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# Impact of obesity on postoperative 30-day outcomes in emergent open ventral hernia repairs



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Obesity;  
Emergent surgery;  
Surgical site  
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## Abstract

**BACKGROUND:** Anecdotally, obese patients experience increased morbidity with emergent ventral hernia repair (VHR). We hypothesized obese patients are over-represented in emergent VHRs and experience increased 30-day morbidity.

**METHODS:** American College of Surgeons National Surgical Quality Improvement Program database (2011 to 2013) was queried for patients undergoing open VHR. Patients were stratified by body mass index (BMI) categories: underweight, normal weight, overweight, and obesity classes I, II, and III; 30-day postoperative complications (surgical site infections, return to operating room, dehiscence, death) were evaluated across BMI for elective vs emergent VHR.

**RESULTS:** In all, 39,822 patients were included: 7.3% emergent. Obese classes I to III represented higher percent of emergent VHRs (55.8% vs 68.9%). Complication rate doubled for emergent group (7.2% vs 14.5%), and likelihood of at least one complication increased with BMI for emergent vs normal weight–elective VHR (overweight odds ratio, 2.2; 95% confidence interval, 1.4 to 3.4; class III odds ratio, 4.0; 95% confidence interval, 2.9 to 5.5).

**CONCLUSIONS:** Selection bias exists with obese patients and ventral hernias. Emergent VHR have increased complications. Elective BMI cutoffs require re-evaluation.

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Ventral hernias (VHs) remain a common surgical dilemma for the acute care and general surgeon. Despite the prevalence of this disease, a clear consensus regarding patient selection, method of repair, and optimal timing of

operative intervention eludes the hernia community. Ventral hernia repairs (VHRs) comprise 2 distinct patient populations: VHs qualifying for elective repair vs those requiring emergent surgical intervention. Emergent VHRs carry increased morbidity, risk of bowel compromise, length of stay, and mortality.<sup>1–6</sup> These high-risk operations are more prevalent today, doubling over the last 10 years.<sup>2</sup>

With the advent of outcomes tracking and increased focus on quality metrics, a paradigm shift in ventral hernia management is underway. The concept of conservative management, safely used in asymptomatic inguinal hernia patients,<sup>7</sup> is now applied to VHs. This “watchful waiting”

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is evolving with mixed results.<sup>8–10</sup> It does complement the contemporary trend supported by the Ventral Hernia Working Group<sup>11</sup> toward preoperative optimization to reduce postoperative complications associated with modifiable risk factors, such as obesity and smoking.<sup>12</sup>

Obesity is the prevalent risk factor in the “watchful waiting” group and an important factor driving hernia development, increased surgical morbidity, and ultimately long-term VHR failure.<sup>13–15</sup> This change in surgeons’ attitude to delaying VHR in favor of preoperative optimization may be distinctly divergent from patient preference and desires. A worse quality of life (QOL) is frequently reported by the nonoperative group compared with those offered early surgical repair, regardless of postoperative outcomes.<sup>16</sup> Laparoscopic advances, however, offer improved outcomes, even in high-risk obese patients. The 2011 Cochrane review showed no difference in recurrence rates (1.22; 95% confidence interval [CI], .62 to 2.38) between open and laparoscopic VHR.<sup>17</sup> Meanwhile, laparoscopic VHR overcame the impact of obesity on 30-day postoperative surgical site occurrences (SSO; wound infections, dehiscence, and reoperation).<sup>18</sup>

In light of the advantage, LVHR confers to obese patients with VHs, surgeons may need to re-evaluate the prejudice toward obesity and elective VHRs. Electing for conservative management, with or without concurrent preoperative optimization of obesity, may inadvertently place patients at increased risk. We hypothesize obese patients are over-represented in emergent VHRs and are at risk of an increased 30-day complications compared with a body mass index (BMI)–matched elective population.

## Methods

The American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database offers a robust blinded, risk-adjusted database evaluating 30-day postoperative outcomes, with currently 707 sites participating. NSQIP enables national benchmarking of complication rates and surgical outcomes.<sup>19,20</sup>

An institutional review board approved the retrospective review of NSQIP data from 2011 to 2013. Patients age  $\geq 18$  undergoing open repair of initial/recurrent incisional or ventral hernias (reducible, incarcerated, and/or strangulated) were included: CPT codes 49560, 49561, 49565, and 49566. Epigastric, umbilical, and Spigelian hernias were excluded given the focus on incisional or ventral hernias. Patients who were pregnant, had disseminated malignancy, advanced liver disease, or previous operation within 30 days were excluded. These exclusion criteria were chosen because of known risk of higher infectious complications and/or low likelihood of VHR in the elective setting. Patients were stratified based on World Health Organization BMI categories of underweight, normal weight (NLWT), overweight (OVWT), and obesity classes I, II, and III (BMI  $<18.5$ ,  $18.5$  to  $25$ ,  $25$  to  $30$ ,  $30$  to  $35$ ,  $35$  to  $40$ , and  $\geq 40$ , respectively).

Demographic variables included year of operation, age, gender, race, diabetes, current tobacco use, congestive heart failure, chronic obstruction pulmonary disease, steroid use, and surgery type (elective vs emergent); 30-day postoperative complications of interest included pneumonia, surgical site infections (SSIs—superficial, deep, and organ space), fascial dehiscence, reoperation, and death. Intraoperative outcomes of interest included use of mesh (CPT code 49568), removal of infected mesh (CPT codes 10180, 11005, and 11008), component separation (CPT code 15,734), and bowel compromise/involvement, which includes enterotomy repair, bowel resection, and ostomy creation (CPT codes 44140, 44141, 44143, 44144, 44021, 44110, 44111, 44120, 44121, 44125, 44130, 44310, 44602, 44603, and 44625).

## Statistical analysis

Descriptive statistics for demographic and baseline characteristics are provided as counts (percent) for categorical variables. Continuous variables are reported as mean (standard deviation) or median (minimum to maximum), depending on the normality/non-normality of the variable, respectively. Chi-square tests were used to assess association between nominal variables. Kruskal–Wallis tests were performed for comparison of ordinal vs nominal variables. Two-sample *t* tests were used to compare approximately normal or symmetric continuous variables. Wilcoxon rank-sum test was used to compare nonsymmetric variables. A logistic regression model was fitted to the data with at least 1 complication as response, defined as at least one of the following occurring: SSO of superficial SSI, deep SSI, organ space SSI, dehiscence, return to the operating room, or death. Potential covariates were gender, age, diabetes, smoking status, chronic obstructive pulmonary disease, ventilator dependent, renal failure, and dialysis. A variable with the combination of emergent/elective and BMI was created to analyze the effect of BMI and type of surgery combined. These variables were selected by univariate logistic regression models. Variables with *P* values  $<.05$  were included as possible predictors (this level was chosen because of the large sample size). Backward, forward, and stepwise selection methods were used to select the final predictors. The final model was assessed with deviance residuals, Hosmer–Lemeshow test, and c statistics. ORs and respective CIs are provided. Analyses were performed with SAS 9.4 (SAS Institute Inc., Cary, NC) and StatXact 10.1 software (Cytel Software Corporation, Cambridge, MA).

## Results

In all, 39,822 patients comprised the total data set. The data set was split randomly by year into 2 sets evenly: 1 set for model selection and estimation of parameters and

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