The use of porcine acellular dermal matrix in a bridge technique for complex abdominal wall reconstruction: an outcome analysis

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\textbf{KEYWORDS:} Bridging; Porcine acellular dermal matrix; Hernia recurrence; Abdominal wall reconstruction; Hernia complications

\textbf{Abstract}

\textbf{BACKGROUND:} Outcomes using the porcine acellular dermal matrix (PADM) in abdominal wall reconstruction (AWR) have been reported when used for midline reinforcement; however, there have been no reports focused on outcomes when used as a bridging mesh.

\textbf{METHODS:} A retrospective review was conducted of all patients who underwent AWR with a non–cross-linked PADM as a bridged repair without midline fascial approximation.

\textbf{RESULTS:} Nine patients were identified with an average follow-up of 546 days. The average preoperative hernia defect diameter was 22.4 cm. After PADM placement, the average defect diameter was 9.8 cm. Complications occurred in 55.6% of patients, with PADM exposure occurring in all of these patients. No PADM was explanted, and all patients eventually healed. Abdominal wall eventration and/or recurrence occurred in 8 of 9 (88.9%) patients.

\textbf{CONCLUSIONS:} When fascial approximation cannot be achieved, PADM bridging may be the best option to avoid complications associated with synthetic mesh. However, there is a high potential for abdominal wall eventration and/or recurrence.

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Clinical outcomes using the PADM have been generally positive, but there have been no reports concerning outcomes when used as a bridge between fascial edges. The purpose of this study was to review outcomes after the repair of complex abdominal wall hernias in which a PADM product was used as a bridge in the setting of severe loss of domain based on an inability to obtain primary fascial closure.

Patients and Methods

An Institutional Review Board–approved, retrospective review was conducted of all patients who underwent abdominal wall reconstruction by the senior authors (P.B and M.Y.N) from 2007 to 2010. Patients who had bridged repair with the PADM were identified. Strattice (LifeCell Corp), a non–cross-linked porcine ADM, was used in all patients. Patient demographics and the pre- and postoperative course were reviewed for each patient.

Operative sequence

All patients received perioperative prophylactic antibiotics before and after AWR. A standard midline surgical approach was used for noninfected patients. Bilateral subcutaneous flaps were elevated above the anterior fascia. Perforating vessels to the adipocutaneous layer were preserved when possible during the dissection. A complete lysis of adhesions was performed when necessary. Previously implanted synthetic material (ie, mesh, sutures, or tacks) was removed if present. In infected patients, composite resection of all infected tissue occurred before the elevation of subcutaneous flaps. Component separation when feasible was performed in attempts to have tension-free abdominal wall closure. In all patients, variable defect sizes were appreciated. When closure was not possible, the PADM was placed in an underlay fashion with 5 cm of mesh fascial overlap with suture fixation.

In patients with a moderate to large abdominal pannus, a panniculectomy was performed in conjunction with AWR. This was usually via a fleur-de-lis pattern; however, in some cases it was a vertical only or horizontal only excision. Drains were routinely placed beneath the subcutaneous flaps.

Postoperative protocol

All patients were admitted for close observation in the postoperative period and were discharged from the inpatient unit after the resolution of ileus and the successful management of perioperative complications. Antibiotics were administered within the first 24 hours after surgery. Patients were evaluated at regular intervals in the postoperative period by various members of the hernia team. Office charts were reviewed for details of each patient’s postoperative course. Drain removal occurred in all patients when output reached below 30 mL/d. An abdominal binder was maintained in each patient for approximately 4 weeks after surgery. The diagnosis of hernia recurrence or bulge was made by a physical examination and radiologic evaluation.

Results

Demographics

During the time interval of this study, 9 patients were identified as having a PADM implanted as a bridging mesh for AWR. Patient demographics are shown in Table 1. Based on the Ventral Hernia Working Group grading system, 3 of 9 (33%) were classified as grade II, 2 of 9 (22.2%) were grade III, and 4 of 9 (44.4%) patients were grade IV. The average age was 57 years (range 40–68) with a mean body mass index of 35.7 (range 21.7–39.5). Patient comorbidities included coronary artery disease (44.4%) and diabetes mellitus (22.2%). A recurrent/complex hernia was present in 100% (9/9) of the patients. A history of a mesh-related infection was noted in 4 of 9 (44.4%) patients.

