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Research Article

The Second Stage of Surgical Treatment After Sleeve Gastrectomy

OO Kalashnikov[1]*, O Yu Usenko[2], IM Todurov[1] and SV Kosiukhno[1]

[1]State Scientific Institution "Center for Innovative Medical Technologies of the National Academy of Sciences of Ukraine", Kyiv, Ukraine

[2]State Institute "Shalimov's National Institute of Surgery and Transplantation" of the National Academy of Medical Sciences of Ukraine, Kyiv, Ukraine

***Corresponding Author:** OO Kalashnikov, Department of Minimally Invasive Surgery, State Scientific Institution "Center for Innovative Medical Technologies of the National Academy of Sciences of Ukraine", Kiev, Ukraine.

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Abstract

Background: Sleeve gastrectomy is currently considered as a primary bariatric surgery. This is because of its relative simplicity and satisfactory results. As observed with other bariatric procedures, surgeons are confronted with insufficient weight loss or weight regain, insufficient resolution of metabolic disorders and intractable severe reflux.

Objectives: The aim of this study was to report the indications for and the outcomes of revisional surgery after sleeve gastrectomy.

Methods: 11 (5%) patients underwent a revision surgery after sleeve gastrectomy procedure for insufficient weight loss or/and severe reflux. All patients with failure after primary sleeve gastrectomy underwent endoscopic and radiologic evaluation. The patients were subdivided in a first group undergoing revision as part of a two-step procedure, a second group with failure of a primary sleeve gastrectomy (insufficient weight loss or/and severe reflux).

Results: Mean initial body mass index and excess weight were 47,7 ± 10,1 (35 - 81,5) kg/m^2 and 76,8 ± 32,6 (46 - 169) kg, respectively before primary sleeve gastrectomy. The mean interval between the two procedures was almost 23 ± 9,2 months in first group and 43 ± 27,4 months in second group. The mean body mass index and % excess weight loss was 49,7 ± 7,1 kg/m^2 and 34,2 ± 15,7% for the first group and 37,2 ± 3,0 kg/m^2 and 18,9 ± 11,9% for the second group, respectively before revisional surgery. Five patients had a two-step procedure because of super obesity in the first group. In the second group: three patients underwent conversion to Roux-en-Y gastric bypass for insufficient weight loss and severe reflux and three patients to re-sleeve gastrectomy for insufficient weight loss and severe reflux. All reflux symptoms were resolved without any medication. The mean body mass index and % excess weight loss was 30,4 ± 4 kg/m^2 and 68,8 ± 11,3% for the first group and 27,7 ± 5,4 kg/m^2 and 62,1 ± 20,6% for the second group, respectively. Only one postoperative complication was observed as a staple line leakage. Revision related mortality was 0%.

Conclusion: The revision rate was 5%. Revision of a sleeve gastrectomy is safe, feasible and effective in the short term in patients that do not achieve sufficient weight loss and in those patients who have sever reflux after the initial sleeve gastrectomy.

Keywords: *Morbid Obesity; Sleeve Gastrectomy; Revisional Surgery; Roux-En-Y Gastric Bypass; Weight Loss Failure; Biliopancreatic Diversion with Duodenal Switch*

Introduction

Numerous meta-analyses have confirmed the advantages of bariatric surgery over conservative methods of treating not only obesity but also related metabolic disorders [1].

Among numerous surgical methods for the treatment of obesity and metabolic disorders, sleeve gastrectomy (SG) has now confidently taken the leading position [2]. Sleeve gastrectomy is an effective and safe bariatric surgery that reduces overweight and resolved metabolic disorders. According to the literature, after SG, weight loss reaches 60 - 70%. Compensation for metabolic disorders: arterial hypertension - 55 - 65%, diabetes mellitus - 45 - 55%, dyslipidemia - 55 - 65% [3,4].

