



## Original articles

## Bariatric procedures in adolescents are safe in accredited centers

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**Abstract****Background:** With the rise of obesity in adolescents, there is an exponential increase in bariatric procedures in this patient population.**Objectives:** The purpose of our study was to examine perioperative outcomes after bariatric surgery in this cohort.**Setting:** University hospital, involving a large database in New York State.**Methods:** The Metabolic and Bariatric Surgery Accreditation Quality and Improvement Program public use file was queried to identify all adolescent patients (age <19 years) undergoing primary laparoscopic Roux-en-Y gastric bypass (RYGB) or sleeve gastrectomy (SG) in 2015. We assessed 30-day postoperative complications.**Results:** We identified 1072 patients who underwent Roux-en-Y gastric bypass (n=279) or SG (n=793). The majority were Caucasian (n=790) and female (n=857) with mean body mass index and age of  $47.9 \pm 8.1$  kg/m<sup>2</sup> and  $18.2 \pm 1$  years, respectively, preoperative hypertension, type 2 diabetes, and obstructive sleep apnea were present in 90 (8.4%), 139 (13%), and 165 (15.4%) of patients, respectively. There was significant difference in preoperative gastroesophageal reflux disease (18.6% versus 13.4%,  $P=.033$ ), obstructive sleep apnea (19.7% versus 13.9%,  $P=.02$ ), and body mass index ( $48.6 \pm 7.9$  versus  $47.6 \pm 8.2$  kg/m<sup>2</sup>,  $P=.03$ ) between patients undergoing Roux-en-Y gastric bypass and SG, respectively. Thirty-day reoperation, readmission, and reintervention were reported in 1.5%, 3.3%, and 1.6% of the adolescent cohort, respectively. Four patients (.4%) developed a staple line/anastomotic leak, and 1 patient (.09%) died within 30 days; 93.9% of all adolescent patients experienced an uneventful 30-day recovery. Uneventful recovery was significantly more likely for patients undergoing SG (95.3% versus 90%,  $P=.001$ ; adjusted odds ratio 2.2, 95% confidence interval 1.31–3.69).**Conclusion:** Perioperative safety of bariatric surgery in adolescents in accredited centers is safer than previously reported with low rate of 30-day events. SG is a safer procedure in this patient population. (Surg Obes Relat Dis 2018;000:1–5.) Published by Elsevier Inc. on behalf of American Society for Bariatric Surgery.**Keywords:**

Bariatric surgery; Adolescents

Obesity is on the rise around the world and affecting all ages. Childhood obesity has nearly tripled since the 1980s, as recent studies have shown that >1 in 6 chil-

dren/adolescents, aged 2 to 19 years, are now considered obese [1–3]. This is despite many policy efforts to reduce adolescent obesity [4]. The health consequences of this epidemic have great effects and represent an enormous economic burden on the U.S. healthcare system, as childhood obesity alone is responsible for approximately \$14 billion in healthcare-related expenditures [5]. Childhood obesity

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will likely further translate into future costs, as these children grow and continue being obese adults.

While obesity and its long-term deleterious effects have been well recognized, bariatric surgery is often recommended for adults, as it has proven to be the most effective means for treatment of obesity and obesity-related co-morbidities [6,7]. In adolescents, previous studies have shown bariatric surgery is safe and has effective outcomes [8–12]. Inge et al. [12], reported outcomes of no in-hospital or 30-day mortality, reoperation rate of 8%, and minor complications of 15% in 242 adolescents in 2014. Earlier studies have had similar rates of morbidity and readmissions [10,11]. Nevertheless, concerns about the safety in this cohort remain, and utilization is lower than adults [8,13].

Although these outcomes mirror the reported experience with adult populations, with improvements in care and technique over time, it is possible that current practice is associated with higher safety. The purpose of this study was to evaluate the perioperative safety of 2 common weight loss procedures, Roux-en-Y gastric bypass (RYGB) and sleeve gastrectomy (SG), in a contemporary nationwide adolescent practice.

