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Obstructing ventral hernias are not independently associated with surgical site infections



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ARTICLE INFO

Article history:

Received 6 January 2015

Received in revised form

20 March 2015

Accepted 21 April 2015

Available online 30 April 2015

Keywords:

Ventral hernia repair

Obstruction

Surgical site infection

ABSTRACT

Background: Delayed operative intervention in the setting of adhesive bowel obstruction has been recently shown to increase the rate of surgical site infection (SSI), raising the concern for bacterial translocation. The effect of obstruction on SSI rate in patients with ventral hernia is unknown. The aim of this study was to assess the association between bowel obstruction and SSI in patients undergoing ventral hernia repair (VHR).

Materials and methods: This study is a retrospective database review. Patients undergoing isolated VHR from 2005–2011 were identified from the American College of Surgeons' National Surgical Quality Improvement Program database. Demographics, comorbidities, and 30-d outcomes were analyzed. Multivariate logistic regression was used for variables with a *P* value of <0.1.

Results: A total of 68,811 patients underwent isolated VHR; 53.1% were male with mean age of 53 ± 15 y and body mass index of 32 ± 8 . Hernia-related obstruction was found in 17,058 (24.8%). In patients with obstruction, SSI was more frequent (3.2% versus 2.6%, $P < 0.001$). Obesity, advanced age, vascular, pulmonary, hepatic, renal disease, and diabetes were more prevalent. After controlling for confounding baseline variables, bowel obstruction was not independently associated with SSI (odds ratio, 0.983, 95% confidence interval, 0.872–1.107). Subgroup analysis of clean classified cases also demonstrated the lack of independent association between obstruction and SSI.

Conclusions: Obstruction in patients undergoing VHR is not independently associated with SSI. Our results suggest that mesh implantation remains a viable option in this setting. Other confounding comorbid conditions should be assessed at the time of surgical intervention to identify patients appropriate for mesh repair.

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This study was presented in part in poster format at the American College of Surgeons Clinical Congress on October 27, 2014.

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<http://dx.doi.org/10.1016/j.jss.2015.04.079>

1. Introduction

Ventral hernia repair (VHR) remains one of the most commonly performed procedures by general surgeons in the United States [1]. It is estimated that 365,000 VHRs were performed within the United States in 2006 at a cost of \$3.2 billion, and the rate continues to rise. Complications of VHR, particularly recurrence and surgical site infection (SSI), are significant contributors to this cost [2].

A multicenter randomized controlled trial published in 2004 concluded that VHR with mesh has lower recurrence rates (32% versus 63%) and no worse outcomes than primary suture repair over a median follow-up of 6 y [3]. Mesh is frequently used, even in emergent settings, with 11.3%–12.3% reported rate of SSI, and mesh removal required in 0.5%–1.3% of patients [4,5]. Single-institution studies have attempted to assess SSI rate in relation to mesh implantation after emergent VHR performed for incarceration but are limited by small sample size [4].

A recent study revealed that delayed operative intervention in patients who present with small bowel obstruction secondary to adhesions leads to higher rates of complications including SSI [6]. The proposed explanation for this association between surgical delay and infectious complications was bacterial translocation, which results from overgrowth and subsequent passage of bacteria from the intraluminal compartment to mesenteric lymph nodes [7,8]. It has been proposed that delay to operative intervention allows more time for translocation to occur.

Although the theory of bacterial translocation in obstruction dates back to the late 1980s, its relationship to SSI has only recently been studied. Furthermore, published data are limited to obstruction secondary to adhesive disease [6]. The effect of obstruction on SSI rate in patients with ventral hernia is unknown. The aim of this study was to assess the association between bowel obstruction and SSI in patients undergoing VHR.

2. Materials and methods

The American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) database was used as a data source for this study. This is a national database with data entered by trained clinical reviewers. It includes preoperative risk factors, laboratory values, intraoperative variables, and 30-d postoperative morbidity and mortality data. The ACS-NSQIP administration periodically audits the data to ensure high reliability. Current procedural terminology (CPT) codes were used to identify patients that underwent isolated VHR between 2005 and 2011. Both open (CPT 49560, 49561, 49565, 49566, 49570, 49572, 49585, 49587, and 49590) and laparoscopic procedures (CPT 49652, 49653, 49654, 49655, 49656, and 49657) were examined. The prevalence of laparoscopic repair was assessed only for the period 2009–2011, during which laparoscopy-specific codes were introduced. Patients who underwent other concurrent procedures, with the exception of mesh implantation, were excluded to ensure that any effect of obstruction on SSI rate would not be related to concurrent gastrointestinal surgery but instead be exclusively attributed to VHR. International Classification of

Diseases Ninth Edition codes delineated uncomplicated cases (553.1, 553.2, 553.20, 553.21, and 553.22) from VHR complicated by obstruction (552.1, 552.2, 552.20, 552.21, and 552.8).

Baseline demographics included age, gender, body mass index (BMI), type of hernia (recurrent versus primary), and presence of comorbid disease. Cardiac comorbidities were defined as congestive heart failure within 30 d, myocardial infarction within 6 mo, or history of angina within 1 mo before the index procedure, as well as previous percutaneous coronary intervention or cardiac surgery. Neurologic comorbidities included impaired sensorium, coma, transient ischemic attack, cerebral vascular accident, hemiplegia, paraplegia, quadriplegia, and tumor involving the central nervous system. Vascular comorbidities included history of hypertension, amputation or revascularization procedure, rest pain, and gangrene. Pulmonary comorbidities included chronic obstructive pulmonary disease, current pneumonia, and preoperative ventilator dependence. Renal comorbidities included renal failure and the need for renal replacement therapy. Hepatic comorbidities included ascites and esophageal varices. Diabetes, history of active smoking, and weight loss >10% within 6 mo were analyzed individually.

The primary outcome assessed was SSI. Superficial, deep, and organ space infections occurring within 30 d of the operation were included in the study. The ACS-NSQIP definition of infection included purulent drainage, a positive culture, abscess, infection documented by an attending physician, or an incision opened by the surgeon for either pain and/or tenderness, fever, localized swelling, redness, or heat, unless if the culture was negative.

Approval for this study was obtained through the ACS-NSQIP administration and the East Carolina University Institutional Review Board. Data analysis was performed using SPSS for Windows version 20 (IBM, Somers, NY). Univariate analysis was performed using chi-square for nominal and ordinal variables with frequencies reported. Mann–Whitney *U*-test was used for continuous variables with median and interquartile range (IQR) reported. Multivariate logistic regression was then performed with all baseline variables with a *P* value of <0.1 on univariate analysis entered into the model, including emergency status, recurrent hernias, and surgical method—open versus laparoscopic. Hosmer and Lemeshow test was used to assess for goodness of fit of the multivariate model with SSI as the dependent variable. This test remained nonstatistically significant (*P* = 0.203) suggesting adequate model fit. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. A *P* value of <0.05 was considered statistically significant. Subgroup analysis examining only cases classified as clean was also performed. The ACS-NSQIP and the hospitals participating in the ACS-NSQIP are the source of the data used herein; they have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

3. Results

We identified 68,811 patients who underwent isolated VHR between 2005 and 2011; 36,539 (53.1%) were male, median age was 53 (IQR, 42–63 y), and median BMI was 31 (IQR, 27–36).

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