



## ORIGINAL ARTICLE

## Results of Revisional Bariatric Surgery: A Single Center Experience

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### Abstract

**Purpose:** With the increase in demand for bariatric surgery, increasing numbers of patients require revisional surgery due to unwanted outcomes of primary bariatric procedures. There is no ideal bariatric procedure for every patient and all bariatric surgeries have failure rates. We aimed to assess the indications for revisional bariatric surgery and short-term surgical outcomes in this study.

**Materials and methods:** All patients who underwent revisional bariatric surgery from March 2012 to June 2018 were determined prospectively. The data were retrospectively reviewed.

**Results:** Forty-four patients were included. Mean age was 42 years. The primary surgery of cases was distributed with 32 laparoscopic sleeve gastrectomy, 7 mini gastric bypass, 4 adjustable gastric band and 5 gastric plication. The most common indication for revisional surgery was insufficient weight loss or renewed weight gain. The mean operation duration was 150 (70-380) minutes and mean duration 4.7 (3-12) hospital stay days. The improvement rates for comorbid for diabetes mellitus (DM), hypertension (HT) and obstructive sleep apnea syndrome (OSAS) were 84.6% (n = 11), 70% (n = 7) and 83.3%. Mini gastric bypass was performed most frequently as revisional procedure. Seven patients developed complications after revision surgery.

**Conclusion:** Revisional bariatric surgery performed using the laparoscopic approach can be successfully completed with acceptable postoperative morbidity risks and shows satisfactory short-term weight loss. There is a need for long-term outcomes.

### Keywords

Revisional bariatric surgery, Roux-en-Y gastric bypass, Laparoscopic sleeve gastrectomy

lic health problem around the world. Though medical treatment or conservative treatment of obesity is generally ineffective, bariatric surgery has proven efficacy for achieving weight loss and improving comorbidities associated with obesity, quality of life and survival [1].

The number of bariatric procedures (BP) have clearly increased in the last decade. With the increase in demand for BP increasing numbers of patients require revisional surgery due to unwanted outcomes of primary bariatric procedures. Revision rates after primary BP are reported from 10 to 25% [2].

The lowest revision rate is associated with the duodenal switch and biliopancreatic diversion and is 5% [3]. Roux en-Y gastric bypass has revision estimates of 10 to 20% [4], while revision incidence after vertical band gastroplasty (VBG) is from 25 to 54% [5]. Laparoscopic adjustable gastric band (LAGB) has highest revision rates of 40 to 50%; however, recent studies have shown this rate has reduced [6]. Overall reoperation rate after sleeve gastrectomy was 1.18% [7].

In this study, we reviewed our first experiences related to revisional bariatric surgery. The aim was to assess the indications for revisional bariatric surgery and short-term revisional surgical outcomes.

### Methods

All patients who underwent BP at our clinic were investigated in a prospectively-updated database and patients with revisional surgery from March 2012 to June 2018 were determined. Patient demographics, body mass index (BMI), primary and revision surgery types, indications of revision, outcomes of revisional surgery and follow-up data for comorbidities were retrospec-

### Introduction

Obesity has become one of the most important pub-

tively investigated.

Detailed information about procedures was given to patients before revisional surgery. Endocrine and psychiatry consultations were held. Detailed history related to weight loss after primary BP, variations in comorbidities and psychosocial factors was taken. Additionally, all patients had upper gastrointestinal (GI) endoscopy and radiography.

## Revisional Surgery Procedures

All revisional surgery procedures except one were performed fully laparoscopically by two experienced surgeons using the same standard technique. For all techniques, anastomosis or stapler lines were checked with methylene blue with the aim of predicting leaks.

