Outcomes of Abdominal Wall Reconstruction with Acellular Dermal Matrix Are Not Affected by Wound Contamination

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BACKGROUND: The optimal type of mesh for complex abdominal wall reconstruction has not been elucidated. We hypothesized that AWRs using acellular dermal matrix (ADM) experience low rates of surgical site occurrence (SSO) and surgical site infection, despite increasing degrees of wound contamination.

STUDY DESIGN: We retrospectively reviewed prospectively collected data from consecutive abdominal wall reconstructions with ADM over a 9-year period. Outcomes of abdominal wall reconstructions were compared between patients with different CDC wound classifications. Univariate and multivariate logistic regression and Cox proportional hazard regression analyses identified potential associations and predictive/protective factors.

RESULTS: The 359 patients had a mean follow-up of 28.3 ± 19.0 months. Reconstruction of clean wounds (n = 171) required fewer reoperations than that of combined contaminated (n = 188) wounds (2.3% vs 11.2%; p = 0.001) and trended toward experiencing fewer SSOs (19.9% vs 28.7%, p = 0.052). There were no significant differences between clean and combined contaminated cases in 30-day SSI (8.8% vs 8.0%), hernia recurrence (9.9% vs 10.1%), and mesh removal (1.2% vs 1.1%) rates. Independent predictors of SSO included body mass index ≥30 kg/m^2 (odds ratio [OR] 3.6; p < 0.001), 1 or more comorbidities (OR 2.5; p = 0.008), and defect width ≥15 cm (OR 1.8; p = 0.02).

CONCLUSIONS: Complex abdominal wall reconstructions using ADM demonstrated similar rates of complications between the different CDC wound classifications. This is in contradistinction to published outcomes for abdominal wall reconstruction using synthetic mesh that show progressively higher complication rates with increasing degrees of contamination. These data support the use of ADM rather than synthetic mesh for complex abdominal wall reconstruction in the setting of wound contamination. (J Am Coll Surg 2014;219:853–864. © 2014 by the American College of Surgeons)

Complex abdominal wall reconstruction (AWR) after oncologic surgery or hernia repair often requires the use of surgical mesh for wound closure. Prospective randomized studies have demonstrated better outcomes for incisional hernia repair reinforced with mesh compared with repairs without reinforcement.[1,2] Studies of AWR using synthetic meshes have shown that surgical site occurrences (SSOs), surgical site infections (SSIs), and hernia recurrences increase with increasing degrees of wound contamination.[3-6] Accordingly, many surgeons choose acellular dermal matrix (ADM) rather than synthetic mesh as a strategy to minimize SSOs and SSIs, particularly in contaminated wounds.[7-18] However, the currently available evidence does not convincingly demonstrate whether ADM results in better AWR outcomes for contaminated wounds than synthetic mesh.

The Ventral Hernia Working Group established guidelines for stratifying patient risk factors and wound characteristics to aid in decision making regarding surgical technique and mesh material selection.[14] The Ventral Hernia Working Group's widely cited hernia grading system for assessment of

Disclosure Information: Nothing to disclose.

Disclosures outside the scope of this work: Dr Garvey receives pay as a consultant for LifeCell Corporation.

Received May 11, 2014; Revised June 20, 2014; Accepted June 23, 2014.
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http://dx.doi.org/10.1016/j.jamcollsurg.2014.06.021
ISSN 1072-7515/14

Abbreviations and Acronyms

AWR = abdominal wall reconstruction
ADM = acellular dermal matrix
BMI = body mass index
HR = hazard ratio
OR = odds ratio
SSI = surgical site infection
SSO = surgical site occurrence

SSO risk suggested synthetic mesh use for low-risk (grade 1) defects and ADM for higher risk defects (grade 2) and contaminated or infected wounds (grades 3 and 4). It has been generally suggested that the incidences of SSO, SSI, and AWR failure (mesh explantation and hernia recurrence) increase with the extent of wound contamination.[6,19-27] However, given the significantly higher acquisition cost of ADM compared to synthetic mesh, some surgeons have shifted toward choosing synthetic mesh even when faced with wound contamination.[4,28]

Our extensive experience with complex AWR has led to several surgical modifications,[16-18,29] including the use of ADM for complex AWR owing to its ability to heal and incorporate even in the face of complex radiated oncologic defects; infected wounds; and debilitated, malnourished patients with multiple comorbidities, without increasing rates of SSO and SSI.[13,14,30-32] Given that there has been no study with adequate methodology, follow-up, and study size that quantifies the relative outcomes for AWR across various degrees of wound contamination when ADM is used, and given our experience with bioprosthetic matrices in complex AWR, we hypothesized that AWRs using ADM result in low rates of SSO and SSI, even with increasing degrees of wound contamination. To test our hypothesis, we compared clinically relevant outcomes of AWR with ADM between established CDC wound contamination classifications.

METHODS

We performed a retrospective cohort study evaluating all consecutive patients who underwent midline AWR with underlay ADM of an abdominal wall hernia or oncologic defect for which the fascia could or could not be primarily closed without undue tension, at The University of Texas MD Anderson Cancer Center, between March 2005 and March 2013. We did not include synthetic mesh reconstructions because the number of cases was too small for meaningful statistical comparison. We grouped patients on the basis of CDC wound classifications: class I (clean), class II (clean-contaminated), class III (contaminated), or class IV (dirty-infected)[33,34] (Table 1). Due to the smaller numbers of class III and class IV wounds, we combined these 2 classes into a single group (ie, contaminated/dirty-infected). We excluded patients with defects that did not involve the midline (lateral defects, n = 37), onlay mesh reconstructions (n = 2), and primary closure of their abdominal wall fascia without mesh. For 30-day SSI and SSO outcomes, we excluded patients whose follow-up was less than 1 month (n = 2). Surveillance CT imaging was obtained according to each patient's tumor protocol, typically quarterly for the first year and then annually thereafter. We obtained data from a prospectively maintained departmental database and from the patients' electronic medical records. The MD Anderson Cancer Center Institutional Review Board approved this study.

Patient and defect characteristics and reconstruction outcomes were analyzed and compared between patients in the 3 CDC classification groups in 2 ways: clean vs clean-contaminated vs contaminated/dirty-infected groups, and clean vs "combined contaminated" (defined as clean-contaminated + contaminated + dirty-infected) groups. The primary outcomes measures were the relationships between the CDC wound contamination classification and SSO, 30-day SSI, reoperation, mesh explantation, and hernia recurrence. Secondary outcomes measures were the relationships between the CDC wound contamination classification and the following specific postoperative complications: bulging/laxity of the abdominal wall and wound healing complications (skin dehiscence, skin necrosis, fat necrosis, cellulitis, abscess, intra-abdominal sepsis, enterocutaneous fistula, hematoma, and seroma).

Table 1. Centers for Disease Control Wound Classifications[33,35]

Wound class	Definition
I (clean)	An uninfected operative wound in which no inflammation is encountered and the respiratory, alimentary, genital, or uninfected urinary tract is not entered.
II (clean-contaminated)	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination.
III (contaminated)	Open, fresh, accidental wounds. In addition, operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation are encountered.
IV (dirty-infected)	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera.