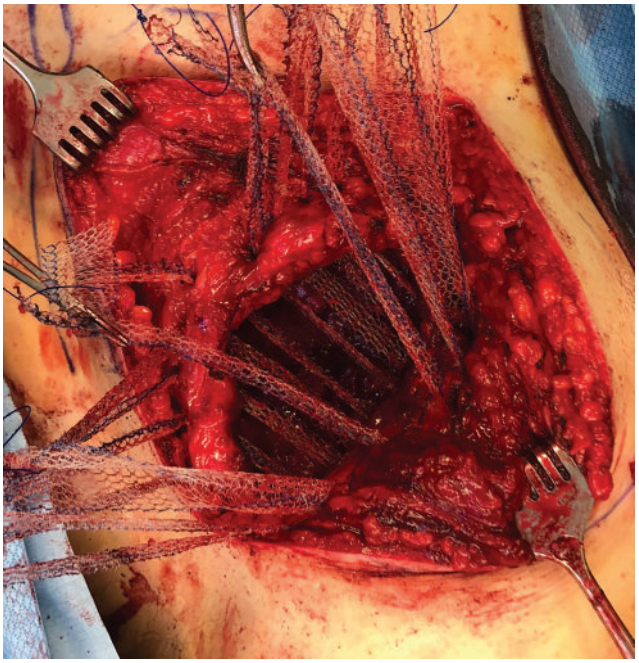

Fig. 4. Mesh strips are passed through the abdominal musculature and iliac crest as described.

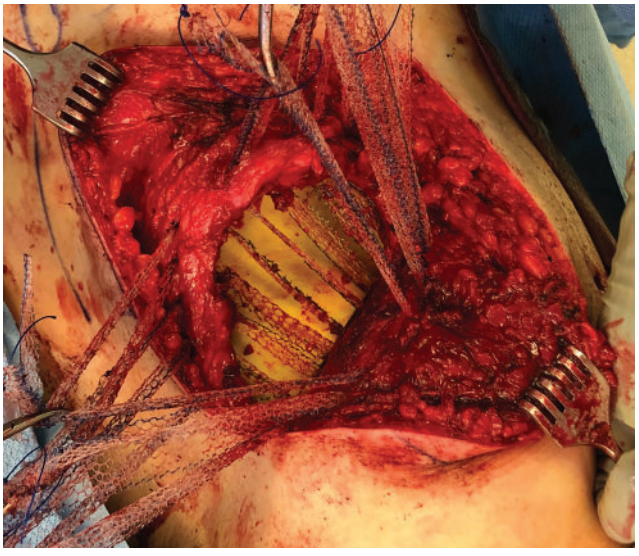

Fig. 5. Additional view of mesh strips.

DISCUSSION

Traumatic flank hernias are rare but potentially difficult problems, with a reported recurrence rate of 7%–26%.[29,35,56] These hernias can be quite bothersome to patients, causing a significant degree of bulging and discomfort. Traditional open repair techniques have consisted of primary repair or more commonly repair with giant mesh reinforcement. We have found that traumatic