### Laparoscopic mini gastric by-pass (LMGB)

Adhesions were separated along the left edge of the stomach and the left lobe of the liver. The remnant stomach was transected at the incisura angularis level with 60 mm Endo-GIA stapler (ATW 35, EthiconEndo-SurgeryInc., Cincinnati, OH, USA). Later ante-cholic distal of the Treitz ligament hadgastro-jejunal anastomosis of nearly 150 cm jejunal loop performed with 44 mm Endo-GIA stapler. Routinely, the omentum was divided in two and omentopexy was performed around the anastomosis. The stapler line was supported by absorbable stitches.

### Laparoscopic Re-sleeve gastrectomy

For revision, as in LMGB, adhesions were separated with blunt and sharp dissections, then the remnant stomach was completely freed. Due to dilated antral pouch or fundus, the remnant stomach was resected as a tube stomach between the pylorus and left crus with 60 mm Endo-GIA stapler accompanied by 36F bougie.

### Laparoscopic sleeve gastrectomy (LSG) after adjustable gastric band

In situations where laparoscopic adjustable gastric band (LAGB) was unsuccessful, the band tube was followed to identify the band intraoperatively. Dense adhesions around the device were carefully dissected, especially near the left lobe of the liver, and the band was isolated by freeing from the fibrotic capsule with excision. If present from previous operations, gastro-gastric sutures were determined and carefully separated. When the band was fully freed it was removed. For transformation to LSG, after removing the band the stomach was placed in normal anatomic position and later dissection was completed along the large curvature until the angle of His. For longitudinal gastric resection, laparoscopic linear stapler was used accompanied by 36 F bougie as standard in our clinic.

### Laparoscopic Roux-en-Y gastric bypass (LRYGB)

Similar to the other procedures, all adhesions were

separated then after the stomach pouch was formed by the linear stapler, 100 cm of jejunum was transected from the Treitz ligament. Side-to-side gastrojejunostomy was performed for the distal jejunum with one 45 mm linear stapler. The anterior face of the anastomosis was manually sutured. Proximal jejunum end hadside-to-side jejuno-jejunosomy performed 150 cm distal of the gastrojejunostomy anastomosis with linear stapler on the posterior wall and manual suturing of the anterior wall.

### Post-operative follow-up

All patients began clear fluids on the 1<sup>st</sup> day postop. Patients with no evidence of sepsis on follow-up and who tolerated oral intake were discharged on the third day after surgery. No patient had nasogastric tube inserted. After surgery, clear fluids were begun in the first week, then pureed food was added for one week and in the third week solid food was permitted. One week after surgery, all patients were administered multivitamins, calcium and vitamin B12. Proton pump inhibitor treatment was prescribed for three months.

Follow-up of patients was performed at 1, 3, 6, 12, 24 and 36 months after revisional surgery. Weight loss, BMI variation, % excessive weight loss (EWL) and % excessive BMI loss (% EBL) were recorded. Resolution of comorbidities was accepted as normalization of preoperative comorbidities at the end of follow-up.

## Results

The study included 48 procedures in 44 patients. The clinical features of patients before revisional surgery are shown in Table 1. Twenty-five patients were referred to our clinic from external centers. Mean BMI before revisional surgery was 39.8 kg/m<sup>2</sup> (19-59).

The most common indication for revisional surgery was insufficient weight loss or weight regain for all initial procedures (n = 35). In the literature, a wide range of definitions are employed to describe weight regain. The weight regain definition, an increase of at least 10

**Table 1:** Basic features before revision.

Variables	Values
Age (years)	42
Gender	
Male	10
Female	34
Interval (months)	34 (8-144)
BMI (kg/m <sup>2</sup> )	39.8 (19-59)
Comorbidities	
DM	13
HT	10
OSAS	6

(DM: Diabetes mellitus; HT: Hypertension; OSAS: Obstructive sleep apnea syndrome; BMI: Body mass index).

kg from nadir weight. Revisional surgery was performed on 12 patients due to stenosis linked to intolerance of solid food with lack of response to endoscopic balloon dilatation treatment and one patient due to alkaline reflux resistant to medical treatment (Table 2). The distribution of types of revisional and their initial surgeries is shown in Table 3.

