

Clinical Science

# Abdominal wall reconstruction in the obese: an assessment of complications from the National Surgical Quality Improvement Program datasets

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Component separation

**Abstract**

**BACKGROUND:** This study utilizes the American College of Surgeons National Surgical Quality Improvement Program database to better understand the impact of obesity on perioperative surgical morbidity in abdominal wall reconstruction (AWR).

**METHODS:** We reviewed the 2005 to 2010 American College of Surgeons National Surgical Quality Improvement Program databases, identifying cases of AWR and examining early complications in the context of obesity (body mass index > 30, World Health Organization classes 1 to 3).

**RESULTS:** Of 1,695 patients undergoing AWR, 1,078 (63.2%) patients were obese (mean body mass index = 37.6 kg/m<sup>2</sup>). Major surgical complications (15.3% vs 10.1%,  $P = .003$ ), wound complications (12.5% vs 8.1%,  $P = .006$ ), medical complications (16.2% vs 11.2%,  $P = .005$ ) and return to the operating room (9.1% vs 5.4%,  $P = .006$ ) were significantly increased, while renal complications (1.9% vs .8%,  $P = .09$ ) neared significance. On logistic regression, obesity only directly led to a significantly increased odds of having a renal complication (odds ratio = 4.4,  $P = .04$ ). Complications were still noted to increase with World Health Organization classification, including a concerning incidence of venous thromboembolism.

**CONCLUSIONS:** Although the incidence of complications increased with obesity, obesity itself does not appear to increase the odds of perioperative morbidity. Specific care should be given to VTE prophylaxis and to preventing renal complications.

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The authors declare no conflicts of interest.

Ethical approval: Deidentified patient information is freely available to all institutional members who comply with the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) Data Use Agreement. The Data Use Agreement implements the protections afforded by the Health Insurance Portability and Accountability Act of 1996.

Disclaimer: 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 of this study.

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A significant portion of patients (13% to 25%) who undergo laparotomy incisions develop subsequent ventral hernias.<sup>1,2</sup> Obese patients may have an increased risk for complications, with recent studies demonstrating even higher rates of ventral hernias following abdominal surgery as well as higher rates of failed initial repairs.<sup>3–6</sup> Many of these patients develop recurrent fascial defects following subsequent hernia repairs, which increase the complexity of future reconstruction. In these cases, component separation may be performed to better reapproximate the abdominal wall fascia.<sup>7–10</sup> This procedure may be of particular importance, in that it can facilitate primary fascial closure and obviate the need for bridging mesh in this high-risk population.<sup>6</sup>

Complex abdominal wall reconstruction (AWR) is a challenging and lengthy procedure which places a significant physiologic stress on the patient and may be associated with significant surgical and medical complications. In obese patients with poly-comorbidities, there may be an added risk of medical and surgical morbidity. Given the emerging prevalence of obesity, data regarding outcomes following AWR in the obese are needed.

A number of studies have demonstrated that obesity is significantly related to the occurrence of postoperative complications, both major and minor, following AWR.<sup>11–13</sup> Such complications may be related in part to the decreased myofibroblast activity and altered collagen maturation observed in these patients.<sup>14–16</sup> Additionally, the higher incidence of medical comorbidities<sup>17</sup> may put obese patients at greater risk for medical complications. However, other studies have not found obesity to be associated with increased risk.<sup>18–20</sup>

Although these studies begin to address the issue of complications following AWR specifically related to obesity, to date there are few large, generalizable outcome analyses that delineate identifiable risk factors for complications following AWR in the obese population. The purpose of this study was to determine the incidence and potential predictors of complications among obese patients undergoing AWR using the prospective American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database in an effort to achieve better risk stratification and improve preoperative patient counseling.

## Methods

We reviewed the 2005 to 2010 ACS-NSQIP databases<sup>21</sup> to identify complex AWR cases, which we defined as a hernia repair with component separation, with or without the use of mesh. We queried the NSQIP dataset using the 2010 Current Procedural Terminology (CPT) codes for hernia repair (49560, 49561, 49565, 49566, and 49868) and cross-referenced these with CPT codes for 15734 (muscle flap, trunk) to identify all patients undergoing hernia repair with component separation. We also characterized the use of acellular dermal matrix as an adjunct for complex

reconstructions using CPT codes 15330, 15331, 15430, and 15431. A manual review of CPT codes was performed to identify patient encounters that included concurrent intra-abdominal surgical procedures; these were categorized as enterolysis (44005), panniculectomy, small bowel procedures, and colonic procedures.

In 2010, there were over 250 community and academic hospitals participating in the ACS-NSQIP throughout the United States. Trained research nurses at participating institutions prospectively collect over 240 clinical data points on patient demographics, comorbidities, and laboratory values, as well as operative factors and 30-day postoperative outcomes. Patients are contacted either in writing or via telephone to ensure complete 30-day postoperative follow-up. Data were accessed on September 28, 2012. All data are depersonalized and Health Insurance Portability and Accountability Act compliant. Each variable is specifically defined within the NSQIP manual, and research nurses are periodically audited to ensure standardization and accuracy of the content; prior audits have demonstrated a low (1.8%) disagreement rate. Definitions and further information about each variable are available on the ACS-NSQIP Website (<http://www.acsnsqip.org/>).

Surgical complications included surgical site infection, wound dehiscence, deep wound infection, and unplanned return to the operating room (OR) within 30 days. Major surgical complications were defined as a deep infection and/or unplanned return to the OR.

In addition to the predefined ACS-NSQIP variables, body mass index (BMI, in  $\text{kg}/\text{m}^2$ ) was calculated for each patient encounter and used these to categorize encounters according to the World Health Organization (WHO) Obesity Classification<sup>22</sup> system. Patients were categorized as nonobese ( $\text{BMI} < 30 \text{ kg}/\text{m}^2$ ), class 1 obesity ( $30$  to  $34.9 \text{ kg}/\text{m}^2$ ), class 2 obesity ( $34.9$  to  $39.9 \text{ kg}/\text{m}^2$ ) and class 3 (morbid) obesity ( $\geq 40 \text{ kg}/\text{m}^2$ ). We also defined malnutrition as an albumin value  $< 3.5 \text{ g}/\text{dL}$ .<sup>23,24</sup> Anemia was defined as hemoglobin  $< 12 \text{ g}/\text{dL}$  in women and  $< 13 \text{ g}/\text{dL}$  in men.<sup>25</sup>

Exploratory univariate analysis was used to compare obese patients undergoing AWR with the nonobese cohort. A variety of perioperative risk factors were included in our analyses, including patient demographics and baseline comorbidities, perioperative laboratory values, hernia type, concurrent procedures, and operative characteristics (ie, operative time, estimated blood loss). Pearson chi-square test or Fisher's exact test was used to analyze categorical variables; unpaired Student *t* test or Mann-Whitney test was used for continuous variables. All variables found to have a  $P \leq .10$  on univariate analysis were used as independent variables in a stepwise logistic regression analysis with the complication of interest as the dependent variable in an effort to control for differences observed between cohorts. For variables with collinearity (ie, BMI, obesity [yes/no], WHO obesity class), only one of the collinear variables was included in the multivariate regression. All tests were two-tailed, with significance defined as  $P < .05$ . Analyses were performed using STATA IC 10.0 (StataCorp, College Station, TX).

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