Impact of body mass index on open ventral hernia repair: A retrospective review

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Background. *A large proportion of patients presenting for ventral hernia repair are obese. It remains unclear, however, whether the degree of obesity is an independent risk factor for adverse outcomes after ventral hernia repair. This study aims to characterize the influence of body mass index class on postoperative complications after open ventral hernia repair.*

Methods. *A retrospective analysis was conducted using data from the database of the American College of Surgeons National Surgical Quality Improvement Program from 2005 to 2015. Patients were stratified into 7 body mass index classes, as well as by type of hernia (reducible versus strangulated) and time of repair (initial versus recurrent). We determined the relationships between body mass index class and patient demographics, comorbidities, and risk of perioperative complications.*

Results. *Our cohort consisted of 102,191 patients, 58.5% of whom were obese. When stratified by body mass index class, higher classes were associated with all postoperative complications (*$P < .0001$*) with a steady increase in complication rates with increasing body mass index class. Patients with strangulated hernias had greater complication rates than those with reducible hernias (*$P < .0001$*). Patients with recurrent hernias also had greater complication rates than those with initial hernias (*$P < .0001$*).*

Conclusion. *Increased body mass index is a risk factor for operative, medical, and respiratory complications after open ventral hernia repair. Patients with body mass index >40 kg/m^2 have greater than twice the risk for complications with odds ratios increasing with increasing body mass index class. Strategies to encourage weight loss may need to be considered seriously prior to open ventral hernia repair, especially for patients with body mass index >40 kg/m^2. (Surgery 2017;■:■-■.)*

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In the past 4 decades, the incidence of obesity in adults in the United States has increased by >10%.[1] More than one-third of the American population is considered obese (body mass index, [BMI] >30 kg/m^2), with the most recent reported rate being 36.5%.[2] This epidemic of obesity is one of the top health concerns in the United States and costs the American public ≈$147 billion in 2008.[3] As the rate of obesity continues to increase, so will the number of obese patients presenting for surgical procedures.

Obesity has been found to be a risk factor for occurrence and recurrence of abdominal wall herniation, including ventral hernias.[4] In 2006, an estimated 350,000 people underwent ventral hernia repair (VHR), making it one of the most commonly performed operative procedures in the United States.[5-7] There is, however, a lack of consensus in the literature regarding obesity and the risk of postoperative complications.[8]

There is a paucity of research regarding the outcomes and safety of VHR in the obese population. The majority of VHRs are performed using an open approach.[9] Few large, systematic, population-based studies examine the impact of BMI on outcomes, both complications and recurrence rates after open VHRs.[10,11] More studies focus on the comparison between a laparoscopic versus open approach.[12-14] To elucidate further the influence of BMI class on complications in open VHR in a representative sample, we performed a retrospective cohort study utilizing a validated, national database.

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METHODS

This was a retrospective cohort study using data from the database of the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP). The NSQIP database was queried for Current Procedural Terminology codes 49561, 49566, 49560, and 49565 to identify patients who underwent open VHR from 2005 to 2015. These Current Procedural Terminology codes capture both initial and recurrent, and reducible or strangulated/incarcerated open VHR. To minimize the impact of coding errors, we limited our analyses to the patients with the most relevant diagnosis codes. This included 92.72% of the patients who underwent what was coded as VHR. The selected diagnoses codes were 553.21 (incisional hernia), 552.21 (obstructed incisional hernia), 553.20 (ventral hernia not otherwise specified), 552.20 (obstructed ventral hernia not otherwise specified), 553.29 (ventral hernia not elsewhere classifiable), 552.29 (obstructed ventral hernia not elsewhere classifiable), 553.1 (umbilical hernia), 553.2 (ventral hernia), 552.1 (umbilical hernia with obstruction), and 552.2 (ventral hernia w/obstruction). The final cohort consisted 102,191 patients.

Patients were stratified into 7 BMI classes: underweight (BMI <18.5 kg/m^2), normal weight (BMI 18.5–24.9), overweight (25–29.9), obese (30–34.5), severely obese (35–39.9), morbidly obese (40–49.9), and super obese (BMI ≥ 50). This classification system is supported by the guidelines of the World Health Organization and current bariatric standards.[15] BMI data were available for all patients.

The primary outcome of the study was any postoperative complication as defined by NSQIP, within 30 days of the operation. The complications were grouped further into operative and medical complications. Surgical site infections and wound disruptions were considered operative complications. Medical complications included pulmonary embolism, acute renal failure, cardiac arrest requiring cardiopulmonary resuscitation, myocardial infarction, peripheral never injury, transfusions, stroke, sepsis, septic shock, deep vein thrombosis or thrombophlebitis, progressive renal insufficiency, and urinary tract infection.[16] Respiratory complications also were analyzed as a subgroup of medical complications and included postoperative pneumonia, unplanned reintubation, and ventilator requirement exceeding 48 hours.

Statistical analysis. Univariate analyses using the χ^2 test for categorical variables and one-way analysis of variance for continuous variables were used to examine the association between BMI class and patient characteristics including comorbidities. Patient characteristics captured included age, sex, and race. Classification according to the American Society of Anesthesiologists, smoking status, and recent weight loss also were examined. Comorbidities included dyspnea, chronic obstructive pulmonary disease (COPD), diabetes, and hypertension. Univariate analyses stratified by reducible/strangulated hernias were used to determine the association between BMI class and rates of complication for all complications, operative complications, medical complications, and respiratory complications. All individual operative complications as well as select medical complications also were included in the analyses. Univariate analyses also were stratified by initial/recurrent hernia based on the procedure code. Multiple logistic regression was used to assess the risk of complication by BMI class with adjustment for potential confounders. Confounders were defined as patient characteristics and comorbidities found to be significantly different across BMI classes in the univariate analyses. A variable controlling for initial versus recurrent hernia repair and one controlling for reducible or strangulated/incarcerated hernia was also included in the model.

RESULTS

In our cohort, 102,191 patients underwent open VHR. Characteristics stratified by BMI class are shown in Table I. Of these patients, 59,806 (58.5%) had a BMI ≥ 30 kg/m^2. When stratified by BMI class, we found differences in age, sex, and race ($P < .0001$ for all). Furthermore, increasing BMI was associated with the presence of all comorbidities and a higher American Society of Anesthesiologists class ($P < .0001$). Smoking also was found to be different across BMI classes, with a lesser percentage of smokers in the greater BMI classes. Lastly, only 0.47% of patients were able to lose $>10\%$ of their body weight in the 6 months immediately preceding their VHR. Weight loss prior to operation differed across BMI classes ($P < .0001$), with the greatest percentage of patients who lost weight prior to VHR occurring in the underweight BMI category (5.0%). In our cohort, 412 patients (0.4%) died within 30 days of operation. Mortality varied across BMI classes ($P < .0001$) with a reverse J trend in which underweight patients had the greatest mortality rate (1.1%), followed by super obese patients (1.00%). Overweight and morbidly obese patients had the least rates of mortality (0.3% for both).