

Predictors of high cost after bariatric surgery: A single institution review



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Background. Drivers of high cost care after bariatric operation have not been well described. We sought to compare 1-year costs between patients who underwent laparoscopic vertical sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass and identify predictors of high cost of care.

Methods. Morbidly obese patients who underwent laparoscopic vertical sleeve gastrectomy (n = 74) or laparoscopic Roux-en-Y gastric bypass (n = 270) at a single institution from 2010–2014 were identified. Patient demographic characteristics, surgeon age, 90-day and 1-year surgical outcomes, and facility cost data were collected. “High cost” patients were defined as those in the top quartile of costs among all patients. Variables hypothesized a priori to be associated with high total costs were included in a bivariate logistic regression model. Those with a P value < .1 were included in a multivariable logistic regression model with “high cost” as the outcome.

Results. Laparoscopic vertical sleeve gastrectomy was associated with slightly greater median total 1-year costs (\$18,234 vs \$17,151; P = .021) and inpatient costs (\$15,026 vs \$13,990; P = .019). On multivariable analysis, having Medicaid (odds ratio 2.72; 95% confidence interval, 1.47–5.06) compared with private insurance, being readmitted to the hospital (odds ratio 5.48; 95% confidence interval, 2.45–12.26), and experiencing a postoperative complication (odds ratio 4.12; 95% confidence interval, 1.79–9.48) were associated with high-cost care.

Conclusion. Suboptimal operative outcomes seem to be the primary driver of high overall costs after bariatric operation. Improving postoperative outcomes may result in substantial cost savings. (Surgery 2016;160:877-84.)

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BARIATRIC SURGERY is the most effective treatment for morbid obesity. Laparoscopic vertical sleeve gastrectomy (LSG) and laparoscopic Roux-en-Y gastric bypass (LRYGB), the 2 most commonly performed bariatric operations in the United States,¹ are associated with substantial excess body weight loss,^{2,3} high rates of resolution of obesity-related comorbidity,⁴ and relatively low rates of operative complications.^{5,6} Bariatric operation also is linked

to increased lifespan for morbidly obese patients when compared with obese patients who do not undergo bariatric operation.⁷⁻¹⁰

Numerous studies have found bariatric operation to be a cost-effective intervention.^{11,12} Long-term cost-savings have been notable particularly among patients with high obesity-related medical and pharmaceutical costs, including type 2 diabetes (T2DM) and patients with coronary artery disease, hypertension, and dyslipidemia.^{13,14} Nevertheless, a retrospective analysis of nearly 30,000 patients published in 2013 found that bariatric operation did not decrease total health care costs, because the decrease in prescriptions and office visits were offset by inpatient costs.¹⁵

Given that nearly 200,000 bariatric operations are performed annually in the United States,¹ understanding the drivers of high-cost care for bariatric operation patients is critical. We sought to identify predictors of high 1-year operative and postoperative costs after bariatric operation at a

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single institution. Furthermore, we sought to compare cost data between patients who underwent LSG and LRYGB.

METHODS

Patient population. A total of 344 morbidly obese patients who underwent LSG or LRYGB at the University of Wisconsin Hospital and Clinics from January 1, 2010, to March 7, 2014, were identified through a review of the billing data of the Department of Surgery. LSG involved the use of a bougie (36-44 Fr) and biosynthetic staple line reinforcement (Bio-A, Gore, Flagstaff, AZ). Gastric bypasses involved stapled jejunojejunostomies and stapled antecolic, antegastric gastrojejunostomies. The gastrojejunostomies was performed with either a transoral or transabdominal passage of a 25-mm EEA stapler. Petersen's defect was closed by 1 of the 5 surgeons routinely. The jejunojejunostomy mesenteric defect was closed with a running, nonabsorbable suture. Roux limb length was between 100 and 150 cm. All cases were performed laparoscopically.

Data source and study variables. A chart review of electronic health records (Epic; Verona, WI) was performed for each patient. Patient demographics (sex, age, race, and insurance type), comorbidities (T2DM, coronary artery disease, hypertension, obstructive sleep apnea, gastroesophageal reflux disease, and hyperlipidemia) were identified through a review of all notes from referring health care providers, the preoperative anesthesiology team, and the bariatric surgery team. Comorbidities were considered present if a physician had noted that the problem was active clinically or it was present on the active problem list. Type 2 diabetes also was considered present if patients were taking diabetes medications or had a hemoglobin A1c greater than 6.5%, consistent with American Diabetes Association guidelines.¹⁶ Gastroesophageal reflux disease, hyperlipidemia, and hypertension also were considered present if the patient was taking medications for these conditions. Four patients were insured dually with Medicaid and Medicare and were categorized as having Medicaid. Preoperative weight and height were obtained from the last preoperative visit with the surgeon. Data on surgeon age at the time of each operation were collected from the Department of Surgery.

Ninety-day and 1-year outcomes. All provider notes available in the electronic health records were reviewed. All emergency department (ED) visits, readmissions, and deaths were recorded. Any complication was a composite variable that was defined as having at least 1 of the following 8 medical complications: deep vein thrombosis,

pulmonary embolism, myocardial infarction, cerebrovascular accident, acute renal failure, wound infection, pneumonia, and urinary tract infection. Criteria of the National Surgical Quality Improvement Program were used to define each complication.¹⁷ Excess weight was defined as the difference between patient weight and ideal weight. Ideal weight was determined for each patient using the Metropolitan Life Insurance Company Height and Weight data tables.¹⁸ Patients who had no visit within 4 months of the 1-year follow-up date were considered lost to follow-up.

Costs. One-year facility cost data were obtained from the information technology division of the University of Wisconsin. Cost data were categorized as inpatient, outpatient, ED, and total. Facility costs included all fixed and variable patient care costs, including operating room costs, medications, and equipment, as well as indirect costs from allocation of overhead costs. Professional fees were not included in these data.

Statistical analysis. Median total costs beginning with the day of operation and continuing 1-year postoperatively were compared between LSG and LRYGB patients using Wilcoxon rank-sum tests. Median costs rather than mean costs were selected to minimize the impact of high cost outliers. Variables hypothesized a priori to be independently associated with high total costs, including patient preoperative BMI, age, sex, race, preoperative coronary artery disease or T2DM, insurance type, age of the surgeon, type of operation, and 90-day postoperative readmissions and complications, were analyzed using bivariate logistic regression models. Those with a *P* value < .1 were included in a multivariable logistic regression model with "high cost" (defined as patients who were in the top quartile of costs amongst all patients) as the outcome. SAS version 9.2 (SAS Institute, Cary, NC) was used for all analyses.

The study protocol was approved by the Health Sciences Institutional Review Board of the University of Wisconsin-Madison.

RESULTS

Patient characteristics. In total, 78.5% (*n* = 270) of patients underwent LRYGB, while 21.5% (*n* = 74) underwent LSG (Table 1); 77.6% of patients were female and 10.5% of patients were non-white. Nearly half had T2DM (45.1%); 44.2% of patients had Medicare, 41.9% had private insurance, and 14.0% had Medicaid.

Operative outcomes. Within 90 days of operation, 24.3% of patients visited the ED, 11.2% of whom were readmitted to the hospital (22.9% of

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