Over the past few years, there has been a increase in the number of SG performed worldwide. The vast majority of patients have good to excellent results of primary bariatric surgery. However, in the long-term postoperative period, some patients notice a recurrence of overweight. Therefore, with an increase in the number of SG the number of patients requiring revision interventions is also increasing [2,5].

Indications for reoperation may include: insufficient weight loss (primary insufficient weight loss or weight regain), reflux esophagitis, dysphagia, complications in the long-term postoperative period (gastric fistula, gastric tube stricture), excessive weight loss, metabolic disorders associated with surgery [2].

The reasons for insufficient weight loss are multifactorial. Intraoperative (technical mistakes during the formation of the gastric tube) and postoperative: lifestyle, the effects of chemotherapy or hormone therapy, alcohol abuse, which in turn leads to an increase in food intake.

According to various authors, the percentage of unsatisfactory results after SG in the long-term postoperative period reaches 50%. The overall frequency of reoperations after primary bariatric surgery varies widely and ranges from 5 to 56% [6]. The issue of choosing the method of revision bariatric surgery after SG is still controversial.

Purpose of the Study

The purpose of this study is to report the indications for and the outcomes of revisional surgery after sleeve gastrectomy.

Materials and Methods

The work is based on a retrospective analysis of the treatment results of 217 patients who underwent sleeve gastrectomy by our team. In 85% of patients, the follow-up period exceeded 2 years.

The data evaluated included patient demographics (age, gender); body mass index (BMI) and percentage of overweight (%OW) before SG, BMI and percentage of excess weight loss (%EWL) before and after revision surgery, and the time interval between the two procedures. In addition, indications for revision surgery, operative parameters, complications, and mortality were included.

The mean age of the patients was 41.1 ± 12.3 years, ranging from 18 to 68 years (96 men and 121 women).

The mean body weight before SG was 141.8 ± 37.2 kg (106 to 246 kg), the mean value of overweight was 76.8 ± 32.6 kg (46 to 169 kg). The mean of BMI before the operation was 47.7 ± 10.1 kg/m^2 (35 to 81.5 kg/m^2). Before the second operation, each patient was evaluated by an multidisciplinary team consisting of a nutritionist, endocrinologist, psychologist, cardiologist, anesthesiologist and surgeon. The preoperative examination protocol, in addition to the generally accepted instrumental and laboratory tests, included

fibroesophagogastroduodenoscopy and contrast radiography of the gastric tube with barium sulfate. Computerized gastrovolumetry was performed to assess the adequacy of the gastric sleeve resection and to measure the reservoir.

The procedure for CT gastrovolumetry was as follows. The patient took 50 ml of 4% aqueous sodium bicarbonate and 50 ml of 4% aqueous tartaric acid solution orally. After 30 and 60 seconds, a computed tomography of the abdominal cavity was performed and the volume of the gastric tube was determined using 3D modeling.

Based on X-ray and CT gastrovolumetry, gastric tube dilation was divided to primary and secondary. Primary dilation was defined as the dilation of a part of the gastric tube in the upper part or in the antral region. Secondary dilation was defined as a uniform dilation of the gastric tube with a volume of more than 250 cm^3.

Indications for re-operation were insufficient weight loss 18 months after surgery (< 50% EWL), progressive weight regain after initial successful weight loss, or symptomatic gastroesophageal reflux disease (GERD).

Before performing a re-sleeve (re-SG) or Roux-en-Y gastric bypass (RYGB), an importance was attached to the evaluation of the gastric tube, especially the esophagogastric junction and the cardiac section. In our opinion, this is one of the key issues for defining the level of mobilization and resection.

During the re-SG, the posterior wall of the gastric tube was mobilized from the antrum to the left crus of the diaphragm. This marker point is a criterion for adequate mobilization of the gastric. In one case, intraoperative fibroesophagogastroduodenoscopy was performed to clearly visualize the esophagogastric junction due to a severe adhesive process. After insertion of a 36 Fr gastric tube, re-SG was performed. Black cassettes with a staple bend level of 2.3 mm were used for crossing. The staple suture line was peritonized with a sero-serous continuous suture.

