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Single institutional experience using biological mesh for abdominal wall reconstruction



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Abstract

BACKGROUND: Complex ventral hernias remain a challenge. We present a study evaluating outcomes of complex ventral hernia repair using human-derived acellular dermal matrix (AlloDerm) and porcine-derived acellular dermal sheet (Permacol).

METHODS: A retrospective review of 251 patients undergoing complex hernia repair was performed. Primary outcome was hernia recurrence; and secondary outcomes included early and late complications and mortality.

RESULTS: Recurrence for Permacol versus AlloDerm was 32% versus 47% ($P = .02$). There was a difference in early complications (48% vs 30%, $P = .007$) and also late complications (30% vs 21%, $P = .16$) of Permacol versus AlloDerm. Overall survival was 85% for the Permacol group versus 78% for the AlloDerm group ($P = .23$). Recurrence for Permacol versus AlloDerm for underlay technique was 19% versus 22% and that for bridging technique was 44% versus 57%.

CONCLUSION: There exists a high complication rate from both Permacol and AlloDerm in complex ventral hernia repair especially when used as a fascial bridge.

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Complex abdominal wall closure remains challenging to a general surgeon. The use of prosthetic materials has allowed closure of large abdominal defects with little or no tension. This has reduced the incidence of recurrence by about 50% when compared to primary closure alone.¹ However, when synthetic meshes are applied in the presence of contamination or infection, there is an increase in hernia recurrence and mesh infection.² It has been shown that infection causes weakening of the mesh–fascial interface and predisposes to higher recurrence rates.³ The use of biological

meshes started in 1990s and has surged to offer solution to this problem. Based on their reported ability for neovascularization and regeneration, they provide an extracellular scaffold for reconstruction of healthy tissue,⁴ which may provide a theoretical advantage over synthetic meshes especially in a contaminated or infected operative field.⁵

Although there is a consensus that biological meshes are appropriate for abdominal wall reconstruction in the presence of contamination, the ideal mesh for general application remains a mystery. Biological meshes differ in origin, sterilization and harvesting processes, and presence of cross-linking.⁴ Crosslinking was originally described in 1975, and it prevents the degradation of collagen-based bio-scaffold by the host or bacterial collagenase, hence maintaining the durability of the material.⁵

Biological meshes are derived from various sources: human, bovine, or porcine. Permacol is a porcine-derived

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acellular dermal (PAD) sheet that is chemically treated with hexamethylene diisocyanate to increase its cross-linking strength, while AlloDerm is a human-derived acellular dermal matrix (ADM) that is not cross-linked. We have reviewed our institution's experience in using PAD and ADM in the reconstruction of abdominal wall defects.

Methods

The study was carried out following guidelines set by our Institutional Review Board. A retrospective study design was used to evaluate outcomes of patients having received PAD or ADM biologic mesh as part of a ventral abdominal wall hernia repair. All parastomal, inguinal, and laparoscopic hernia repairs were excluded. Records of all pieces of ADM dispensed by our blood bank and of all pieces of PAD dispensed by our operating room facilities were queried. The decision to use PAD or ADM was based on the availability of the 2 meshes and surgeon discretion in the operating room.

Data were extracted from patient medical records for demographics, surgical history, operative indications and technique, complications, and postoperative care. Follow-up was established by progress notes, imaging studies, and telephone interviews. Recurrence was defined by the presence of a bulge on physical examination, imaging, or by patient self-reporting.

Operative technique was divided into 3 different methods based on the ability to close the fascial defect. The onlay technique was defined as placement of the biologic mesh superficial to the primary closure of the rectus fascia. Underlay was defined as placement of the mesh in an intraperitoneal position deep to anterior abdominal wall defect and then closure of the fascia over the mesh with minimum 2 cm underlap. Bridging was defined as placement of the biologic between edges of the rectus sheath where primary closure was not feasible. The use of wound vacuum devices and drains were recorded.

Primary outcome was hernia recurrence; and secondary outcomes included early and late complications and mortality. Early complications were defined as events such as seroma, intra-abdominal abscess, fascial dehiscence, wound infection, and enterocutaneous fistula occurring within 30 days of initial repair. Late complications were defined as wound-related events occurring after 30 days but within 1 year of initial repair. Techniques of mesh placement were also analyzed. Effects of comorbidities and surgical techniques on recurrence and complications were also analyzed.

Standard statistical analysis was used to compute means, standard deviations, medians, and interquartile ranges. Categorical variables were analyzed using a chi-square analysis or Fischer's exact test. Distributions that were non-Gaussian were analyzed using nonparametric testing (Mann-Whitney rank tests). Survival times were

constructed using Kaplan-Meier curves, showing probability of recurrence versus postop time in months; Cox proportional hazards regression was used to assess covariates' effects on survival. *P* values <.05 were considered statistically significant.

Results

A total of 251 patients underwent complex ventral hernia repair between January 2007 and June 2011 at our institution, a tertiary care hospital. Patients were divided into 2 groups, repair with PAD (124) or ADM (127). In the PAD group, the average age was 61.9 ± 13.7 years, while the average age in the ADM group was 61.3 ± 14.6 years ($P = .76$). There were 52% men in the PAD group and 43% men in the ADM ($P = .15$) group. The average body mass index (BMI) between the 2 groups was 30.7 ± 7.6 versus 31.8 ± 8.0 kg/m² ($P = .25$). The following comorbidities or hernia risk factors were studied: obesity, diabetes, hypertension, cancer, chronic obstructive pulmonary disease, end stage renal disease, coronary artery disease, and steroid use. The most comorbid condition in both groups was hypertension; PAD (54%) versus ADM (56%) ($P = .81$). The 2 groups were comparable in age, proportion of male subjects, BMI, and other comorbid conditions listed above. Follow-up for hernia recurrence was 48% by computed tomography, 35% by physical examination, and 17% by phone call.

In the PAD group, there were 2.35 ± 1.47 previous abdominal operations compared to 2.36 ± 1.51 in the ADM group ($P = .94$). In the PAD group, there were $.71 \pm 1.03$ previous hernia repairs compared to $.74 \pm 1.01$ ($P = .83$) in the ADM group. Surgical indications, wound classification, and surgical technique are listed in [Table 1](#).

There was a significantly higher proportion of patients in the PAD group with early complications (48% vs 30%, $P = .007$) compared to the ADM group. There was no significant difference in the late complication rate (30% vs 21%, $P = .16$) between the 2 groups. Recurrence rates were significantly higher in the ADM group (47% vs 32%, $P = .022$) than in the PAD group. The median times to recurrence were not significantly different: 18 months for PAD and 15 months for ADM ($P = .63$). Our institution carried ADM first before PAD. Because of high expense and small graft sizes, transition to PAD was made. Overall survival was 84.8% in the PAD group versus 78.0% in the ADM group ($P = .23$). Mesh explantation rate was also similar between the 2 groups: 10% in the PAD group and 9.4% in the ADM group ($P = .95$) ([Table 2](#)).

Mesh placement was achieved by using 3 different techniques: onlay, underlay, and bridging of the defect as dictated in the operative note. The allocation of surgical techniques to the different biological mesh groups was not randomized. The PAD group was closely associated with the underlay technique and the ADM group was more closely associated with the bridging technique ([Table 1](#)). Hence a comparison was conducted between the surgical

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