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CASE REPORT

A novel approach for salvaging infected prosthetic mesh after ventral hernia repair

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Abstract
Background Salvaging infected prosthetic material after ventral hernia repair is rarely successful. Most cases require mesh excision and complex abdominal wall reconstruction, with variable success rates. We report two cases of mesh salvage with a novel use of percutaneous drainage and antibiotic irrigation.
Cases Two patients developed infected seromas after laparoscopic ventral hernia repair. One patient with a remote history of methicillin-resistant *Staphylococcus aureus* (MRSA) mesh infection underwent laparoscopic ventral hernia repair with a 20 × 23-cm piece of Parietex composite mesh. Two weeks post-operatively, he developed fevers and MRSA was aspirated from the seroma. Another patient had a 32 × 33-cm piece of ePTFE placed for repair. He subsequently developed a massive seroma requiring repeated aspirations. Four months following the repair, he developed an infected seroma with *Klebsiella* pneumonia. Each patient underwent percutaneous drainage of their abscesses with a six-French-pigtail catheter under ultrasound guidance. After 2 weeks of parenteral antibiotics and clinical resolution, the patients were placed on 4 weeks of gentamicin irrigations (80 mg in 30 cc solution) via the drain three times per day. Once therapy was completed, the drains were removed. The first patient also remains on daily oral doxycycline for suppression for his MRSA. Both patients have remained free of clinical signs of infection at 12 and 16 months, respectively, following the completion of therapy.
Conclusion Percutaneous drainage followed by antibiotic irrigation is a potential alternative to prosthetic removal when treating infected mesh in carefully selected patients.

Keywords Ventral hernia · Mesh · Infection · Percutaneous · Irrigation

Introduction

The placement of permanent prosthetic materials during ventral hernia repair has resulted in a significant reduction in recurrence rates [1]. However, prosthetic infection remains a significant clinical problem. While the exact incidence of mesh sepsis is unknown, when it occurs, it is typically devastating for both the patient and the surgeon. Certain patients have been identified as having a higher incidence of mesh infections, including those with a recurrent hernia, a previous infection of the surgical site, and routine tobacco use [2, 3]. Unfortunately, these same patients are also likely to have a recurrent hernia if prosthetic mesh is not utilized in their repair. Therefore, despite the previously mentioned risk factors, most surgeons use prosthetic material in all but the smallest ventral hernia repairs. With the utilization of laparoscopic ventral hernia repair techniques, mesh sepsis is less common, but it has been reported to occur in up to 1–2% of cases [4].

Once a prosthetic mesh becomes infected, most cases demand a major operation with eventual prosthetic explantation. This typically leaves the patient with few

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reconstructive options and a high reherniation rate. Alternative methods of treating infected prosthetic material are needed to address this complex clinical situation. We present a unique approach to salvaging an infected prosthetic mesh after laparoscopic ventral hernia repair.

Case presentation

Case 1

A 58-year-old male presented with a recurrent upper abdominal ventral hernia. His past surgical history was notable for a previous open ventral hernia repair with a combined ePTFE and polypropylene mesh (Composix, C.R. Bard, Inc., Murray Hill, NJ, USA) mesh that eventually required removal secondary to methicillin-resistant *Staphylococcus aureus* (MRSA) infection 2 years prior. On this presentation, the patient had a completely healed wound with no signs of clinical infection. He subsequently underwent a laparoscopic ventral hernia repair of the recurrent hernia. Pre-operatively, the patient received a single prophylactic dose of vancomycin antibiotic. The hernia defect measured 11 × 15 cm and a 20 × 23-cm piece of polyester composite mesh (Parietex PCO, Covidien, Inc., North Haven, CT, USA) was used for the repair. After surgery, he had a short uncomplicated post-operative hospitalization and was discharged to home without event.