The method of revision RYGB. A proximal reservoir of up to 30 ml in diameter was formed from the gastric tube using linear staplers with preservation of the left gastric artery. Part of the stomach fundus was removed. At a distance of 150 cm from the ligament of Treitz, the jejunum was transected and a posterior jejunojejunal gastroenteroanastomosis was formed on the posterior wall of the proximal gastric reservoir using a 36 Fr gastric tube. The windows between the mesentery of the transverse colon and the alimentary loop and between the alimentary and biliary loops were sutured.

The technique of biliopancreatic diversion with the duodenal switch off according to the Hess-Marceau technique (BPD/DS). The duodenum was transected 3 cm distal to the pylorus after partial viscerolysis after its preliminary mobilization. After that, the length of the small bowel was measured along its anti mesenteric margin in the stretched position. The small intestine was transected at a distance from the ileocecal junction equal to 40% of the total length of the small intestine plus 25 cm, but not less than 200 cm and not more than 350 cm. A terminal-lateral bulbo-ileoanastomosis was formed with a distal fragment that was passed behind the colon through a window in the mesocolon. The proximal fragment of the small intestine was included in the Ru passage at a distance of 100 cm from the ileocecal angle.

Results

SG is the universal operation, given the possibility to convert it to any other bariatric procedure (revision RYGB, revision mini gastric bypass or BPD).

Revision surgery after SG was performed in 11 (5%) of our patients.

All patients were divided into two groups: the first group included patients with morbid super obesity, in whom SG was performed as part of the planned first stage of obesity treatment. The second group included patients with a GERD clinic and/or ineffective weight loss or weight regain.

Before the SG, the mean BMI in the first group was 66.1 ± 15.5 kg/m^2 (range 42.6 - 81.5 kg/m^2), in the second group - 41.2 ± 5.1 kg/m^2 (range 35.3 - 50 kg/m^2). It should be noted that among the patients of the second group, two patients underwent surgery in another medical center.

Revision surgery after SG is becoming increasingly common due to the rapid increase in the number of patients who have undergone this procedure as a treatment for morbid obesity. The problem of insufficient weight loss and weight regain after SG is a problem, as it is for other bariatric surgeries.

Revision surgeries were performed in 23 ± 9.2 months in the first group and in 43 ± 27.4 months in the second group.

Before the second operation, the mean BMI in the first group was 49.7 ± 7.1 kg/m^2 (range 38.1 - 55.5 kg/m^2), in the second group - 37.2 ± 3.1 kg/m^2 (range 35 - 43.2 kg/m^2). The %EWL in the first group was 34.2 ± 15.7%, in the second group 18.9 ± 11.9%, respectively.

We found that in choosing the optimal revision surgery for each patient, first of all, it is necessary to clearly collect a bariatric history, and then assess the patient's BMI and eating behavior.

The next step was a barium passage radiography to detect primary or secondary dilation of the gastric tube. CT gastrovolumetry was performed to assess gastric restriction after SG.

The primary dilation of the gastric tube indicated technical mistakes that were made during the primary SG. A huge antrum was left as a result of a far deviation from the pylorus during the first stapler. In case of inadequate mobilization of the posterior stomach wall to the left crus of the diaphragm, usually during the learning curve or in patients with super morbid obesity, the bottom or posterior gastric pouch is left.

Re-SG was performed in case of inadequate gastrorestriction during primary gastric tube dilation (in the upper part or in case of a leftover gastric fundus).

In patients after re-RSG, the mean BMI was 25.5 ± 1.1 kg/m^2 (range 24.4 - 26.8 kg/m^2) and %EWL was 69.9 ± 5.5%, respectively.

