OBES SURG (2011) 21:517–523
DOI 10.1007/s11695-010-0249-1

NEW CONCEPTS

Laparoscopic Conversion of Roux-en-Y Gastric Bypass to Sleeve Gastrectomy As First Step of Duodenal Switch: Technique and Preliminary Outcomes

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Published online: 14 September 2010

Abstract
Background Weight loss issues are one of the problems that can affect patients after undergoing bariatric surgery. We report the feasibility, safety and preliminary outcomes of laparoscopic conversion of Roux-en-Y gastric bypass (RYGB) to sleeve gastrectomy (SG), as a first step of duodenal switch (DS), for insufficient weight loss or weight regain.
Patients and Methods Between August 2007 and November 2009, four patients benefited from laparoscopic conversion for insufficient weight loss or weight regain, mainly due to a new dietary behaviour such as sweet eating. At the time of RYGB, the mean weight and body mass index (BMI) was 118.5±32.8 kg and 43.2±8 kg/m^2, respectively. The mean interval time between RYGB and conversion to SG was 36.7±15.6 months. At the time of conversion, the mean weight, BMI, % excess weight loss (%EWL) and % excess BMI loss (%EBMIL) was 101.7±24.7 kg, 37.3±6.6 kg/m^2, 27.5±11.8% and 26.5±12%, respectively. The procedure involved the dismantling of both anastomosis, performance of SG before restoration of gastric continuity, and new small bowel anastomosis.
Results Mean operative time was 233.7±46.4 min. There were no conversions to open surgery and no mortality. One patient developed a gastric fistula. Mean hospital stay was 20.2±17.9 days. After a mean follow-up of 11±12.8 months, the mean weight, BMI, %EWL and %EBMIL was 81±12.1 kg, 30.3±5.1 kg/m^2, 59.3±31.5% and 42.3±34.5%, respectively. During follow-up, one patient underwent the second step of DS.
Conclusions Laparoscopic conversion of RYGB to SG is feasible and safe despite the development of gastric fistula. Weight loss is increased, leaving the patients in better conditions to undergo the second step of DS.

Keywords Gastric bypass · Weight regain · Insufficient weight loss · Sleeve gastrectomy · Duodenal switch · Laparoscopy

Introduction

Laparoscopic Roux-en-Y gastric bypass (RYGB) is one of the most common bariatric procedures performed, and is reported to offer at mid-term a % excess weight loss (%EWL) of 43–68.1% [1–3]. Laparoscopic sleeve gastrectomy (SG) is actually becoming a popular procedure for morbid obesity [4, 5], achieving a %EWL of 48.5±8.7% after the first 4 years [5]. %EWL after duodenal switch (DS) is reported to be of 68.9% after more than 10 years [6].

Weight loss issues (either too much weight or too little weight loss) or weight regain after initial successful weight loss, are a few of the negative aspects that can affect patients after undergoing bariatric surgery.

Weight regain after RYGB can be related to technical failures or to new dietary behaviour. Technical causes of weight regain can be gastric pouch dilation, gastrojejunostomy dilation and development of gastro-gastric fistula.

Patients who undergo RYGB frequently develop new alimentary habits like hyperphagia, polyphagia or sweet eating. Hyperphagia, which means volume eating (eating

This paper is presented at the XV World Congress of International Federation for the Surgery of Obesity and Metabolic Disorders, Long Beach CA, USA, September 3–7, 2010.

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too large meals), will logically be treated by increasing restriction by placement of an adjustable gastric band [7–9], or a non-adjustable ring [10] around the gastric pouch. Polyphagia, which means grazing (eating too frequent meals), can logically be treated by conversion of RYGB to a malabsorptive procedure like distal RYGB (DRYGB), or DS performed in two steps. A new mixed alimentary behaviour, characterized by grossly increased caloric intake, will be treated by conversion to SG, leaving the probability of adding a significant malabsorption consequent by the second step of DS.

The authors report the feasibility, safety and preliminary outcomes of laparoscopic conversion of RYGB to SG, performed as a first step of DS, for insufficient weight loss or weight regain mainly related to a new sweet-eating behaviour.