Surgical technique

The average preoperative diameter of the hernia defect was 22.4 cm (Table 2). Primary fascial closure was attempted with component separation techniques in 6 of 9 (66/7) patients. In 3 of 9 (33/3%) patients, a staged approach was used for definitive abdominal closure. The average residual defect diameter was 9.8 cm. A concomitant panniculectomy was performed in 3 of 9 (33.3%) patients. After repair, the average hospital stay was 11.7 days.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient demographics and background information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total no. of patients*</td>
<td>9</td>
</tr>
<tr>
<td>Grade II</td>
<td>3 (33.3)</td>
</tr>
<tr>
<td>Grade III</td>
<td>2 (22.2)</td>
</tr>
<tr>
<td>Grade IV</td>
<td>4 (44.4)</td>
</tr>
<tr>
<td>Age, mean</td>
<td>57</td>
</tr>
<tr>
<td>Range in years</td>
<td>40 to 68</td>
</tr>
<tr>
<td>Body mass index, mean</td>
<td>35.7</td>
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<tr>
<td>Comorbidities</td>
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<tr>
<td>Coronary artery disease</td>
<td>4 (44.4)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2 (22.2)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Chronic steroid use</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Prior hernia repair</td>
<td>9 (100)</td>
</tr>
<tr>
<td>History of mesh infection</td>
<td>4 (44.4)</td>
</tr>
</tbody>
</table>

All values are n (%) unless otherwise specified.
*Grading based on recommendations by the Ventral Hernia Working Group.
Outcomes

The average follow-up period for all patients was 546 days (range 242–1,043 days) (Table 2). The overall complication rate was 55.6% (Table 3). Skin necrosis occurred in 5 of 9 patients (55.6%). Wound infection occurred in 4 of 9 patients (44.4%), with inevitable PADM exposure occurring in 5 of 9 patients (55.6%). Local wound care measures were initiated consisting of moist dressings and negative-pressure wound therapy. Operative debridements were completed as necessary and based on tissue viability. Secondary closure was completed in 2 of the 5 patients (40%). In the remaining 3 patients (60%), the PADM showed revascularization and granulation. Skin grafts were used for final wound closure in these 3 patients. No PADM was removed in any patient. Abdominal wall eventration or recurrence occurred in 8 of 9 patients (88.9%). The average time to eventration/recurrence was 6 months, with the earliest recurrence occurring in 3.5 months after surgery (Fig. 1). The single patient with no recurrence had a follow-up of 1.2 years.

Comments

Synthetic mesh has been the mainstay treatment of large ventral hernia before the introduction of the ADM. Since the advent of new biologic products, widespread use has allowed clinicians to focus attention on determining appropriate candidates for ADM placement. Currently, high-risk patients and patients with infected wounds have gained increasing attention because they are ideal for ADM placement.10,11 In settings in which fascial reapproximation is not achieved, determining which bridging mesh to use can be challenging. The decision is facilitated based on the patient risk profile. In low-risk patients, synthetic mesh can be considered. In the absence of early morbidity, synthetic mesh can have long-term durability with low recurrence rates.12 In high-risk patients, the use of synthetic mesh can lead to possible exposure and infection, which increases morbidity and compromises outcomes.13,14 Biologic mesh is frequently considered in these instances in order to minimize morbidity in complex repairs.

Early experience with the HADM used for bridged repairs had high recurrence, bulge, and eventration rates. Blatnik et al2 evaluated 11 patients with an HADM implanted as a bridging mesh. They found an 80% recurrence rate within a 2-year follow-up period with a majority of patients needing revisional surgery. Candage et al1 found similar conclusions when evaluating a series of patients with HADM implantation. Eighty-eight percent of patients who developed eventration were those with bridged repairs.3

When fascial reapproximation was obtained, we found sustained repairs with PADM reinforcement.9 Interestingly, the bridging technique using the PADM resulted in recurrence rates similar to studies investigating the HADM.1,2 These findings may likely be the result of prolonged tension across the biologic mesh resulting in expansion of the biologic mesh because of dermal elasticity. In addition, in this patient cohort, we found a high complication rate mostly related to infection and wound-healing issues. Despite these complications, no PADM was removed.

Our results show that eventration/recurrence occurs at approximately 6 months after repair. The earliest eventration/recurrence occurred at 3.5 months after repair. The single patient in our series to have had a sustained PADM-bridged repair had a follow-up period of approximately 1 year.
Consequently, this single patient had a lower body mass index than the other patients in the cohort, and no perioperative complications were observed in this patient.

In addition to the high recurrence rates with bridged PADM, our findings underscore the importance of appropriate patient selection when choosing mesh adjuncts for AWR. Large ventral hernias in high-risk patients are a reconstructive challenge. In instances of large hernias, preoperative determination of the ability to achieve midline closure may obviate the need to bridge defects. However, predicting fascial closure is difficult, and the placement of a bridging synthetic mesh in a high-risk patient may lead to serious complications. In these situations, the costs and benefits of PADM versus synthetic mesh bridging must be weighed. PADM bridging may have improved early morbidity at the expense of a high occurrence of long-term abdominal wall eventration and/or recurrence.

References