Characteristics and Outcomes for Patients Undergoing Revisional Bariatric Surgery Due to Persistent Obesity: A Retrospective Cohort Study of 10,589 Patients

Steffane McLennan, Kevin Verhoeff, Valentin Mocanu, Uzair Jogiat, Daniel W Birch, Shahzeer Karmali, Noah J. Switzer

INTRODUCTION

Inadequate weight loss represents the most common reason patients qualify for revisional bariatric surgery [1, 2]. Previously, a systematic review by Mahawar *et al.* concluded that revisional procedural have longer hospital stays with increased risk of complications due to their technical challenges [3]. Others have also reported worse long-term outcomes with inferior weight loss compared to primary procedures [3-5]. While revisional procedures have been suggested to have increased risk, their overall safety profile remains safe [6, 7]. However, revisional surgery is heterogeneous and conducted for various indications including reflux, malnutrition, and inadequate weight loss amongst other reasons. The heterogeneity of available data limits our ability to understand and contextualize the safety of revisional procedures [3, 8-10]. Characterizing demographics, operative technique, and outcomes for patients receiving revisional surgery specifically for inadequate weight loss would inform patient selection and operative intervention for largest group of patients receiving revisional bariatric surgery.

Our study represents the largest to date evaluating patient selection and peri- and post-operative safety outcomes for those undergoing revisional bariatric procedures for inadequate weight loss or weight recidivism. Understanding and comparing patient demographics, procedure type, and complications of revisional procedures will help guide decision making in patients with weight regain after initial bariatric interventions.

OBJECTIVES

- **Evaluate patient selection and demographics**
- **Compare procedure type and operative duration of primary and revisional procedures for inadequate weight loss**
- **Assess perioperative outcomes of primary versus revisional procedures for inadequate weight loss**

METHODOLOGY

MBSAQIP® METABOLIC AND BARIATRIC SURGERY ACCREDITATION AND QUALITY IMPROVEMENT PROGRAM

Study Type: Retrospective cohort analysis utilizing the 2020 MBSAQIP database

Primary Outcome: characterizing demographics, including index procedure, of patients undergoing revisional bariatric surgery for inadequate weight loss or weight recidivism

Secondary Outcomes: evaluation of post-operative outcomes

Patient data included in this study were categorized into two distinct cohorts:

1. patients undergoing first-time elective bariatric surgery
2. patients undergoing revisional procedures for inadequate weight loss

Statistical Analysis:
Categorical and continuous data were expressed as absolute values with percentages and as a weighted mean ± standard deviation, respectively. Chi-squared analysis was used to analyze cohort differences for categorical data and ANOVA for continuous data.

A non-parsimonious multivariable logistic regression model was developed using hypothesis-driven purposeful selection methodology and was used to adjust for comorbidities and determine independent predictors of 30-day post-operative serious complications and mortality. A main effects model was generated via bivariate analysis of variables with a p-value < 0.1 or from variables previously deemed clinically relevant to our primary outcome. Goodness of fit was assessed using the Brier Score (BS) and the receiver operating characteristic (ROC) curve. STATA 17 statistical software (StataCorp, College Station, TX, USA) was used to complete all statistical analysis.

RESULTS

Patient and Procedure Characteristics

	Initial Procedure n = 147,835 n (%)	Revisional n = 10,589 n (%)	p-value*
Age, years			
mean ± sd	43.6 ± 11.9	48.3 ± 10.5	<0.001
Gender			
Female	119,739 (81.0)	9,051 (85.5)	<0.001
Male	28,096 (19.0)	1,538 (14.5)	
BMI, kg/m²			
mean ± sd	45.2 ± 7.8	43.6 ± 7.8	<0.001
Functional Status Preoperatively			
Independent	146,807 (99.4)	10,517 (99.4)	0.758
Partially Independent	797 (0.5)	58 (0.5)	
Totally Dependent	38 (0.0)	4 (0.0)	
ASA class			
1-2	28,196 (19.1)	2,179 (20.6)	<0.001
3	113,316 (76.9)	7,997 (75.7)	
4-5	5,878 (4.0)	388 (3.7)	
Smoker	10,440 (7.1)	540 (5.1)	<0.001
Diabetes			
No or diet controlled	112,754 (76.3)	8,879 (83.9)	<0.001
Non-insulin dependent	10,063 (6.8)	432 (4.1)	
Insulin dependent	25,018 (16.9)	1,278 (12.1)	