The mean operation duration was 150 (70-380) minutes and mean duration 4.7 (3-12) hospital stay days. The improvement rates for comorbid for diabetes mellitus (DM), hypertension (HT) and obstructive sleep apnea syndrome (OSAS) were 84.6% (n = 11), 70% (n = 7) and 83.3% (n = 5) (Table 4).

Mean follow-up duration after revisional surgery was 16 months (0-36) with detailed weight parameters shown in Table 5. In the first six months, all patients were followed up, but in the 36<sup>th</sup> month, 8 patients were possible. The lowest BMI was found to be 29.43 kg/m<sup>2</sup> in the 36<sup>th</sup> month.

## Discussion

Many patients require revisional surgery after primary operations due to a variety of reasons; such as, insufficient weight loss or weight gain, delayed complications related to implants in addition to revisional procedures performed to manage early surgical complications. Although many articles have researched a variety of bariatric procedures used, the studies about appropriate revisional surgery are limited. It is necessary to devise an appropriate revision strategy to be adapted for indications to manage the decision-making process [8-10].

In our clinic, revisional surgery comprised 3.4% (48/1383). The most common reason was insufficient weight loss or gain. The other most common reason was stenosis. However, these indications are not fully

**Table 2:** Causes for revision.

	LSG	LGP	LAGB	LMGB
Renewed weight gain	22	5	4	4
Stenosis	10	-	-	2
Alkaline reflux	-	-	-	1

(LSG: Laparoscopic sleeve gastrectomy; LGP: Laparoscopic gastric plication; LAGB: Laparoscopic adjustable gastric band; LMGB: Laparoscopic mini gastric bypass).

**Table 3:** The distribution of types of revisional and primary surgeries.

Types of revisional procedures	Types of primary surgery			
	LSG	LGP	LAGB	LMGB
Laparoscopic mini gastric bypass	23	3	2	-
Laparoscopic Roux-ny	3	-	-	7
Laparoscopic re-sleeve gastrectomy	6	-	-	6
Laparoscopic sleeve gastrectomy	-	2	2	-

(LSG: Laparoscopic sleeve gastrectomy; LGP: Laparoscopic gastric plication; LAGB: Laparoscopic adjustable gastric band; LMGB: Laparoscopic mini gastric bypass).

independent of each other and many patients have a combination of these complaints.

From literature for revisional LSG, El Chaar, et al. performed 2.5% revision for 281 patients [11]. In our clinic, for revisional surgery with primary LSG, LMGB (71.8%) technique was applied linked to patient and surgeon choice. The revisional procedure selection is linked to a variety of factors including patient history and intraoperative findings [12]. In our series, the majority of primary procedures were selectively transformed to LSG or LMGB. Though some of our patients had laparoscopic re-sleeve due to neo-fundus or high-volume remnant stomach, primarily generally LMGB was used.

An advantage of LGP is the potential to revise to other bariatric procedures due to unwanted results. Atlas, et al. reported they performed revisional LSG due to insufficient weight loss in the postoperative 6<sup>th</sup> month [13]. In the largest series to date, Talebpour, et al. [14] reported on 38 patients with revisional bariatric operations due to weight gain or inability to lose weight after LGP. Of these 38 patients, 25 had malabsorptive operations, 11 had replication and 2 had gastric bypass. In our series, 5 LGP patients, all from external centers, were

**Table 4:** Short-term outcomes of revisional surgery.

Variable	Value
Laparoscopy	47
Laparotomy	1
Op. duration (min)	150 (70-380)
Hospital stay days	4.7 (3-12)
Comorbidities (n)	
DM	2
HT	3
OSAS	1
Complications (n)	
Stenosis	2
Hemorrhage	2
Alkaline reflux	1
Internal hernia	1
Intestinal injury	1

(DM: Diabetes mellitus; HT: Hypertension; OSAS: Obstructive sleep apnea syndrome).