At his 2-week follow-up visit, he was complaining of abdominal pain. His anterior abdomen was noted to be erythematous over a notable seroma, and the patient had a low-grade fever. The seroma was aspirated and cultures revealed MRSA. The patient was placed on intravenous vancomycin. Under ultrasound guidance, a six-French-pigtail catheter was placed into the fluid collection. A computed tomography (CT) of the abdomen that followed demonstrated a fluid collection above the mesh with air (Fig. 1).

After clinical improvement and 2 weeks of vancomycin therapy, the patient was placed on gentamicin irrigations (80 mg in 30 cc solution) via the drain three times daily. This therapy was continued for 4 weeks, and the drain was removed. He was additionally placed on life-long daily oral doxycycline suppressive therapy for the recurring MRSA infections. At 12 months of follow-up, the patient has retained his prosthetic and remains without clinical signs of infection. A follow-up CT scan at 1 year demonstrates no fluid, signs of infection, or recurrence of his hernia (Fig. 2).

Case 2

A 70-year-old male presented for elective repair of a large ventral hernia. His past surgical history was significant for an open colectomy 15 months prior for colon cancer, which was complicated by a post-operative wound evisceration. He later required a series of complex abdominal wall reconstructions, with the most recent operation including an enterocutaneous fistula resection and fascial reapproximation using human acellular dermal matrix (ADM; AlloDerm, LifeCell Corp., Branchburg, NJ, USA) as a bridged repair. Eight months after this procedure, the patient presented with a large recurrent ventral hernia. This hernia was subsequently repaired laparoscopically. Cefazolin was given pre-operatively. The defect measured 24 × 25 cm and was repaired with a 32 × 33-cm piece of ePTFE (Gore-tex Dual Mesh Plus, W. L. Gore & Associates, Inc., Flagstaff, AZ, USA) mesh with no immediate

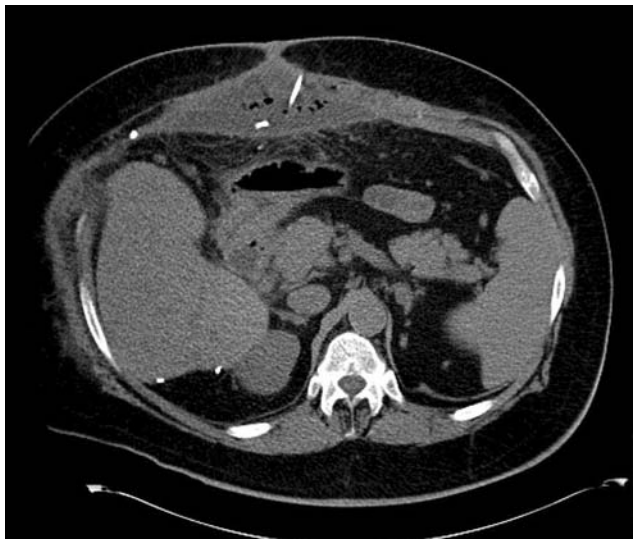

Fig. 1 Case 1 computed tomography (CT) following ultrasound-guided drain placement into peri-mesh fluid collection

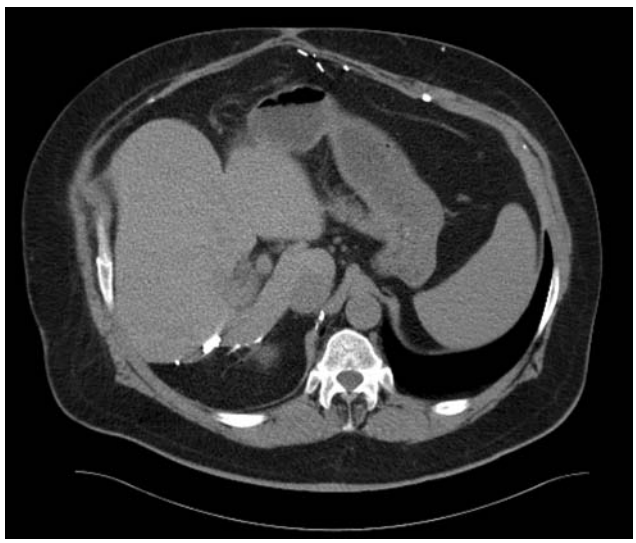

Fig. 2 Case 1 follow-up CT after 1 year demonstrating complete resolution of abscess cavity without evidence of hernia recurrence

post-operative complications. After a short inpatient hospitalization, he was discharged home wearing a binder for 6 weeks with routine follow-up.