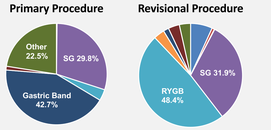
	Initial Procedure n = 147,835 n (%)	Revisional n = 10,589 n (%)	p-value*
Procedure Type			
Sleeve gastrectomy	103,777 (70.2)	3,236 (30.6)	<0.001
Roux-en-Y gastric bypass	37,689 (25.4)	4,911 (46.4)	
Laparoscopic biliopancreatic diversion	1,350 (0.9)	686 (6.5)	
Other	5,019 (3.4)	1,756 (16.6)	
Operative Duration			
RYGB	125.5 ± 57.8	151.0 ± 74.3	<0.001
Other	73.2 ± 41.1	113.6 ± 72.3	
Surgical Approach			
Endoscopic	470 (0.3)	601 (5.7)	<0.001
Laparoscopic	147,259 (99.6)	9,903 (93.5)	
Open	106 (0.1)	85 (0.8)	

sd, standard deviation; BMI, body mass index; ASA, American Society of Anesthesiologists; GERD, gastroesophageal reflux disease; COPD, chronic obstructive pulmonary disease; DVT, Deep Vein Thrombosis; MI, myocardial infarction; PCI, percutaneous coronary intervention.
* p-values were determined using chi-squared analysis for categorical data & ANOVA for continuous data.

Patients undergoing revisional procedures were more like to be female (85.5% revisional vs. 81.0% initial; p < 0.001), had lower body mass index (43.6 ± 7.8 kg/m² revisional vs. 45.2 ± 7.8 kg/m² initial; p < 0.001), and less metabolic comorbidities than patients undergoing primary bariatric surgery.

Procedure types for patients undergoing revisional bariatric surgery

The most common revisional procedures were Roux-en-Y gastric bypass (48.4%) and sleeve gastrectomy (31.9%). Notably, RYGB represented only 25.4% of procedures in the primary bariatric surgery cohort.



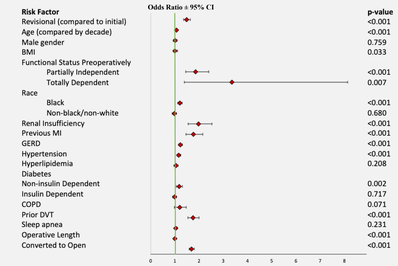
- Laparoscopic biliopancreatic diversion
- Single anastomosis gastric bypass
- Single anastomosis duodeno-ileal (SADI) bypass
- Sleeve gastrectomy
- Roux-en-Y gastric bypass
- Roux-en-Y distal gastric bypass
- Adjustable gastric band
- Gastric pouch or stoma plication
- Other

30-day outcomes of revisional procedures

Patients undergoing revisional procedures were more likely to experience serious complications (3.0% initial vs. 5.6% revisional; $p < 0.001$) and required reoperation more than twice as frequently (1.0% initial vs 2.4% revisional; $p < 0.001$)

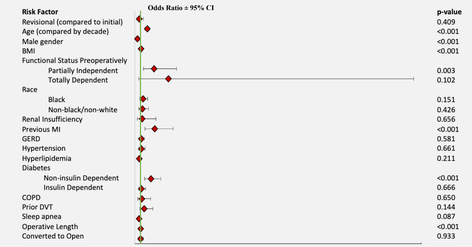
RESULTS

Multivariate logistic regression for serious complications (n=157,185)



BMI, body mass index; MI, myocardial infarction; GERD, gastroesophageal reflux disease; COPD, chronic obstructive pulmonary disease; DVT, Deep Vein Thrombosis.

Multivariate logistic regression for 30-day mortality (n=157,185)



Revisional procedures are independently associated with an increased risk of serious complications (OR 1.49, CI 1.36-1.64, p < 0.001) but were not a significant predictor of 30-day mortality (OR 0.74, CI 0.36-1.50, p = 0.409)

CONCLUSIONS

Despite a decreased burden of metabolic comorbidities, patients undergoing revisional procedures for inadequate weight loss have worse perioperative outcomes when compared to primary elective bariatric surgery. Importantly, revisional procedures are independently associated with serious complications. This data highlights important safety outcomes for patients undergoing revisional bariatric procedures for weight regain to inform patient selection for revisional bariatric surgery.

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