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# Indications, safety, and feasibility of conversion of failed bariatric surgery to Roux-en-Y gastric bypass: a retrospective comparative study with primary laparoscopic Roux-en-Y gastric bypass

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**Abstract**
*Background* Roux-en-Y gastric bypass (RYGB) is considered the "gold standard" revision procedure. The purpose of this study was to compare the surgical outcome of primary laparoscopic RYGB (pLRYGB) to revisional open or laparoscopic Roux-en-Y gastric bypass surgery (rRYGB).
*Methods* A retrospective analysis of all patients who underwent pLRYGB or rRYGB from January 2003 to December 2009 has been performed. Demographics, indications for revision, and complications have been reviewed. The rRYGB and pLRYGB patients have been compared.
*Results* Seventy-two patients underwent rRYGB, and 652 patients underwent pLRYGB. Mean follow-up was 35 and 45 months, respectively. Fifty-six rRYGB procedures were performed laparoscopically. The primary operations had consisted of laparoscopic gastric banding ($n = 28$), laparoscopic vertical banded gastroplasty ($n = 19$), laparoscopic sleeve gastrectomy ($n = 6$), laparoscopic RYGB ($n = 3$), and biliopancreatic diversion with duodenal switch ($n = 16$). Indications included weight regain ($n = 29$), malabsorption ($n = 16$), gastrogastric fistula ($n = 5$), band-associated problems ($n = 3$), and refractory stomal ulceration ($n = 1$). There was no significant difference in early or late postoperative complications when comparing rRYGB to pLRYGBP patients (11.1% vs. 5.52%, $P = 0.069$ and 19.4% vs. 24.2%, $P = 0.465$ respectively). Five rRYGB patients (7.04%) required reintervention (3 internal hernias, 1 ventral hernia, 1 laparoscopic exploration) compared with 101 pLRYGB patients (15.71%; $P = 0.051$). None of the patients died. Mean hospital stay was not significantly longer in the rRYGB group (5.38 vs. 4.95 days, $P = 0.058$).
*Conclusions* In our series, hospital stay, morbidity, and mortality of rRYGB were not significantly higher compared with pLRYGB. Furthermore, we believe that this type of revisional bariatric surgery should be performed in high-volume bariatric centers.

**Keywords** Bariatric surgery · Roux-en-Y gastric bypass · Reoperation

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The negative effects of overweight and obesity are well-known. A recent review, published by Guh et al. [1], found statistically significant associations between obesity and the incidence of type II diabetes, six different types of cancer, cardiovascular diseases (including arterial hypertension, coronary artery disease, congestive heart failure, pulmonary embolisms, and stroke), asthma, gallbladder disease, osteoarthritis, and chronic back pain.

Nonsurgical treatment is an ineffective measure for sustained weight loss [2]. Surgery is effective to reduce both obesity and its comorbidities [3], but the type of (revisional) surgery needed is still a matter of much debate.

In the 1960s and 1970s, the jejuno ileal bypass (JIB) with the Payne [4] or Scott [5] modification was widely performed. This technique was based on the weight gain problems observed in patients with shortened gut but was abandoned due to important morbidity and mortality [6].

In 1967, Mason and Ito [7] described the first gastric bypass, introducing a restrictive component. During the

1970s and 1980s, pure restrictive procedures [adjustable gastric banding (AGB), gastroplasty] gained wide acceptance because of their technical simplicity and lack of metabolic complications. In 1976, Scopinaro [8] published the biliopancreatic diversion (BPD), tackling the problems of the JIB by minimizing the side effects but preserving the benefits. In the 1990s, there was a revival of the gastric bypass with various modifications [banded gastric bypass, distal Roux-en-Y gastric bypass (RYGB)], the BPD was modified giving birth to the duodenal switch (DS) and the gastric sleeve gained wide acceptance as restrictive procedure [9].

A lot of these procedures are still being performed, both open, but mainly laparoscopic. It is clear that this great variety of procedures implicates that not one procedure is the "holy grail" for all obese patients. Bariatric surgery is becoming more and more prevalent, and the number of patients asking for a solution for weight regain or intolerable side effects is going to increase. The question is what surgery can do for these patients. Do we have remedial procedures that can tackle the side effects and reduce weight, but above all, can we perform these procedures in a safe way?

Due to the increasing demand for revisional bariatric surgery in our service, we wanted to compare the surgical outcome of our revisional Roux-en-Y gastric bypass (rRYGB) procedures with our primary laparoscopic Roux-en-Y gastric bypass (pLRYGB) procedures and literature to illustrate that conversion to RYGB is achievable and safe.