Following his discharge, he developed a large seroma that was drained twice in the office via percutaneous aspiration. After 4 months of the persistent seroma, he underwent radiologic guided percutaneous aspiration. Four hundred cubic centimeters of serosanguinous fluid was evacuated. He returned the next day febrile to 38.8°C, complaining of nausea, vomiting, and lower abdominal pain. Laboratory studies revealed a WBC of 18.9×10^9/l. A CT of the abdomen and pelvis was obtained and demonstrated a peri-mesh fluid collection with air. He was admitted to the hospital and was started on broad-spectrum parenteral antibiotics (vancomycin and piperacillin/tazobactam) until culture results were obtained. An ultrasound-guided percutaneous drainage of the collection was performed, and a six-French-pigtail catheter was placed into the cavity. Fluid cultures grew *Klebsiella* pneumonia sensitive to ciprofloxacin. Over the next several days, the patient's clinical condition improved dramatically. He was given a 2-week course of ciprofloxacin with the drain left in place. Following this therapy, he was started on gentamicin irrigations via the drain three times daily, as in Case 1, and the drain was removed. The patient was then followed clinically and, after 16 months, has had no recurrence of infection and retains his prosthesis.

Discussion

A frequent consequence of prosthetic mesh use in ventral hernia repair is the development of a seroma. Potential complications of these collections requiring treatment may be septated cyst formation [5], cellulitis [6], or the most morbid result of a frank mesh infection. Single-dose pre-operative antibiotic therapy for ventral hernia repair has been supported [7, 8] and is now widely practiced currently, although, with the prevalence of seroma formation and its risk for infectious complications, some surgeons have considered post-operative antibiotics prophylactically. Edwards et al. [6] compared 7 days of post-operative antibiotic therapy against pre-operative prophylaxis alone and found some potential benefit to avoid infectious complications related to the seroma. There is, otherwise, very limited data to support this practice routinely. Subsequently, when mesh-related infections do occur, most surgeons advocate a combination of antibiotic therapy and complete mesh removal as the primary mode of therapy [9].

Abdominal wall reconstruction following the removal of an infected prosthetic mesh, however, is a challenging surgical problem. Often, the defect remaining after mesh resection is larger than the original defect. Most would agree that placing another synthetic mesh is contraindicated for the risk of recurrent infection. Therefore, the surgeon has few reconstruction options. Biologic mesh used as a bridged repair has resulted in unacceptably high recurrence rates in our hands [10]. Alternatively, large complex reconstructive procedures offer improved results. The ideal approach would involve some means to preserve the prosthetic material and avoid resection. We have presented two cases using the novel approach of percutaneous drainage of the infection with local antibiotic irrigation to salvage the mesh. This method has proven to be safe and successful in this highly selected group of patients and offers some hope of mesh salvage in these difficult clinical situations.

The problem of managing infected prosthetic material is not unique to general surgeons. In fact, less invasive alternatives to complex reoperative procedures have been attempted and described initially in other specialty literature. Vascular surgeons have described much of the earliest alternative therapy when dealing with infected prosthetic vascular grafts. Initial reports, in the 1970s, discussed periodic salvage attempts using debridement and irrigation alone in treating these infections [11, 12]. Two case series published in 1981 by Kwaan and Connolly [13] and Almgren and Eriksson [14] described irrigation methods specifically as opposed to graft removal as a way of salvaging the vascular prosthetic. These techniques were attempted in a very select group of patients typically deemed to be poor surgical candidates. Kwaan and Connolly described opening the wound for debridement and drainage, and then applying constant povidone–iodine irrigation to the graft. Nine of 10 patients in this series avoided vascular graft removal at a minimum of 12 months of follow-up. Almgren and Eriksson performed a local debridement and followed it with instilling a cloxacillin irrigation solution into drains left alongside the graft. All four patients with prosthetic grafts in this series recovered from their infections. These then led to other published reports where modifying the instilling agents as well as utilizing percutaneous drainage also yielded successful results [15, 16].