Patients and Methods

Between August 2007 and November 2009, four patients (all females) benefited from laparoscopic conversion of RYGB to SG. Their mean age was 42±14.7 (26–56) years. Multidisciplinary consultation, involving psychological counseling, gastroscopy and barium swallow, permitted us to rule out mental disorders (as binge eating or night eating) as well as technical failures. In addition, the nutritionist's counseling reported a new eating pattern, namely, sweet-eating.

At the time of RYGB, the mean weight and body mass index (BMI) was 118.5±32.8 kg (90–152) and 43.2±8 kg/m^2 (35–52), respectively. Two patients suffered from obesity-related co-morbidities (one from arterial hypertension and one from type 2 diabetes mellitus). The mean interval time between RYGB and conversion to SG was 36.7±15.6 (17–55) months. In this interval, the extreme achieved weight, BMI, %EWL, % excess BMI loss (%EBMIL) was 90.7±32.4 kg (53–130), 33.2±7 kg/m^2 (20.5–44), 52.9±43.2% (15.5–111.7) and 52.5±43.4% (15.3–111.5), respectively.

At the time of conversion, the mean weight, BMI, %EWL and %EBMIL was 101.7±24.7 kg (80–130), 37.3±6.6 kg/m^2 (31–44), 27.5±11.8% (15.5–41.8) and 26.5±12% (15.3–41.6), respectively. The obesity-related co-morbidities were resolved in both patients.

The main objective of our study was to describe the feasibility of our technique, and to document whether the conversion we used might lead to tangible effects in terms of stopping weight regain and reinducing further weight loss. Due to our study design, which features a small series of cases, we used descriptive statistical methods. We reported frequency tabulations for categorical variables and mean and standard deviation as summary parameters of the observed distributions of continuous covariables or outcomes.

The main criteria of evaluation were %EWL and %EBMIL calculated on the basis of the initial weight before RYGB. The ideal weight for evaluation of %EWL and %EBMIL was set at a BMI of 22 kg/m^2. We also provide graphical representations of means of continuous outcomes after the first follow-up period and the second follow-up period. Due to the narrative nature of the study and its extremely limited sample size, no inferential statistical analysis was carried out.

Technique

The patient was positioned supine with the legs and both arms in abduction (French position). The surgeon stood between the patient's legs, the person holding the camera was to the patient's right and the assistant to the patient's left. The procedure started by inserting the first 12-mm trocar, using the Hasson technique, on the mid-clavicular line in the left upper quadrant. Four additional trocars were placed under direct intraperitoneal view, usually at the same position as for the original surgery: a 5-mm trocar on the left anterior axillary line at 5 cm distal to the costal margin, a 10-mm trocar at some 20 cm below the xyphoid process, a 12-mm trocar on the right mid-clavicular line on the same horizontal line, and a 5-mm trocar just distal to the xyphoid process. The alimentary loop was identified, and adhesions between the parietal peritoneal sheet and the greater omentum and/or small bowel, and between the left liver lobe and the gastrojejunostomy were severed (great care was taken to prevent damage to the hepatic capsule). At this stage, both the diaphragmatic crura were clearly identified and separated from the esophagus. In case of crural diastasis or incipient hernia, hiatoplasty was performed by passing one or two figure-of-eight sutures with 1 polypropylene. The gastric remnant was separated from the adhesions with the gastric pouch and gastrojejunostomy by stapling. Green loads were used (EndoGIA, Covidien, New Haven, CT, USA) considering tissue thickness. The gastric pouch was sectioned by a firing of linear stapler green load, just proximal to the anastomosis in healthy tissue, and extreme care was taken not to devascularize the little stomach pouch, since it usually survives on just one or two branches of the left gastric artery (Fig. 1). The fundus of the gastric remnant was subsequently freed from top to bottom along the greater curvature, down to the level of the body of the stomach. At this level, the body of the gastric remnant was transected from lateral to medial by firings (usually two) of linear stapler green load (Fig. 2). The gastric pouch was opened on its posterior side, and the remaining upper pole of gastric remnant on its anterior side (Fig. 3), in order to accommodate a 34-Fr orogastric bougie, pushed down at this time by the anesthesiologist. The orogastric bougie was advanced towards the pylorus, permitting us to complete the SG, by stapling the antrum with multiple firings of linear stapler

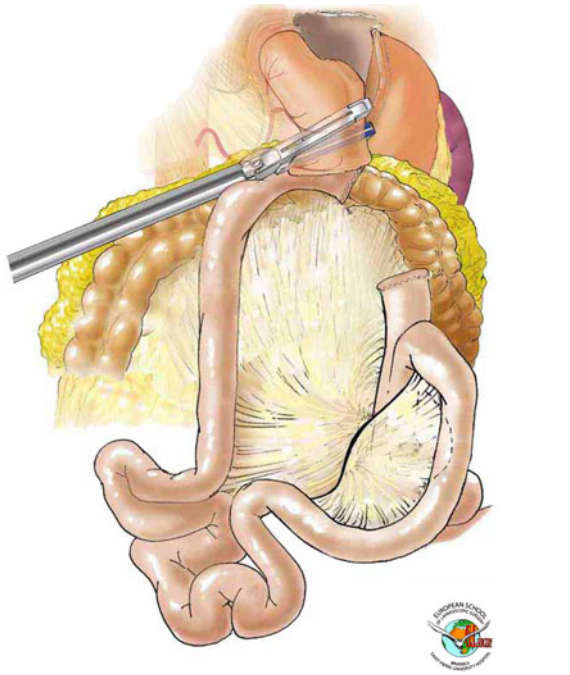

Fig. 1 Dismantling of the previous gastrojejunostomy on the gastric side

green load alongside the tube (Fig. 4). After this step, the continuity of the stomach was established by a manual gastrogastrostomy between the gastric pouch and the gastric remnant, performed by two 1 polydiaxone (PDS) running sutures (Fig. 5). The jejunojejunostomy was localized and the alimentary, biliary and common limbs were identified. The anastomosis was dismantled by firings of linear stapler blue load, in an attempt to duplicate the original staple line and certainly not to impinge on the distal end of the alimentary limb (Fig. 6). A linear stapler white load

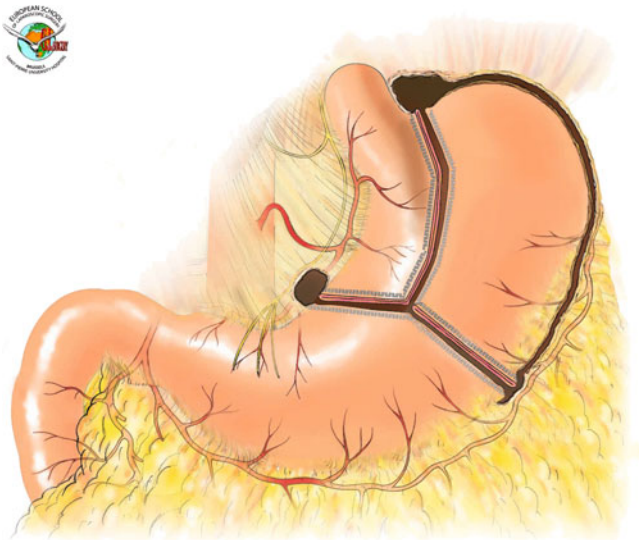

Fig. 2 Fundectomy of the gastric remnant

Fig. 3 Opening of the gastric pouch and gastric remnant to accommodate the orogastric bougie

anastomosed the proximal end of the alimentary limb and the distal end of the biliary limb, and the enterotomy was closed by two 2/0 PDS running sutures. The blind loop of the biliary and alimentary limbs was resected after completion of the new jejunojejunostomy (Fig. 7). The mesenteric window, created at the time of RYGB, was closed using purse string of 1 polypropylene, thereby re-establishing the original anatomy. The gastrointestinal continuity was checked by insufflation of compressed air through the orogastric bougie. Two drains were left in the abdominal cavity near the gastrogastrostomy and the body of the stomach. The specimen was retrieved from the abdomen by

