

# Conversion from Sleeve Gastrectomy to Roux-en-Y Gastric Bypass—Indications and Outcome

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## Abstract

**Background** Due to excellent weight loss success in the short-time follow-up, sleeve gastrectomy (SG) has gained popularity as sole and definitive bariatric procedure. In the long-term follow-up, weight loss failure and intractable severe reflux can necessitate further surgical intervention.

**Methods** A retrospective analysis of laparoscopic conversions from SG to Roux-en-Y gastric bypass (RYGB) was performed to assess the efficacy for reflux relief and weight loss success.

**Results** A total of eight out of 73 patients (11%) underwent conversion to RYGB for severe reflux ( $n=3$ ) or weight regain ( $n=5$ ) after a median interval of 33 months following laparoscopic sleeve gastrectomy. In one of the patients, a banded gastric bypass was performed. In both groups, conversion to RYGB was successful, as proton pump inhibitor medication could be discontinued in all patients presenting with severe reflux, and a significant weight loss could be achieved in the patients with weight regain within a median follow-up of 33 months. Postoperative complications were observed in only one patient as leakage at the gastrojejunostomy was successfully treated by temporary stent placement.

**Conclusion** Conversion to RYGB is an effective treatment for weight regain or intractable reflux symptoms following SG. Thus, SG can be performed, intended as sole and definitive bariatric intervention, with conversion from SG to RYGB as an exit strategy for these complications.

**Keywords** Sleeve gastrectomy · Conversion · Gastric bypass · Weight regain · Reflux

## Introduction

Sleeve gastrectomy (SG) as sole bariatric procedure was introduced as first step intervention in a two-step approach in high-risk [1, 2] or super-obese [3] patients. With excellent short-term results for weight loss [4–6], SG has gained enormous popularity in the bariatric world. Nowadays, SG is performed not only in super-obese but also in morbidly obese patients as sole and definitive weight loss intervention [7, 8]. As presented by Buchwald et al. [9], SG represented 5.3% of all bariatric procedures performed worldwide in 2008.

Weight regain is observed in all bariatric procedures, with restriction as the main weight loss mechanism like laparoscopic adjustable gastric banding (LAGB) [10, 11], vertical banded gastroplasty (VBG) [12] or even Roux-en-Y gastric bypass (RYGB) [13–15], combining restriction with mild malabsorption. As SG is seen as a restrictive procedure, some weight regain is also to be expected in the longer follow-up. Besides re-sizing the gastric sleeve as “re-sleeve gastrectomy” [16, 17], conversion to Roux-en-Y gastric bypass [18], or the completion of the biliopancreatic diversion with duodenal switch [19, 20] can be performed as second step procedure to re-induce weight loss.

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As described by Himpens et al. [21], severe symptoms of gastroesophageal reflux disease (GERD) [22] can be a consequence of SG, as a narrow gastric tube is formed and the angle of His as part of the anti-reflux barrier between the stomach and the lower esophagus is resolved. As a high dosage therapy of proton pump inhibitor (PPI) medication (e.g., esomeprazole magnesium or pantoprazole 40 mg twice daily) might not achieve sufficient relief of GERD symptoms in all of the patients, conversion to RYGB can serve as definitive surgical intervention in these cases.

Aim of this retrospective study was to assess the efficacy of laparoscopic conversion to Roux-en-Y gastric bypass (RYGB) in patients who underwent SG as sole and definitive bariatric procedure, but presented with weight loss failure or intractable severe reflux in the long-term follow-up.

## Materials and Methods

From December 2002 to September 2009, a total of 73 patients underwent laparoscopic sleeve gastrectomy intended as sole and definitive bariatric procedure at the Department of Surgery of the Medical University of Vienna. Of these patients, a total of eight (11%) were converted laparoscopically to Roux-en-Y gastric bypass due to severe reflux (group A,  $n=3$ ) or weight regain (group B,  $n=5$ ). Demographic data of the study population is listed in Table 1, including one patient with Prader–Willi syndrome. Patient selection was limited to high-volume eaters excluding patients with reflux symptoms or sweet eaters. SG was performed according to the standardised technique described previously [23, 24].

Mean interval from SG to the conversion was 33 months (range, 15–70 months) for all patients, with patients converted after 15, 33, and 70 months for reflux and after 24, 31, 32, 54, and 63 for weight regain. Weight loss was different comparing both groups, as a mean excess weight loss (EWL) of  $67\pm 31\%$  (range, 36–98%) was achieved by patients of group A, compared to a mean EWL of group B of  $15\pm 35\%$  (range, –27–63%) including weight regain.

Before conversion, all patients underwent routine gastroscopy. Furthermore, in patients suffering from severe reflux, pH-metry was performed to quantify and confirm reflux as indication for surgery. Patients presenting with weight regain underwent double-contrast upper GI series to assess the incidence of gastric sleeve dilation.

### Surgical Technique

Conversion from SG to RYGB was performed laparoscopically using a five-trocar technique similar to primary RYGB. Using the Ultracision™ device (Ethicon Endo-

surgery Inc.), adhesions between the gastric sleeve and the liver were dissected. Thereafter, the jejunio-jejunostomy was established using a linear stapler (EndoGIA™, Auto-Suture, Covidien) with a white cartridge (2.5 mm stapler) resulting in a bilio-pancreatic limb of approximately 80 cm and an alimentary limb of approximately 150 cm. Similar to primary RYGB, horizontal stapling of the stomach was performed approximately 6 cm distal to the gastroesophageal junction using a green cartridge (4.8 mm staples), forming a narrow pouch. Additionally, vertical stapling for sleeve resizing was necessitated in only two patients, using a 36-Fr bougie for pouch calibration. The gastric remnant was not resected. The gastrojejunostomy (GJS) was performed in a circular stapled fashion in seven patients; in one patient, a linear GJS was established. In one patient, conversion to a banded gastric bypass was performed, using the A.M.I. soft gastric bypass band [25] (A.M.I. Feldkirch, Austria) with a 36-Fr bougie for individual band diameter adjustment.

Weight loss is expressed as percent EWL based on the Metropolitan Life Table [26]. Weight regain as indication for surgical revision was defined as an increase in body weight of more than 10 kg from the nadir. Indication for conversion from SG to RYGB due to intractable reflux was defined as the insufficiency of high-dosage PPI medication to achieve adequate symptoms relief. Two of the three patients with reflux as indication for conversion to RYGB also presented with some weight regain, but in these cases, reflux and not weight regain was the leading symptom for surgery.

## Results

The mean total operative time of laparoscopic conversion from SG to RYGB was 169 min (range, 90–300 min); no conversions to open surgery were performed. Postoperative complications were limited to one leak at the gastrojejunostomy, successfully treated by temporary placement of a self-expanding silicone stent (Polyflex™, Boston Scientific).

### Reflux

The three patients with reflux as indication for surgery were on high-dosage PPI medication without achieving sufficient relief of GERD symptoms. In all patients, preoperative pH-metry confirmed severe reflux as indication for surgery. Postoperatively, all patients experienced a profound and immediate relief of reflux symptoms and were able to stop PPI medication. No recurrence of reflux symptoms was observed for a mean follow-up of 14 months so far. In two of these three patients, a minor weight regain of 8 and

12 kg from nadir was observed before conversion to RYGB. After surgery, weight loss for these two patients was 5 and 14 kg at 2 and 14 months, respectively.

### Weight Regain

The five patients who underwent conversion to RYGBP for weight regain achieved a mean primary reduction in body weight of  $32 \pm 14$  kg (range, 17–47 kg) but regained weight in an extent of mean  $22 \pm 10$  kg thereafter (range, 16–36 kg; Table 1). In none of these patients, significant sleeve dilation was found in the preoperative double-contrast swallow. After conversion to RYGB, a mean weight reduction of  $15.2 \pm 8.0$  kg (range, 6–25 kg) was achieved within a follow-up from 1 to 52 months, resulting in significant weight loss success (Table 2).

### Discussion

We report on indications and outcome of the first series of laparoscopic conversion from laparoscopic sleeve gastrectomy to RYGB due to weight loss failure or severe gastroesophageal reflux. In all patients suffering from reflux, the establishment of a gastric bypass led to a complete relief of the GERD symptoms, as PPI medication could be discontinued. For patients presenting with significant weight regain after SG as sole bariatric procedure, a weight loss of 6 kg or more could be achieved by conversion to RYGB. Thus, conversion from SG to RYGB was highly effective in these both indications.

For all bariatric procedures that are exclusively based on restriction as LAGB [10, 11] or VBG [12], some weight regain is observed in the longer follow-up. Also for RYGB,

as based on a combination of restriction and mild malabsorption, the same observations are described [13–15]. Thus, weight regain has to be expected also after SG, but no detailed data focusing on this topic has been presented so far.

As introduced by Regan et al. [3] in 2003, sleeve gastrectomy can serve as a first-step bariatric procedure in a two-step approach. He performed SG in seven super–super obese patients, followed by conversion to RYGB at a mean interval of 11 months after a mean weight loss of 37 kg corresponding to a mean EWL of 33%. Different to our series, the second step was initially planned.

Beside super–super obesity, high operative risk was seen as primary indication for SG [2, 27, 28]. Nowadays, many bariatric centers perform SG as sole and definitive bariatric procedure not only in these selected patients but also in the morbidly obese with average operative risk. Weight loss was described by %EWL of approximately 60% for the first 2 years following SG [4, 5, 29–32], which might partly be explained by the reduction of plasma ghrelin levels [23, 33, 34], contributing to the reduction in the sensation of hunger [31, 34, 35].

As a second-step procedure is not primarily scheduled after the primary weight loss, some patients will present with significant weight regain in the longer follow-up. For weight loss failure in laparoscopic adjustable gastric banding, conversion to RYGB and not re-banding was recommended by Weber et al. [10] This corresponds to the results of Gagner et al. [36], among others [37, 38], also advocating conversion to RYGB in LAGB failure. Also for weight loss failure in VBG, conversion to RYGB is seen as a procedure of choice [19].

Recently, the placement of an adjustable band has been reported for weight loss failure after SG [39]. In this case, a

**Table 1** Demographic data of eight patients, who were converted from laparoscopic sleeve gastrectomy (SG) to Roux-en-Y gastric bypass due to reflux ( $n=3$ ) or weight regain ( $n=5$ )

Sex	Age (years)	BMI (kg/m <sup>2</sup> )	Body weight (kg)	Indication for conversion	Weight regain <sup>b</sup> (kg)
F	39	41.5	120	Reflux	–
F	29	41.0	120	Reflux	8 <sup>c</sup>
F	37	47.6	110	Reflux	12 <sup>c</sup>
M	52	44.8	167	Weight regain	16
M	34	48.5	157	Weight regain	36
M <sup>a</sup>	15	40.0	100	Weight regain	18
F	55	39.8	115	Weight regain	13
M	25	72.3	214	Weight regain	17

Age, BMI, and body weight at time of SG

<sup>a</sup> Patient with Prader–Willi syndrome

<sup>b</sup> From nadir

<sup>c</sup> Reflux was the leading symptom for conversion to RYGB

**Table 2** Data on indications and weight loss outcome for laparoscopic conversion from Sleeve gastrectomy (SG) to Roux-en-Y gastric bypass (RYGB)

Weight SG (kg)	Nadir Weight (kg)	Weight RYGB (kg)	EWL (%)	Interval SG-RYGB (months)	Weight loss <sup>a</sup> (kg)	Follow-up (months)
Reflux						
120	65	65	98	15	10	62
120	95	103	36	70	14	2
110	65	77	63	33	5	14
Weight regain						
167	130	146	28	54	17	24
157	140	178	-27	24	20	52
100	82	104	-10	31	25	42
115	75	88	63	36	6	7
214	167	184	21	32	8	1

<sup>a</sup> Weight loss starting from conversion to gastric bypass

Lap-Band™ (Allergan, Irvine, CA, USA) was placed in the standard pars-flaccida technique, as an EWL of only 16% was achieved after SG performed over a 60-Fr bougie. Within 9 months, the patients lost 78 lb of weight, corresponding to an EWL of 57%.