## Methods

After institutional review board approval, the Metabolic and Bariatric Surgery Accreditation Quality and Improvement Program (MBSAQIP) public use file was used to identify adolescents who underwent bariatric surgery in 2015. The MBSAQIP is a de-identified administrative database that collects patient-level clinical data, including demographic characteristics, weight, body mass index (BMI), procedural details, and 30-day postoperative complications, from 742 participating institutions. Information is entered by specially trained surgical clinical reviewers in each participating site and audited for accuracy with chart reviews.

Adolescent patients (age  $\leq 19$  yr) undergoing either laparoscopic RYGB or SG were identified. The age of  $\leq 19$  year was chosen based on the Teen Longitudinal Assessment of Bariatric Surgery (Teen-LABS) study [12]. Patient demographic characteristics, co-morbidities, and complications were compared between the 2 procedures. Thirty-day reoperation, readmission, and reintervention were examined. Reintervention was defined as either requiring endoscopic or interventional radiology intervention as per the MBSAQIP data dictionary. Patients were considered having an uneventful recovery if there was no record of complication, reoperation, readmission, reintervention, or mortality within 30 days from surgery, similar to previous studies [14].

Categorical variables were compared using  $\chi^2$  or Fisher's exact test and are reported as count (percentage). Continuous variables were compared using the Mann-Whitney *U*

Table 1  
Preoperative characteristics.

Preoperative characteristics	RYGB	SG	<i>P</i> value
GERD medication	52 (18.6%)	106 (13.4%)	<b>.03</b>
Limited ambulation	1 (.4%)	1 (.1%)	.5
Hypertension	27 (9.7%)	63 (7.9%)	.4
Hyperlipidemia	9 (3.2%)	15 (1.9%)	.2
Venous stasis	1 (.4%)	1 (.1)	.5
Renal Insufficiency	0	2 (.3%)	1.0
Therapeutic Anticoagulation	0	1 (.1)	1.0
Diabetes			
T2D (insulin use)	6 (2.2%)	13 (1.6%)	.2
T2D (no insulin use)	39 (14.0%)	81 (10.2%)	
COPD	0	2 (.3%)	1.0
Tobacco	17 (6.1%)	46 (5.8%)	.9
History of PE	0	3 (.4%)	.6
OSA	55 (19.7%)	110 (13.9%)	<b>.02</b>
Steroid/immunosuppressant Use	2 (.7%)	8 (1.0%)	1.0

RYGB=Roux-en-Y gastric bypass; SG=sleeve gastrectomy; GERD=gastroesophageal reflux disease; T2D=type 2 diabetes; COPD=chronic obstructive pulmonary disease; PE=pulmonary embolism; OSA=obstructive sleep apnea.

test and reported as mean ( $\pm$ standard deviation). Multivariable logistic regression was used to control for confounders for variables with  $P \leq .1$  on univariable analysis, as well as preselected variables with established effect on postoperative outcomes in bariatric surgery (age, sex, and BMI). Odds ratios with 95% confidence intervals are reported as indicated. Statistical analysis was performed using SPSS Statistics version 25 for Windows (IBM Corp, Armonk, NY, USA). The American College of Surgeons MBSAQIP and the participating centers 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.

## Results

There were 1072 adolescents who underwent bariatric procedures: 279 (26%) were RYGB and 793 (74%) were SG. Mean age was  $18.2 \pm 1$  years, with the youngest patient being 13 and the oldest 19 years of age (Fig. 1). The majority was Caucasian ( $n = 790$ , 73.7%) and female ( $n = 857$ , 79.9%) with mean BMI of  $47.9 \pm 8.1$  kg/m<sup>2</sup>.

Preoperative hypertension, type 2 diabetes, and obstructive sleep apnea were present in 90 (8.4%), 139 (13%), and 165 (15.4%) of patients, respectively. There was significant difference in preoperative gastroesophageal reflux disease (18.6% versus 13.4%,  $P = .033$ ), obstructive sleep apnea (19.7% versus 13.9%,  $P = .02$ ), and BMI ( $48.6 \pm 7.9$  versus  $47.6 \pm 8.2$ ,  $P = .03$ ) between patients undergoing RYGB and SG, respectively (Table 1).

Thirty-day reoperation, readmission, and reintervention were reported in 1.5% ( $n = 16$ ), 3.3% ( $n = 35$ ), and 1.6% ( $n = 17$ ) of the adolescent cohort, respectively. Five patients (1.8%) in the RYGB group underwent reoperation

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