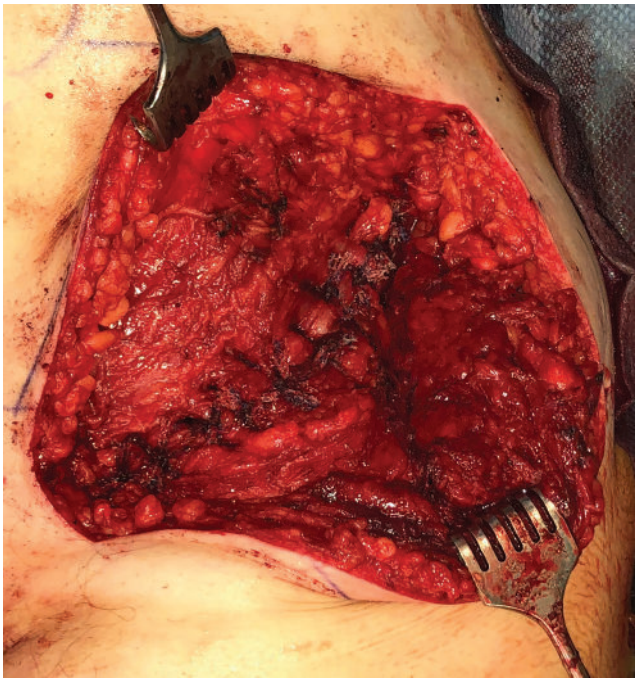

Fig. 6. View following fascial closure.

Fig. 7. One-month postoperative result.

flank hernias are amenable to primary closure without the nonspecific use of mesh. Rather, a targeted placement of mesh at the repair site using strips of mesh (instead of monofilament suture) distributes the forces of closure across a larger surface area, helping reduce the likelihood of pull-through with improved outcomes over suture repairs.[53] In addition, efficient, secure, and inexpensive fixation is provided to the iliac crest using drill holes. This series of 4 patients serve as excellent model for us to describe this effective technique. Our limited number of patients experienced no complications.

Traumatic abdominal wall hernias are themselves rare entities, and descriptions of primary repair are largely limited to case reports.[23,33,35,57–59] While several factors contribute to the decision of primary versus mesh-supported repair, including defect size and presence of abdominal contamination, we find that our mesh strip technique provides some of the advantages of planar mesh while avoiding the difficulties and time required to place a large sheet of prosthetic material. Cases were completed on average under 2 hours for these surgeries. Drilling through the iliac crest provides a reliable method of fixating the fascia to the bone. Pain control requirements were similar to a midline incisional hernia repair with mesh. The most commonly described alternative is the use of suture anchors.[43,44,48,49] One series of 8 patients, one of the largest series of this type, who received suture anchor fixation for flank hernias reported a recurrence rate of 20%.[49] Although our series is limited, our results compare favorably to this. Suture anchors provide good fixation to the bone but are still limited by the need for sutures to hold on to the muscle of the lateral abdominal wall. Suture fixation of muscle is problematic—one of the reasons that flank hernias, in general, are considered difficult to repair.

Our study's main limitation is its limited sample as a case series. Traumatic abdominal wall hernias are rare injuries, and this is a single-surgeon experience. Ongoing follow-up will provide valuable data on our series as patients are followed for hernia recurrence, pain, and any potential problems of the mesh strip repairs that could require revision.

Table 1. Demographics and Surgical Details

Demographic	n (%)
Total number of patients	4
Age at the time of surgery (mean, range), y	38.5 (30–57)
Men	3
Women	1
BMI (mean, range), kg/m²	27.8 (22–31)
Current smoker	0
Chronic steroids or immunosuppressants	0
No. patients with previous hernia repairs	1 (25)
Cause of hernia	3 motor vehicle collision 1 crush injury at work
Hernia size (transverse), cm, mean	6.1
Hernia size (vertical), cm, mean	6.1
Operating room time (mean, range), min	114 (78–130)
Component separation performed	0

BMI indicates body mass index.

CONCLUSIONS

Traumatic flank hernias are rare injuries that can be difficult to address, with outcomes worse than those of midline hernias. Traditional approaches to repair have included sheets of mesh, due to the conceptual difficulty of the best means to fix the mesh to the bone. In this article, we describe a technique of primary repair with mesh strips that distributes the forces of repair across a greater surface area than can be achieved with sutures, but a more targeted placement of mesh is needed than described in other techniques. Placing drill holes through the iliac crest avoids the cost and complexity of suture anchors.

Gregory A. Dumanian, MD
Division of Plastic Surgery
Department of Surgery
Northwestern Feinberg School of Medicine
675 N. Saint Clair St., Suite 19-250
Chicago, IL 60622
E-mail: gdumania@nm.org

PATIENT CONSENT

Patients provided written consent for the use of their images.

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