Although re-RS seems to be technically easier, without anastomoses, the rate of postoperative complications is higher compared to primary SG. A few publications and a short follow-up period do not allow us to conclude on its real safety.

If the volume of the gastric tube was greater than 250 cm^3, gastric restriction was considered uneffective. If the volume was less than 250 cm^3, clinical and endoscopic signs of GERD were assessed. Depending on this, a decision was made to choose a Roux-en-Y gastric bypass or BPD/DS.

Among the patients included in the study, primary dilation of the gastric tube was detected in 2 patients and secondary dilation in 3 patients.

In the group of patients after RYGB, the mean values of BMI and %EWL were 30.1 ± 7.5 kg/m^2 (range 24.9 - 38.6 kg/m^2) and 55.1 ± 28.5%, respectively. The follow-up period was 12.7 ± 11 months.

In all patients included in the study, clinical manifestations of GERD disappeared after RYGB without the use of proton pump inhibitors. Our data confirm the efficacy of RYGB in the treatment of GERD in 100% of cases.

In the classical BPD/DS, the gastrorestrictive component is performed by the SG. Therefore, on the one hand, it follows that the BPD/DS is the logical second stage of obesity treatment. The Hess-Marceau and SADI BPD represent other promising options for revision intervention in this category of patients. Due to the large percentage of excess weight loss observed after BPD compared to other bariatric surgeries, there is an increased interest in the use of this operation in patients after SG with ineffective weight loss.

However, after this operation, there is a high rate of long-term postoperative complications, the most severe of which is protein malnutrition syndrome, which is a direct consequence of aggressive surgical intervention in the patient's metabolism and can lead to death.

BPD/DS can only be offered to patients who are highly motivated, responsible for the follow-up program, and who can clearly understand the detailed information about the risks and serious side effects of malabsorption.

In the first group of patients after BPD/DS, the mean values of BMI and %EWL were 30.6 ± 4.2 kg/m^2 (range 25.6-35.3 kg/m^2) and 68.8 ± 11.3%, respectively.

In one patient, due to inadequate weight loss and secondary dilation of the gastric tube after BPD/DS, distal gastric bypass according to Roux-en-Y was performed. The %EWL 2 years after surgery was 81%.

BPD/DS after SG, in all patients, was the planned second stage of treatment of obesity and metabolic disorders. All patients before the first surgery were in the morbidly obese group (BMI > 60 kg/m^2). The surgery was performed 23 ± 9.2 months after SG. The volume of the gastric tube was 267.2 ± 3.4 ml. This was considered as an adequate gastric restriction.

Among the patients included in this study, one postoperative complication was recorded, according to the Clavien-Dindo class IIIa classification.

One patient had the staple line leak after reGS. The patient was discharged from the clinic on the 5th postoperative day in a satisfactory condition, without signs of complications or deviations from the normal process of the postoperative period. She sought help on postoperative day 14 with an intoxication clinic and complaints of fever up to 39C, pain in the left subdiaphragmatic area with radiation to the left clavicle. During the radiographic control of water-soluble contrast, the failure of the staple suture line was diagnosed with the formation of a subdiaphragmatic abscess in the left subdiaphragmatic area. The first stage of treatment included puncture and drainage of the abscess under ultrasound guidance, transfer of the patient to total parenteral nutrition, antibacterial therapy, and gastric secretion blockers. After stabilizing the patient, the second stage was the use of endoscopic endovac therapy. After four sessions, we managed to achieve healing of the failure.

Reoperations were performed in two patients after BPD/DS. An abdominoplasty of the anterior abdominal wall was performed as a result of aesthetic deformity after loss of excess body weight.

There were no deaths among the patients included in this study.

Discussion

During its initial stages, SG was performed as a first step procedure in highly obese and high-risk patients [2]. Nowadays many bariatric centers perform SG as a sole and definitive bariatric procedure not only in few selected patients, but also in the morbidly obese

with average operative risk [7]. In these patients, weight regain matters, as a second step procedure is not generally scheduled after the primary weight loss.