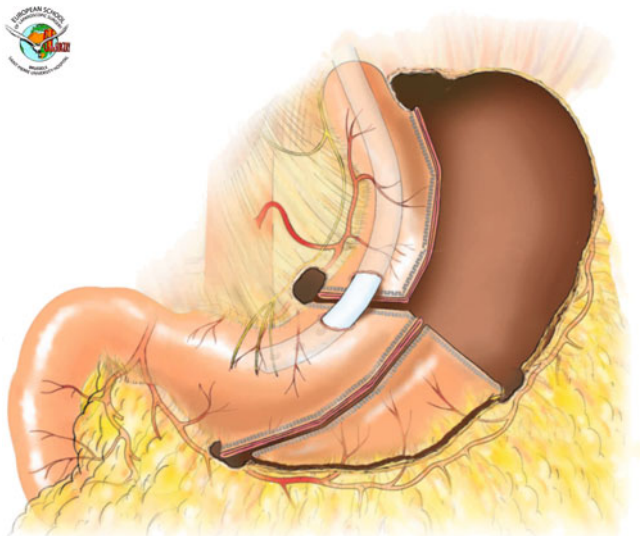

Fig. 4 Resection of the gastric antrum to complete sleeve gastrectomy, after placement of an orogastric bougie and before the restoration of the gastric continuity

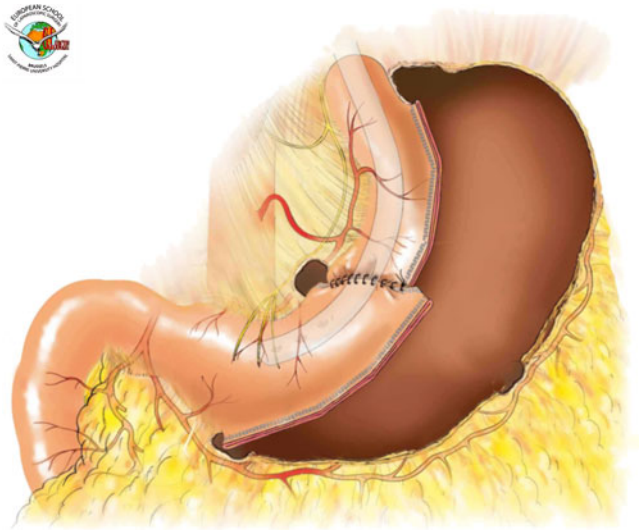

Fig. 5 Restoration of the gastric continuity through a manual gastrogastrostomy between the gastric pouch and the gastric remnant

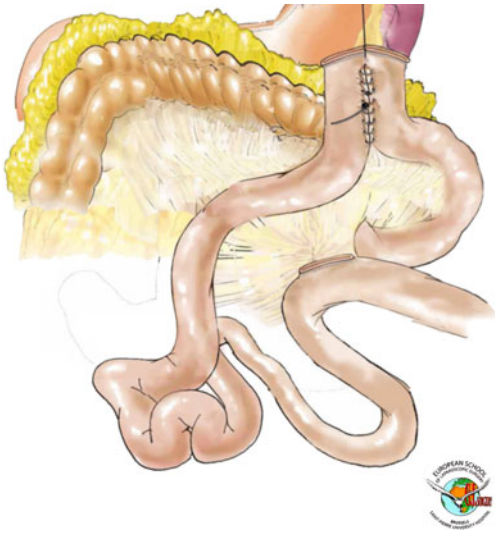

Fig. 7 Restoration of the small bowel continuity through a new jejunojejunostomy, performed between the previous alimentary proximal end and the previous biliary distal end

enlarging the left 12-mm upper quadrant trocar, which was subsequently closed in layers. A methylene blue swallow was realized on the first postoperative day, and if negative a liquid diet was started on the second postoperative day. The patient was discharged on a pureed diet on the fifth postoperative day, and a normal diet was started at the 3rd postoperative month.

Results

The mean operative time was 233.7±46.4 min (195–300). There were no conversions to open surgery and no mortality. In all patients, gastric continuity was fashioned with a manual anastomosis and small bowel continuity with a side-to-side linear mechanical.

One patient (25%) developed a fistula at the site of the gastrogastrostomy. Mean hospital stay was 20.2±17.9 days (5–40).

All patients were followed up by office visits, and after a mean follow-up of 11±12.8 (3–30) months, the mean weight, BMI, %EWL and %EBMIL was 81±12.1 kg (63–90), 30.3±5.1 kg/m^2 (24.5–37), 59.3±31.5% (12.9–82.3) and 42.3±34.5% (6.2–80.7), respectively (Fig. 8). During this follow-up, one patient underwent the second step of DS.

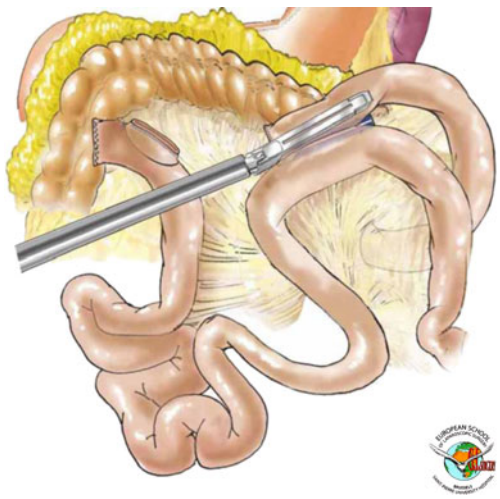

Fig. 6 Dismantling of the previous jejunojejunostomy (more on the biliary limb)

Discussion

Obese patients are strongly encouraged to undergo follow-up by multidisciplinary counseling, involving psychologist, nutritionist and surgeon. In the years after surgery, patients often deny a newly developed eating behaviour. In case of insufficient weight loss or weight regain, the culprit is, more often than not, abuse of sweets. Patients with RYGB consuming large amount of fast carbohydrates can initially be confronted with dumping syndrome, which is considered helpful in an effort to lose weight [11]. This symptom, if at all present, usually disappears with time because of body adjustment. Abuse of sweets can be confirmed in laboratory findings with increased levels of cholesterol, especially LDL cholesterol [12] and nonalcoholic fatty liver disease [13]. Patients with this new behaviour will no be longer deterred from eating sugars, but usually become clinically symptomatic (fatigue, drowsiness, neurologic symptoms). The first treatment for this condition is obviously trying to

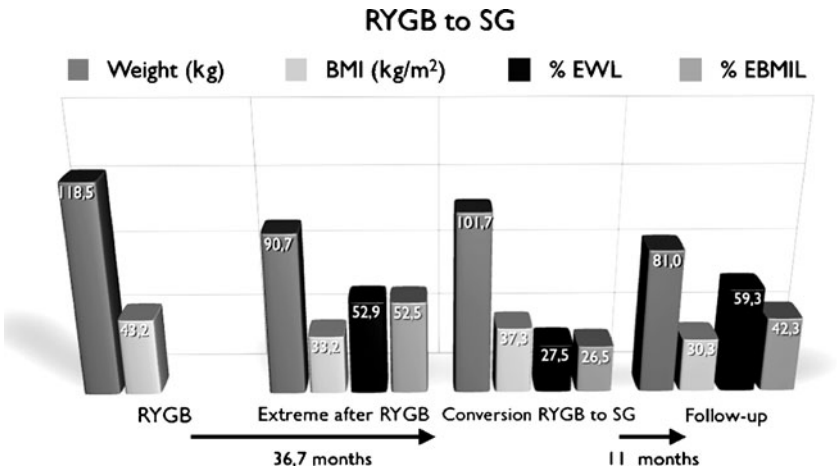

Fig. 8 Comparison of weight, BMI, %EWL, %EBMIL at RYGB, at extreme values before the conversion to SG, at the conversion to SG, and at follow-up (mean values)

correct the unhealthy dietary change, but if these measures do not suffice, medical treatment with insulin-modulating agents like acarbose or glyclaside should be tried. Surgical options are aiming at delaying gastric pouch emptying like placement of the Fobi ring around the gastric pouch [14] or gastric pouch restriction by endolumenal approach [15].