Orthopedic surgeons have also reported the successful salvage of prosthetic joints using local irrigation methods. In a series of 24 infected joints, 20 were successfully salvaged with local debridement and serial arthroscopic irrigations with normal saline [17], thereby, avoiding a repeat total joint replacement. A recent series utilized a more rigorous form of this therapy by performing continuous irrigation of the joint with an antibiotic solution through drains placed in the operating room for 7–29 days [18]. Eight of 10 prosthetic joints were salvaged in that series. Hence, as has been described, irrigation and drainage has shown promise in various select settings when applied to infected prosthetic materials.

Very few reports have described the successful salvage of infected prosthetic mesh after ventral hernia repair. Petersen et al. [19] described a series of eight patients in which an attempt to salvage the mesh was performed by wound debridement and a course of saline irrigation averaging 23 days in duration. Of them, five recovered without requiring mesh excision. The three failures had ePTFE mesh utilized for the inciting repair. Conversely, Kercher et al. [20] were able to salvage a piece of exposed ePTFE mesh with serial local debridements and drainage performed in the operating room. These less traditional approaches, however, more often require eventual mesh removal secondary to chronically draining sinuses or fistula formation [3]. More recently, with the utilization of a vacuum-assisted dressing system, other groups have reported small series of successful mesh salvage [21]. Paton et al. [22] reported a series of six patients with limited mesh involvement in which debridement, drain placement, and applying a vacuum dressing salvaged the mesh. Two other patients in this series were treated with percutaneous drainage without antibiotic irrigation for presumed mesh sepsis. Only one patient eventually required mesh explantation due to recurring infection.

Our initial patient carrying a history of a prior MRSA mesh infection, with a completely healed and normal-appearing wound, brings up a difficult surgical dilemma. MRSA bacteria have shown virulent characteristics and can be a difficult organism to completely eradicate [23]. The ability of MRSA to cause delayed prosthetic infections in seemingly dormant wounds has been well described in the orthopedic literature. Oral suppression therapy for treating indolent MRSA prosthetic infections has been reported in two small observational studies. In each case, the oral suppression salvaged prosthetic joints in 100% ($n = 6$) [24] and 89% ($n = 19$) [25] of cases with methicillin-resistant *Staphylococcus* species (aureus or coagulase negative). However, in the circumstance where the prosthetic was removed remotely secondary to MRSA sepsis, should the surgeon ever place another prosthetic, even if there are no obvious signs of infection? Another report from the orthopedic literature showed that prosthetic joint reimplantation or attempted salvage following infection from a methicillin-resistant *Staphylococcus* species resulted in only a 48% success rate for hip arthroplasties and 18% for knee arthroplasties, whereas infections with methicillin-sensitive species were treated effectively in 81 and 89% of patients, respectively [26]. These findings suggest that extreme caution should be used when choosing to re-implant prosthetic material following infection with a methicillin-resistant *Staphylococcus* species. In our current practice, we now feel that a history of prior MRSA mesh infection is a relative contraindication for the placement of a new synthetic mesh, even if the wound does appears to be clean. The morbidity and risks of failure from re-infection, we feel, necessitates an alternative approach utilizing component separation and potentially biologic mesh.

Conclusion

The treatment of an infected mesh following ventral hernia repair remains a complicated problem for the general surgeon. Percutaneous drainage with antibiotic irrigations is a novel approach to salvaging an infected mesh as opposed to routine removal. With relatively few therapeutic options available to treat mesh infections, this may be another potential less invasive treatment method, especially in poor re-operative candidates. This therapy, however, should be reserved for a select group of stable patients without signs of systemic sepsis. Further investigation of this treatment is necessary in larger series of patients to determine its ultimate outcome.

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