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Suture versus preperitoneal polypropylene mesh for elective umbilical hernia repairs

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ABSTRACT

Background: Repair of primary ventral hernias (PVH) such as umbilical hernias is a common surgical procedure. There is a paucity of risk-adjusted data comparing suture *versus* mesh repair of these hernias. We compared preperitoneal polypropylene (PP) repair *versus* suture repair for elective umbilical hernia repair.

Methods: A retrospective review of all elective open PVH repairs at a single institution from 2000–2010 was performed. Only patients with suture or PP repair of umbilical hernias were included. Univariate analysis was conducted and propensity for treatment-adjusted multivariate logistic regression.

Results: There were 442 elective open PVH repairs performed; 392 met our inclusion criteria. Of these patients, 126 (32.1%) had a PP repair and 266 (67.9%) underwent suture repair. Median (range) follow-up was 60 mo (1–143). Patients who underwent PP repair had more surgical site infections (SSIs; 19.8% *versus* 7.9%, $P < 0.01$) and seromas (14.3% *versus* 4.1%, $P < 0.01$). There was no difference in recurrence (5.6% *versus* 7.5%, $P = 0.53$). On propensity score–adjusted multivariate analysis, we found that body mass index (odds ratio [OR], 1.10) and smoking status (OR, 2.3) were associated with recurrence. Mesh (OR, 2.34) and American Society of Anesthesiologists (OR, 1.95) were associated with SSI. Only mesh (OR, 3.41) was associated with seroma formation.

Conclusions: Although there was a trend toward more recurrence with suture repair in our study, this was not statistically significant. Mesh repair was associated with more SSI and seromas. Further prospective randomized controlled trial is needed to clarify the role of suture and mesh repair in PVH.

1. Introduction

Although primary ventral hernia (PVH) repairs are among the most common general surgery procedures, with over 270,000 performed in the United States each year [1], there is currently no accepted gold standard. PVH, as defined by the European Hernia Society (EHS) [2], is the most commonly umbilical hernias (and less commonly epigastric, spigelian, or lumbar hernias). In open repairs, multiple suture techniques and various mesh repairs are used, with mixed results. Reported recurrence rates for elective PVH repairs vary, ranging from 0%–20%, and wound infection rates range from 0%–29%

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(8–26, Table 1). However, these studies are limited by small sample size and quality, making it difficult to determine the best surgical approach (Table 1). The estimated annual cost for ventral hernia repairs in the United Sates is 3.2 billion dollars [1]. Determining the best surgical practice for repairing primary ventral hernias could reduce the reoperations and complications necessitated by recurrences and complications. A small amount of improvement in this area will result in a huge payoff for patients, the health care system, and society [3].

The purpose of this study was to evaluate outcomes of simple suture repair compared with a specific mesh repair, preperitoneal polypropylene (PP), in open, elective umbilical hernia repair. In addition, our secondary purpose was to identify factors contributing to poor outcomes with these procedures.

2. Methods

2.1. Study population

A retrospective chart review was conducted on all patients who underwent elective open umbilical hernia repairs at a single institution from January 2000 to December 2010. Institutional review board approval was obtained. A computerized patient record system was used to collect patient information. Patients were included if they underwent an elective open umbilical hernia repair with suture or PP. Patients were excluded if they had any other type of hernia repaired, non-PP repair, or recurrent PVH repair (which would be classified as an incisional ventral hernia).

2.2. Surgical technique

All patients received preoperative antibiotics and a standardized surgical preparation according to hospital protocol. Hernias were all repaired with transverse incisions with dissection down to the fascia and hernia sac. Hernia sacs and contents were reduced into the peritoneal or preperitoneal space.

Suture repairs were performed by transverse closure of the hernia defect with interrupted permanent sutures. PP mesh repairs were performed through an underlay technique. The preperitoneal space was developed and an underlay of polypropylene with at least 3 cm of overlap was deployed in the preperitoneal space. Fascia was closed over the mesh or left open with securement to the mesh with permanent suture based on attending surgeon preference. Subcutaneous tissue was irrigated and skin was closed.

2.3. Study variables and outcomes assessment

Patient variables collected include age, body mass index (BMI), ethnicity, gender, and hernia size as defined by the EHS [2], American Society of Anesthesiologists (ASA) status, chronic obstructive pulmonary disease, coronary disease, diabetes mellitus, prostate disease, current smoking, and alcohol use disorder (≥2 alcoholic drinks/d). Postoperative variables collected include hospital admission, length of stay, surgical site infection (SSI) as defined by Center for Disease Control established guidelines, seroma, 90-d readmission, reoperation (anytime postoperative), recurrence, and follow-up duration. Recurrence was determined by radiographic data, last clinical examination, or reoperation reports. Seromas were recorded if the patient had radiographic evidence of a fluid collection or clinical evidence of a seroma. The main independent variable of interest was repair type classified as either suture or mesh (PP) repair. The main outcomes of interest were SSI, seroma, and recurrence. Follow-up duration was determined by last clinical examination.

2.4. Statistical analysis

Patient characteristics of the overall cohort were assessed using an unpaired two-tailed *t*-test for parametric continuous variables, whereas a Mann–Whitney *U* test was used for nonparametric continuous variables. Fisher exact test was used for categorical variables.

Data were risk adjusted using two methods: case-matching and propensity for treatment-adjusted multivariate analysis. A one-to-one case matching of suture repair to PP repair was performed. Cases were matched by hernia size (EHS classification), BMI, ASA status, and age. Categorical variables were case matched by direct matching ±1, whereas continuous variables were matched by the nearest neighbor. Results were compared with paired two-tailed *t*-test for parametric continuous variables, whereas a Mann–Whitney *U* test was used for nonparametric continuous variables. McNemar or chi-square test was used for categorical variables.

Propensity for the treatment of suture *versus* mesh repair was developed based on hernia defect size, patient BMI, ASA score, and age. A propensity score was applied to all patients with suture or PP umbilical hernia repair. Propensity score–adjusted multivariate logistic regression models were built to assess the effect of a given variable on each SSI, seroma, and recurrence while controlling for other variables in the model. All preoperative and operative variables were initially put into the multivariate model and then reduced in a stepwise manner to identify the best fit according to the Aikake information criterion criterion. In addition, for hernia recurrence, a second model taking into account duration of follow-up was also developed. Diagnostics of the multivariate logistic regression model were assessed, and validation was performed using a 10-fold cross validation. All statistical analysis was performed on the statistical software R [4–6].

3. Results

Of 442 elective open PVH repairs performed during the study period, 31 patients had a mesh repair other than PP, 19 had nonumbilical PVH (epigastric, spigelian, or lumbar), and 392 met our inclusion criteria. Of these 392 patients, 126 (32.1%) had a repair with PP (mesh), and 266 (77.9%) underwent suture repair.

Patients with mesh repair were more likely to have larger hernia defects (4.7 ± 0.3 *versus* 2.0 ± 0.2, $P < 0.01$) and have an elevated BMI (32.5 ± 0.4 *versus* 30.5 ± 0.3, $P < 0.01$). Table 2 summarizes the outcomes of the unadjusted suture and