The treatment of sugar consumption-linked symptoms is essential since this behaviour can bring the patients at risk of developing conditions caused by excessive insulin production or improved insulin sensitivity [16]. In extreme cases, this latter condition can lead to symptomatic hyperinsulinemic hypoglycemia [17], or in contrast, because of combustion of insulin stocks, to insulinopenic diabetes. Finally, the hyperinsulinemic status is reported to possibly evolves into beta-cell hyperplasia [18] and even nesidioblastoma [19]. Hence, patients with RYGB presenting insufficient weight loss or weight regain mainly due to a new sweet eating pattern who do not respond to dietary and medical treatment, need to undergo another operation. A valuable option is to convert the procedure of RYGB to a restrictive procedure which does not bypass the duodenum [20, 21].

Symptomatic dumping syndrome without postprandial hypoglycemia needs to be approached differently. This condition has to be treated by dietary efforts in close consultation with a nutritionist, and medical treatment with serotonin antagonists or somatostatin analogs can be attempted. In case of unsuccessful results and/or persisting symptomatic dumping syndrome, surgical procedures aiming at delaying gastric pouch emptying [14, 15] or conversion of RYGB to the original anatomy can be proposed [22]. This latter option is obviously associated to the risk of weight regain, which again can be resolved with the next malabsorptive procedure.

It is our belief that during revision of RYGB to SG, the sequence of the different steps performed for the restoration of the gastric continuity is critical. The gastric pouch and gastrojejunostomy have to be exposed completely, in preparation for the gastrogastrostomy. In order to perform SG satisfactorily, the gastric remnant needs be resected at the level of the fundus and body, as well as at the antrum after the placement of the orogastric bougie towards the pylorus. These steps allow performing a narrow SG, similar to SG performed as a primary bariatric procedure. We prefer to fashion the gastrogastrostomy manually, because linear anastomosis can be difficult when the size of the pouch is small, and circular anastomosis can be complicated by stenosis as reported in 25% of patients [23].

Early complications such as fistula and stenosis at the gastrogastrostomy due to ischemia, remain a constant worry. One of our patients developed a gastric fistula, probably related to poor vascularization of the gastric pouch. Hence, it is mandatory to maximally preserve the upper branches of the left gastric artery at the cranial part of the lesser curve. Our patient developed a low output leak, and with consequent conservative treatment, healing was achieved after 40 days. In case of high output leak, the preferred treatment would have been placement of endoscopic stent [24]. However in case of unstable and septic patients, laparoscopic lavage and drainage will be required. In contrast to Parikh et al. [23], we did not record complications as stenosis during follow-up in this selected series of patients.

Hospital stay for our patients is longer than reported elsewhere [23], which reflects early complications like gastric fistula in one of our patients.

Operative time obviously depends on the time spent to perform the necessary adhesiolysis in the different steps of the resection of the gastric remnant and the restoration of gastric continuity. In case of too dense adhesions, a conversion to open surgery may be preferable [23]. Small bowel restoration appears to demand significantly less time than the other steps. This can explain why our mean

operative time approaches more the 255 min reported in one-step DS, than the total of 303 min achieved in the two-step DS [23].

In this limited series of patients, substantial weight loss followed the conversion to SG. This is most likely due to the enhanced gastric restriction. In our four patients we recorded, in the same mean follow-up time of 11 months, a mean %EWL of 59.3%. This is higher than the 57.4% reported in the four patients who underwent two-step DS, but lower than the 68.7% reported in six patients who underwent one-step DS [23].

It is our policy to perform the conversion of RYGB to DS in two steps, not only to reduce morbidity and mortality [25, 26], but also because we adhere to the Scopinaro's principle of not combining restriction and malabsorption at the same time [27, 28].

During follow-up, one of our patients (25%) already has benefited from the second step of DS. After a follow-up of 14 months after DS, the patient experienced a weight loss of 20 kg, and a BMI decrease to 27.3 kg/m^2. Obviously, the increased weight loss with DS is related to the malabsorptive process, which is more important than with RYGB [29, 30].

In conclusion, laparoscopic conversion of RYGB to SG is feasible and safe. The appearance of gastric fistula is a definite risk. Weight loss is increased, which leaves the patients in better conditions to undergo the second step of DS.

Disclosures The authors have no commercial associations that might pose a conflict of interest in relation to this article.

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