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Original article

Bariatric surgery in patients with reduced kidney function: an analysis of short-term outcomes

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Abstract

Background: With rates of obesity among patients with chronic kidney disease (CKD) mirroring that of the general population, there is growing interest in offering bariatric surgery to these patients. We sought to determine the safety of bariatric surgery in this patient population.

Methods: Patients who underwent selected laparoscopic bariatric procedures between 2005 and 2011. Estimated glomerular filtration rate (eGFR) was calculated and divided into stages of CKD. Procedures included Roux-en-Y gastric bypass (RYGB), laparoscopic adjustable gastric band (LAGB), and laparoscopic sleeve gastrectomy (SG). Univariable analysis and multivariable adjustment was used to compare complication rates across stages of eGFR.

Results: A total of 64,589 patients were included: 64.5% underwent RYGB, 29.8% LAGB, and 5.7% SG. A total of 61.7% of patients had normal eGFR (Stage 1), 32.0% were stage 2, 5.3% were stage 3, and 1.0% were stage 4/5. After adjusting for relevant patient characteristics, there was a trend toward increasing complications from stage 1 to stage 4/5 CKD among RYGB, LAGB, and SG groups, but none were statistically significant. Similarly, major complications generally increased across stages of CKD for each procedure, but was only significant for RYGB comparing stage 3 to stage 1 (OR 1.22; 95% CI: 1.01–1.47; $P = .042$) and risk difference .96% (95% CI: .03–1.96). Considering only stage 4/5 CKD, overall ($P = .114$) and major complications ($P = .032$) were highest in the RYGB group, followed by SG and LAGB.

Conclusion: More advanced stages of CKD do not appear to be statistically associated with an increased risk of 30-day postoperative complications. (Surg Obes Relat Dis 2015;11:828–835.) © 2015 Published by Elsevier Inc. on behalf of American Society for Metabolic and Bariatric Surgery.

Keywords: Bariatric surgery; Chronic kidney disease; ACS NSQIP; Surgical outcomes; Patient safety

The obesity epidemic is a growing problem in North America. Among U.S. adults, over 30% are obese and two thirds are overweight with morbid obesity (body mass index [BMI] >40 kg/m^2) affecting approximately 5% of the population [1]. Obesity poses a serious threat to health and is associated with an increased prevalence of cardiac disease, diabetes mellitus, hypertension, and obstructive sleep apnea [2]. Furthermore, obesity increases the risk of

American College of Surgeons National Surgical Quality Improvement Program 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.

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developing chronic kidney disease (CKD) 4-fold (7-fold in the morbidly obese) [3]. Not only do the obesity-related co-morbidities of hypertension and diabetes account for 70% of the causes for end-stage renal disease (ESRD), obesity is also an independent predictor for developing ESRD [3,4].

Despite the well-described benefits of bariatric surgery on the amelioration of obesity-related illnesses, there appears to be a general reluctance to perform bariatric surgery in patients with ESRD likely because of safety concerns [5–7]. In a recent study, Cloyd et al. [7] demonstrated an increase in morbidity and mortality among hemodialysis patients compared to nonhemodialysis patients undergoing major abdominal surgery. In addition to perioperative risk, concerns over what is referred to as the 'obesity paradox', in which epidemiologic evidence suggests a survival advantage in hemodialysis patients with higher BMI, have called to question whether bariatric surgery should be offered to ESRD patients [8,9]. However, obesity is also an independent predictor of poor outcomes after kidney transplantation [10–12] and has been shown to be a barrier to accessing transplantation [13].

Bariatric surgeons are increasingly asked to see patients with impaired kidney function in the setting of multiple other medical co-morbidities and, at some centers, patients with ESRD in the setting of transplantation. There are limited data on the safety of performing bariatric surgery in patients with renal impairment. The objective of this study was to determine the effect of varying degrees of kidney dysfunction on short-term outcomes after bariatric surgery.

Methods

Data sources

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) Participant Use Files, from the years 2005 to 2011, were used for this study. ACS NSQIP is a prospective, multi-institutional, cohort study collecting rich clinical data on patients undergoing surgical procedures. Data are collected on preoperative, intraoperative, and postoperative variables, including 30-day outcomes. ACS NSQIP data methodology has been described in detail elsewhere [14–19]. The study protocol was approved by the institutional Research Ethics Board.

Study patients

All patients $\geq$18 years old with a BMI $\geq$30 kg/m^2 who underwent a bariatric procedure during the study period were included in this study. Bariatric procedures were identified using both Current Procedural Terminology (CPT) codes and the ICD-9 diagnosis (i.e., the diagnosis was related to morbid obesity or associated condition). Three bariatric procedures were included: (1) laparoscopic Roux-en-Y gastric bypass (RYGB) (CPT 43644–5, 43846); (2) laparoscopic adjustable gastric band (LAGB) (CPT 43770); and (3) laparoscopic sleeve gastrectomy (SG) (CPT 43775). Open bariatric procedures and revisional surgeries were excluded. Furthermore, patients were excluded if they exhibited high risk features such as documented American Society of Anesthesiologists (ASA) 5, recorded as an emergency case, a history of ascites, or a worsening cardiac condition. Patients were also excluded if a major concurrent procedure was performed at the time of their procedure. Fig. 1 outlines patient flow based on inclusion and exclusion criteria.

Exposure and outcomes

The exposure of interest was the estimated glomerular filtration rate (eGFR) in mL/min/1.73 m^2, grouped according to stages of chronic kidney disease (CKD): stage 1: $\geq$90 (normal reference group), stage 2: 60–89.9, stage 3: 30–59.9, and stage 4/5: $<$30 [20]. The eGFR was computed using the CKD-EPI formula because of its ability to more accurately characterize eGFR in bariatric patients [21]. Because patient race was missing in 9% of patients, eGFR was calculated using both with race missing and with race imputed using random assignment, with the latter presented in our results. Imputation was performed maintaining the proportions of race from the nonmissing data. CKD stages 4 and 5 were grouped together as eGFR $<$ 30 because of small numbers of patients. All patients on dialysis were placed in this group.

Our primary outcomes were 30-day overall postoperative morbidity, 30-day major postoperative morbidity, and 30-day postoperative mortality. ACS NSQIP collects data on over 20 postoperative complications including wound-related, septic or infectious, bleeding, thromboembolic, cardiorespiratory and renal complications. Both overall complications and major complications were composite outcomes of the postoperative 30-day complications listed in the data set, with major complications excluding urinary tract infections and superficial/deep wound infections. Both overall and major complications included prolonged length of stay ($>$30 d), reoperation within 30 days, and mortality as a complication. All endpoints were binary outcome variables.

Statistical analysis

Summary statistics were used to define the study population. Univariable analyses using the χ^2 test or the Fisher's exact test was performed to compare categorical variables and the Kruskal-Wallis test was used to compare continuous variables. Multivariable logistic regression was performed for each procedure separately and for both overall and major complications (6 total equations). Because there were too few deaths to perform multivariable regression modeling, only unadjusted results are provided for 30-day mortality. Variables controlled for in our models