As for the bariatric procedures such as gastric banding or VBG that are exclusively based on restriction, some weight regain is observed after SG in the longer follow-up. As a growing number of series are reported with only short-time follow-up, data on weight loss after SG consists of exclusively very good results for weight loss [6].

In gastric bypass surgery, the placement of a band above the gastro-jejunostomy (banded gastric bypass) led to a better long-term weight loss success compared with nonbanded gastric bypass [8]. Similar to the banded gastric bypass, a band can also be placed in SG performed as «primary banded sleeve gastrectomy», as published by Gentileschi P., *et al*. [9] In this series of 27 patients, a band of 6 cm length made of biologic tissue (AlloDerm) was placed approximately 6 cm below the gastro-esophageal junction. After 1 year, the average body mass index was reduced from 49.6 to 31.6 kg/m^2. Without the long-term data, it remains unclear if band placement can avoid weight regain after SG, especially as weight regain was found to occur after the first year postoperatively [9].

Weiner., *et al*. found the volume of the removed stomach to be a predictor for weight loss failure [10]. A higher incidence of weight regain was observed in patients with less than 500 cm^3 of the stomach resected.

In SG, the gastric fundus, known as main localization of Ghrelin-producing cells is resected together with parts of the corpus and antrum. As a consequence, we found stable low Ghrelin levels at up to 6 months after SG [11]. This might partially explain the reduced sensation of appetite found in the early postoperative period [6].

In the longer follow-up, a compensatory increase of plasma Ghrelin levels could contribute to weight regain in some patients. However, in the recent study on 5-year SG data, we found stable low plasma Ghrelin levels [11]. But no data on eating behavior for the long-time follow-up have been reported so far. Thus, a normalization or over- compensation of appetite after SG could occur even beside substantially reduced plasma Ghrelin levels in the longer follow-up.

For laparoscopic adjustable gastric banding conversion to RYGBP is seen as a procedure of choice for the treatment of weight regain [12]. In contrast to that, only a limited number of studies and case reports have focused on the treatment possibilities for weight regain SG so far.

Sleeve resizing can be performed in cases of significant sleeve dilation [13]. An adjustable gastric band can also be placed to restore restriction in weight regain after SG. As SG is part of the duodenal switch procedure, BPD/DS can also be completed to add malabsorption to the strictly restrictive SG. When choosing the right revisional procedure, a concomitant severe reflux should also be taken into consideration. In some patients with clinically relevant reflux this might also contribute to weight regain as patients eat to ''treat'' reflux. Thus, we recommend pH-metry to quantify gastroesophageal reflux in all candidates for revisional surgery in cases of weight regain after SG. In these cases, conversion to RYGBP should be performed and not completion of the BPD/DS.

However, weight regain itself should not be seen as an argument against SG, as weight regain is also observed after RYGBP, which is based on a combination of restriction and mild malabsorption. Nevertheless, RYGBP can be seen as the golden standard in bariatric surgery. Comparing weight loss over the time, we found a similar excessive weight loss after 1 year for patients with a later weight regain compared with long-term weight stable patients after SG. Weight regain was found to occur most likely within the second year after SG [6].

Therefore, we recommend schedules for outpatient follow-up visits be adapted, with short intervals especially within the second year after SG, to identify patients with weight regain as soon as possible and perform early revisional surgery to prevent major or complete weight regain.

Conclusion

The percentage of revision surgery after sleeve gastrectomy was 5%. Indications for revision surgery after sleeve gastrectomy are insufficient weight loss, weight regain, and/or gastroesophageal reflux disease. Revision of a sleeve gastrectomy is safe, feasible and effective in the short term in patients that do not achieve sufficient weight loss and in those patients who have sever reflux after the initial sleeve gastrectomy.

Conflict of Interest

The author has no conflict of interest.

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