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Weight loss after bariatric surgery: a propensity score analysis

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ABSTRACT

Background: Laparoscopic vertical sleeve gastrectomy (LSG) has replaced laparoscopic Roux-en-Y gastric bypass (LRYGB) as the most commonly performed bariatric surgical procedure in the US for more than the past several years. Identifying which patients will achieve optimal outcomes remains challenging. We compared 90-d and 1-y outcomes between LSG and LRYGB patients and identified predictors of surgery type and excess body weight loss (EBWL).

Methods: Patient demographics, comorbidities, and weight loss were extracted from electronic health records of patients who underwent LRYGB ($n = 270$) or LSG ($n = 74$) from January 2010 through March 2014 at a single institution. Variables hypothesized to be associated with surgery type were included in a multivariable model to generate a propensity score for each patient. Propensity score–adjusted multivariable odds ratios (ORs) for characteristics associated with EBWL >50% were calculated.

Results: Overall 90-d complication rates were similar between the LRYGB and LSG cohorts. LRYGB patients had more frequent emergency department visits (27.1% *versus* 14.1%; $P = 0.029$) but similar rates of readmission (12.3% *versus* 8.5%; $P = 0.53$). Female sex, presence of gastroesophageal reflux disease, and surgeon age ≥40 were associated with a greater likelihood of undergoing LRYGB. On propensity score–adjusted multivariable analysis, lower body mass index (OR 3.00 [95% confidence interval (CI) 1.66–5.40]), absence of type 2 diabetes (OR 2.55 [95% CI 1.43–4.54]), and undergoing LRYGB (OR 5.29 [95% CI 2.52–11.09]) were associated with EBWL >50%.

Conclusions: Sleeve gastrectomy patients had similar rates of complications compared with gastric bypass patients. Lower body mass index and absence of type 2 diabetes were associated with optimal weight loss. Incorporating these findings into preoperative discussions may help patients set reasonable postoperative goals.

Introduction

The field of bariatric surgery has changed significantly for more than the past decade. Outcomes have improved substantially and laparoscopic vertical sleeve gastrectomy (LSG) has replaced laparoscopic Roux-en-Y gastric bypass (LRYGB) as the most commonly performed bariatric surgical procedure in the US.[1,2] Reasons for the significant shift in the

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distribution of bariatric surgery are multifactorial and include the addition of third-party payer coverage for sleeve gastrectomy[3] and the American Society for Metabolic and Bariatric Surgery's endorsement of sleeve gastrectomy as a primary bariatric surgical procedure in its position statement.[4]

Another potential reason for the increase in sleeve gastrectomy volume is the perception that it is a lower risk surgical procedure compared with gastric bypass. Randomized trials have found sleeve gastrectomy has lower rates of postoperative complications.[5–8] However, sleeve gastrectomy has also been associated with lower resolution rates of type 2 diabetes[6] and gastroesophageal reflux disease (GERD)[7] and less 1-y excess weight loss.[9–12]

We aimed to identify trends in 90-d and 1-y patient outcomes, including excess weight loss and comorbidity resolution rates, after sleeve gastrectomy or gastric bypass at a single institution. We also sought to identify patient and surgeon characteristics that were independently associated with the type of bariatric surgery patients had received and with greater 1-y excess weight loss.

Materials and methods

Patient population

Three hundred forty four patients with a diagnosis of morbid obesity who underwent LRYGB or sleeve gastrectomy at the University of Wisconsin Hospital and Clinics from January 1, 2010 to March 7, 2014 were identified from the Department of Surgery billing data. All surgical procedures were laparoscopic. All gastric bypasses involved a stapled jejunojejunostomy (common channel created and enterotomy closed with an endoscopic gastrointestinal anastomosis (GIA) stapler or suture closure) and a stapled antecolic, antegastric gastrojejunostomy (GJ). The GJ was performed *via* either transabdominal or transoral passage of an end-to-end anastomosis (EEA) stapler. The mesenteric defect of the jejunojejunostomy was closed with a running, nonabsorbable suture. The Petersen defect was closed per surgeon preference (one surgeon routinely closed the defect and the other four did not close the defect). Roux limb length was 100–150 cm. All sleeve gastrectomies involved a Bougie (36–44 Fr) and use of a biosynthetic staple line reinforcement (Bio-A, Gore, Flagstaff, AZ).

Data source and study variables

A chart review using electronic health record (EHR; Epic, Verona, WI) data was performed and year of surgery was recorded. Patient characteristics included gender, age, race, and insurance type. The presence of six obesity-related comorbidities—hypertension, hyperlipidemia, obstructive sleep apnea, coronary artery disease, GERD, and type 2 diabetes—was identified by reviewing all available notes from the bariatric surgery team, referring physicians, and the preoperative anesthesiology evaluation. Preoperative weight and height were obtained from the last visit with the operating surgeon before surgery. Cases performed by each surgeon and the surgeon's age at the time of surgery were collected from the Department of Surgery.

Ninety-day outcomes

All provider notes that were available in the EHR were reviewed. Length of stay, readmissions, reoperations, emergency department (ED) visits, intensive care unit admissions, and deaths were recorded. Definitions established by the National Surgical Quality Improvement Program were applied for surgical complications.[13] These included deep vein thrombosis, pulmonary embolism, myocardial infarction, cerebrovascular accident, acute renal failure, wound infection, pneumonia, and urinary tract infection. Anastomotic or staple line leaks were identified from radiographic studies (extravasation of enteric contrast) or during reoperation. Postoperative hemorrhage was identified if the patient required a blood transfusion. Anastomotic strictures, dilations, and marginal ulcers were identified through a direct review of endoscopy reports. A GJ stricture was defined as any GJ $<$10 mm in diameter (a standard gastroscope could not be passed). Intra-abdominal abscesses were identified through abdominal computed tomography, exploratory laparoscopy, or laparotomy.

One-year outcomes

The follow-up period was defined as the interval between the bariatric surgical procedure and clinic visit closest to 1-y postoperatively in which the patient's weight was measured. If there was no visit within 4 mo of the 1-y follow-up date, the data were considered missing. Ideal body weight was obtained from Metropolitan Life Insurance Company Height and Weight tables.[14] Percent excess body weight loss (EBWL) was defined as follows: (preoperative weight − follow-up weight)/(preoperative weight − ideal body weight) × 100. Comorbidities were considered to be resolved if a physician had noted that the problem had been resolved clinically or it was absent from the active problem list. Type 2 diabetes was also considered resolved if patients no longer required diabetes medications after surgery or their hemoglobin A1c was $<$6.5% consistent with American Diabetes Association guidelines for clinical diagnosis of diabetes.[15] Obstructive sleep apnea was also considered resolved if the patient had a negative sleep study. GERD was considered resolved if the patient stopped taking acid blocking medications (H2 blockers, protein pump inhibitors). Hyperlipidemia and hypertension were also considered resolved if the patient was no longer taking his or her respective medications.

Statistical analysis

The Fisher exact tests and the Student *t*-tests were used to compare categorical and continuous variables, respectively. Preoperative body mass index (BMI), age, sex, presence of type 2 diabetes and GERD, type of insurance, surgeon age, and year of surgical procedure were hypothesized *a priori* to be independently associated with type of surgery. Thus, they were included in a multivariable logistic regression model to generate a propensity score for each patient.