One limitation of the conversion from SG to RYGB might be the possibility of weight regain, which is described even after primary RYGB [13–15]. “Weight regainers” after SG might even turn out to be “weight regainers” after conversion to RYGB in the longer follow-up.

Banded gastric bypass was found to be more efficient in terms of weight loss compared to non-banded gastric bypass [40]. Thus, conversion to banded gastric bypass might be more effective to prevent weight regain in the longer follow-up in patients presenting with weight loss failure after SG.

To avoid weight regain after SG, a band can also be placed in SG performed as “primary banded sleeve gastrectomy” [41], as published by Alexander et al. In this series of 27 patients, a band of 6 cm length made of biological tissue (AlloDerm®) was placed approximately 6 cm below the gastroesophageal junction. After 1 year, BMI was reduced from 49.6 to 31.6 kg/m<sup>2</sup>.

Weiner et al. [42] found the volume of the removed stomach as a predictor for weight loss failure, observing a higher incidence of weight regain in patients with <500 cc of the stomach resected. In our series, none of the five patients presenting with weight regain had <680 cc of the stomach removed. Thus, other factors beside the volume of the resected stomach might also contribute to weight regain after SG.

Besides weight regain, also severe reflux is observed in some SG patients. Himpens et al. [21] described a high rate of PPI medication limited to the short term following SG

and reported a reduction of PPI medication in the longer follow-up when comparing laparoscopic SG and LAGB. Different to these findings, we observed a high rate of permanent PPI medication following SG. In a limited number of patients, reflux symptoms did not improve even to high-dosage PPI medication sufficiently, thus necessitating a definitive surgical intervention.

As observed in LAGB, any inhibition of the food passage through the stomach can lead to “stase” reflux. This might explain the high incidence of clinical relevant reflux in the LAGB patients in the series published by Himpens et al. [21] in the longer follow-up. Similar to these findings, strictures of the gastric sleeve, which have been reported to occur within an incidence of <1% [43], could lead to severe reflux in SG. In our series, no strictures of the gastric sleeve were observed, confirmed by gastroscopy performed before conversion to RYGBP.

In 2006, we reported on a patient who underwent conversion from SG to RYGB due to severe reflux symptoms after an interval of 15 months [24]. With an EWL of 98%, LSG was successful for weight loss, but high dosage of PPI medication was not able to relief from reflux. After conversion to RYGB, the patient was able to stop PPI medication immediately, and for a long-term follow-up of 6 years so far, she never experienced reflux symptoms. Also the other two patients, who had to be converted to RYGBP for severe reflux, were able to stop PPI medication definitively.

In Crohn’s disease, SG and not RYGB is recommended as bariatric procedure of choice [44]. Therefore, we performed SG in a morbidly obese patient with Crohn’s disease. Unfortunately, she presented with intractable reflux and a weight regain of 12 kg postoperatively. To rule out strictures of the small bowel, we included

computer tomography enteroclysis into the preoperative workup and performed laparoscopic conversion to RYGB, leading to an immediate relief of the reflux symptoms in this patient.

No recommendations for the treatment of reflux or weight regain following SG have been published so far. Laparoscopic conversion from SG to RYGB is technically simple, safe, and effective for re-inducing weight loss and for treatment of severe reflux after SG. In case of weight loss failure without clinically significant reflux, completion to duodenal switch can also be recommended.

**Conflict of interest** Gerhard Prager has two educational grants: one from Johnson & Johnson and one from Covidien. The other authors have no conflict of interest.

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