**Table 5:** Weight loss parameters following revisional surgery.

Follow-up duration	Patient numbers	Weight (kg)	BMI (kg/m <sup>2</sup> )	EWL%	EBL%
1 month	47	99 (50-137)	36.51 (20-52)	18.61	19.19
3 months	47	91 (51-130)	34.42 (20-50)	32.43	27.31
6 months	47	83 (51-125)	31.45 (20-46)	45.71	45.58
12 months	34	80 (52-127)	30.01 (20-41)	60.43	72.74
24 months	17	82 (57-120)	30.72 (22-40)	66.06	81.32
36 months	8	83 (59-115)	29.43 (23-39)	68.77	78.01

(BMI: Body mass index; EWL: Excess weight loss; EBL: Excess BMI loss).

revised with LMGB for 3 and LSG for 2 cases. However, 2 cases with LGP were revised to LMGB due to stenosis developing in the early postoperative period. These cases were investigated with surgical specimens, postoperative gastroscopy and radiologic images and we concluded that the plication line requires full opening during revision surgery. With this experience, we lowered readmission and reoperation rates by choosing bypass techniques rather than a restrictive procedure.

LAGB which was described in 2001 and rapidly gained popularity due to high perceived reliability profile and low morbidity and mortality rates [15]. Additionally, in recent times, there are high removal rates and revision procedures related to LAGB and the number of primary procedures has significantly reduced [16]. Some studies have shown LRYGB or LSG may be appropriate revisional procedures after failed LAGB [17]. The most common procedures among revision patients are band removal (32.8%), then band revision (30.5%), band removal and change (19.1%), removal and transition to LSG (5.6%) or removal and transition to LRYGB (11.9%) [18]. Our data also show that LRYGB or LSG can successfully manage unwanted outcomes due to primary LAGB. Debates related to the topic of transition of failed LAGB to other bariatric procedures in single or two stages continues. Some researchers choose a two-stage procedure due to reasons such as predictable surgical duration, low complication risks after surgery and reduced incidence of delayed anastomosis stenosis [19]. Others defend the single-stage operation, stating it can be reliably performed without increasing surgical complication risks [20]. In our clinic, we completed transition to LSG or LMGB in a single stage for revisional procedures after LAGB.

Revisional surgery is widely accepted as complicated and technically difficult. Generally postoperative complication risks are higher compared to primary procedures and perioperative morbidity rates are reported as 13-34% [21]. With the development of laparoscopic surgical skills, a few studies in recent times have shown laparoscopic revision can be reliably performed by well-educated and experienced bariatric surgeons at expert bariatric centers. In our series, seven patients developed complications, such as stenosis, hemorrhage, alkaline reflux, internal hernia and intestinal injury. The

major complication rate was 14.58% was similar with earlier publications. In the literature, there are higher mortality rates defined for revisional surgery compared to primary surgery. Owens, et al. reported the mortality rate for primary procedures was 0.5% and was 1.3% after revisions [22]. In our series, one case developed mortality due to non-surgical respiratory problems.

As previously defined, successful weight-loss is arbitrarily defined as weight-loss equal to or greater than 50 percent of excess body weight after bariatric surgeries. In our study, the revisional surgery provide successful results in 12 and 36 months follow-up. The main of the percentage of excess weight loss was 60.43% after one year and 68.77% at 3 years.

There are some limitations to our study. Firstly, it is a retrospective study of a single center and the number of patients is relatively low. Second, the follow-up duration is slightly short and there is still a need to collect long-term outcomes. The major power of this article is that it is one of the recent study that reports the results of revisional surgery for bariatric surgeries.

In conclusion, revisional surgery performed using the laparoscopic approach can be successfully completed with acceptable postoperative morbidity risks and shows successful short-term weight loss. There is a need for long-term outcomes related to weight loss and delayed complications in the future.

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