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Suture, synthetic, or biologic in contaminated ventral hernia repair

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ABSTRACT

Background: Data are lacking to support the choice between suture, synthetic mesh, or biologic matrix in contaminated ventral hernia repair (VHR). We hypothesize that in contaminated VHR, suture repair is associated with the lowest rate of surgical site infection (SSI).
Methods: A multicenter database of all open VHR performed at from 2010–2011 was reviewed. All patients with follow-up of 1 mo and longer were included. The primary outcome was SSI as defined by the Centers for Disease Control and Prevention. The secondary outcome was hernia recurrence (assessed clinically or radiographically). Multivariate analysis (stepwise regression for SSI and Cox proportional hazard model for recurrence) was performed.
Results: A total of 761 VHR were reviewed for a median (range) follow-up of 15 (1–50) mo: there were 291(38%) suture, 303 (40%) low-density and/or mid-density synthetic mesh, and 167(22%) biologic matrix repair. On univariate analysis, there were differences in the three groups including ethnicity, ASA, body mass index, institution, diabetes, primary *versus* incisional hernia, wound class, hernia size, prior VHR, fascial release, skin flaps, and acute repair. The unadjusted outcomes for SSI (15.1%; 17.8%; 21.0%; $P = 0.280$) and recurrence (17.8%; 13.5%; 21.5%; $P = 0.074$) were not statistically different between groups. On multivariate analysis, biologic matrix was associated with a nonsignificant reduction in both SSI and recurrences, whereas synthetic mesh associated with fewer recurrences compared to suture (hazard ratio = 0.60; $P = 0.015$) and nonsignificant increase in SSI.
Conclusions: Interval estimates favored biologic matrix repair in contaminated VHR; however, these results were not statistically significant. In the absence of higher level evidence, surgeons should carefully balance risk, cost, and benefits in managing contaminated ventral hernia repair.

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1. Introduction

Mesh reinforcement of ventral hernia repair (VHR) is a widely accepted practice supported by multiple randomized controlled trials [1–8]. However, these trials of mesh reinforcement have largely been performed in clean ventral hernia repairs. For higher-risk, contaminated cases, there are no randomized controlled trials and little comparative data guiding the choice of closure technique. In large database studies, use of mesh in contaminated cases is associated with an increased risk of surgical site infection (SSI), particularly deep and organ space SSI [9]. In addition to concerns for residual confounding due to unmeasured variables, these database analyses are limited by the lack hernia specific data such as mesh type and lack of reporting of outcomes beyond 30 d. Further evidence regarding the safety of mesh in contaminated ventral hernia repairs has been extrapolated from randomized controlled trials of prophylactic mesh placement in wound class II cases. These trials have demonstrated that mesh placement can reduce the risk of hernia formation without increasing the risk of SSI [10]. Caution should be used in generalizing these results to ventral hernia repairs, particularly complex ventral hernia repairs. Thus, no widely accepted consensus or guidelines exist regarding mesh placement in contaminated ventral hernia repairs [9,10]. Currently, there are three common practice patterns with contaminated ventral hernia repairs as follows: (1) suture repair with a presumed high rate of recurrent ventral incisional hernia and subsequent mesh repair in a clean setting, (2) low-density and/or mid-density (i.e., light-weight and/or mid-weight) synthetic mesh repair, and (3) non–cross-linked biologic matrix repair. Suture repair is considered to be associated with the lowest risk of SSI but the highest risk of hernia recurrence. Low-density and/or mid-density synthetic mesh and biologic mesh are presumed to decrease the recurrence rate but at a price of increased wound complications and SSI [11,12]. However, there is little evidence to support these assumptions.

The aims of this study are: (1) to evaluate the patterns of mesh use in academic practices across the country and to identify the settings and circumstances where there is clinical equipoise (i.e., when there is no good basis for a clinician to choose one option *versus* another) [1] in closure technique and (2) to compare the outcomes of suture, low-density and mid-density synthetic mesh, and biologic matrix use in clinical settings where there is clinical equipoise in repair practice. The hypotheses are that (1) there is substantial heterogeneity in practice, particularly for cases with contamination and (2) suture repair, compared to synthetic mesh or biologic matrix repair, is associated with the lowest risk of SSI during contaminated ventral hernia repair.

2. Materials and methods

The Ventral Hernia Outcomes Collaborative multicenter retrospective database of all consecutive ventral hernia repairs performed at seven institutions from January 1, 2010 to December 31, 2011 was accessed. All patients undergoing an open VHR with at least 1 mo of follow-up were assessed for inclusion. Patients were divided into three groups: suture repair (suture), low-density and/or mid-density polypropylene repair (synthetic), and non–cross-linked biologic matrix repair (biologic). The primary outcome was SSI, as defined by the Centers for Disease Control and Prevention (CDC). [13] A superficial SSI is defined by the CDC as an infection within 30 d of an operative procedure involving only the skin and subcutaneous tissue of the incision and with at least one of the following criteria: (1) purulent drainage from the incision, (2) organisms isolated from culture of the wound, (3) opening of the wound by the clinician and pain or tenderness, localized swelling, erythema, or heat, or (4) diagnosis of SSI by the physician. A deep SSI must occur within 30–90 d of the operative procedure, involve deep soft tissues of the incision (fascial and muscle layers), and have at least one of the following criteria: (1) purulent drainage from the deep incision, (2) spontaneous dehiscence or opened by clinician and fever or localized pain or tenderness, or (3) an abscess of other evidence of deep incision infection based anatomic and/or histopathologic examination or imaging. Finally, organ and/or space SSI must occur within 30–90 d of the operative procedure, involve any part of the body deeper than the fascial and/or muscle layers that was manipulated during the procedure, and have one of the following: (1) purulent drainage from a drain placed in deep organ and/or space, (2) organisms isolated from culture from deep and/or organ space, or (3) an abscess or evidence of infection of the organ and/or space detected on anatomic and/or histopathologic examination or imaging. Conditions such as cellulitis, stitch abscess, and localized stab wound or pin site infection (excluding trochar sites) are not considered SSIs. Overall infection rate (including superficial, deep, and organ and/or space) and serious infection rate (including deep and organ space infections) were reported. Secondary outcome was hernia recurrence, which was assessed clinically or radiographically. Computed tomography (CT) scans were obtained on demand based on clinical assessment. Postoperative CT scans, when available, were reviewed for hernia recurrence by two trained abstractors. Disagreements in radiographic recurrence were settled by in person discussion with review of the operative details. Reoperation was also measured and was defined as any subsequent operation involving the mesh, fascia, or abdominal cavity.

Patient demographics, comorbidities, and surgical details were assessed using standards established by the National Surgical Quality Improve Project. Trained abstractors assigned wound class based on CDC guidelines for surgical wound classification. Institutional principal investigators randomly audited cases for accuracy. Hernia size for all hernias was determined based on the European Hernia Society classification of ventral incisional hernias: small–width <4 cm, medium–width ≥ 4–10 cm, large–width ≥ 10 cm [14]. Hernia details were reported using definitions that have been previously published [15,16]. Patients closed with suture, light-weight and/or mid-weight synthetic mesh, or non–cross-linked biologic matrixes were compared.

Univariate analysis was performed using the appropriate test (Pearson chi square, analysis of variance, or