## Materials and methods

### Demographics

A retrospective database of all gastric bypasses performed between January 1, 2003 and December 1, 2009 at the Groeninge Hospital, Kortrijk, Belgium, has been obtained. Of the 724 recorded bypasses, 72 were rRYGB procedures. In the primary group, there were 462 females with mean age at surgery of 38.6 ± 11 years and mean BMI of 42.8 ± 4.9 kg/m$^2$. A hundred and ninety were male with mean age of 42.8 ± 4.9 years and mean BMI of 42.6 ± 5.1 kg/m$^2$. In the revisional group, 61 were female with mean age at surgery of 41 ± 10.6 years and mean BMI of 37.7 ± 7.9 kg/m$^2$. Eleven were male with mean age of 42.5 ± 10.7 years and mean BMI of 43.6 ± 8.6 kg/m$^2$. Mean follow-up was 45 and 35 months respectively for the primary and revisional group.

Statistical analysis of preoperative comorbidities (including presence of dyspnea, thyroid disease, arthrosis, sleeping apnea, diabetes, dyslipidemia, cardiovascular pathology, arterial hypertension, pulmonary disease, and psychiatric disorders) showed only a significant difference for psychiatric and pulmonary disease, which was more frequent in the redo group ($P < 0.05$).

### Surgery

All patients underwent the same preoperative analysis consisting of psychological, dietary psychiatrical, endocrinological, gastroenterological, and cardiopulmonary evaluation. If *Helicobacter pylori* was found on gastroscopic biopsy, eradication was started and surgery was postponed. Two to 3 weeks before surgery, patients were put on a diet to reduce liver size.

After removal of any residual restriction (inflatable or plastic band), the angle of Hiss is dissected. The lesser sac is opened by creating a window on the lesser curvature below the second gastric vein (approximately 4 cm below the gastroesophageal junction). A 20–30 cm$^2$ gastric pouch is created using gold (3.8 mm) or green (4.1 mm) Echelon staplers (Ethicon, J&J). One 45-mm linear stapler is fired horizontally and two or three 60-mm-linear staplers are fired vertically (not necessary in case of previous sleeve). After dividing the omentum, an antecolic end to side gastrojejunostomy is created using a 25-mm circular stapler with orally introduced anvil (PCEEA, Tyco, USSC, Norwalk, CT). The anastomosis is oversewn with separated stitches of PDS 2/0. Continuity is restored using a side to side jejunojejunal anastomosis at 150 cm (white Echelon stapler 2.5-mm Ethicon J&J). Separated PDS 2/0 stitches are used for closure of the enterotomy. The cut omega technique is completed by transecting the small-bowel remnant between the gastrojejunostomy and the jejunojejunostomy using white Echelon staplers. A bubble test is performed to check the proximal anastomosis. Mesenteric and Petersen's defect are not closed.

If the first bariatric procedure was a (banded) gastric bypass, only reconstruction of the proximal anastomosis was performed. For Scopinaro procedures, conversion was performed through laparotomy and normal anatomy was restored before creating the gastric bypass.

A normal postoperative course consists of no food on Day 1, restricted water consumption (20 cc/24 h) on Day 2, normal water consumption on Day 3, and discharge on Day 4 after eating mashed foods. Upper gastrointestinal examinations were performed if there was a clinical suspicion of leakage.

### Follow-up

All patients had the same follow-up protocol at the outpatient bariatric clinic, all returning 1, 3, 6, and 12 months after surgery followed by an annual visit.

### Statistics

Demographic characteristics, preoperative condition, surgical details, morbidity, and mortality of the primary gastric bypass group ($n = 652$) were compared with the results of the redo bypass group ($n = 72$). Statistical analysis was performed using a Fisher exact test, and $P < 0.05$ was considered significant. If other tests were used, this is mentioned in the article.

## Results

Between January 1, 2003 and December 1, 2009, 72 patients underwent conversion to RYGB. The primary operations had consisted of laparoscopic AGB ($n = 28$), laparoscopic vertical banded gastroplasty ($n = 19$), laparoscopic SG ($n = 6$), laparoscopic RYGB ($n = 3$), and BPD with DS ($n = 16$). Indications for conversion are illustrated in Table 1 and included weight regain ($n = 29$), malabsorption ($n = 16$), gastrogastric fistula ($n = 5$), band-associated problems ($n = 3$), and refractory stomal ulceration ($n = 1$). The 16 patients with previous Scopinaro procedure underwent open conversion. All other cases were tackled laparoscopically.

### Peroperative problems

Peroperative complications occurred in 8 of 72 patients (11.11%), which is significantly more ($P = 0.005$) than the 21 of 652 (3.22%) in the primary group. There were two serosal tears, three important bleedings, one stapler dehiscence when creating the stomach pouch. Two surgical reports described problems with the insertion of the anvil. All of the problems could be resolved laparoscopically, so no conversion was needed in the laparoscopic group. There were no peroperative problems in the open group. Mean length of stay in the revisional group was 5.375 ± 1.64 days and 4.95 ± 2.72 days in the primary group ($P = 0.0579$). Statistically on the borderline was not significant.

### Early complications

During the early postoperative phase (<30 days postoperative), 8 patients (11.11%) experienced 10 problems (Table 2) in the revisional group as opposed to 36 (5.52%) patients with 41 problems in the primary group. There was

**Table 2** Early and late postoperative surgical complications

| Postoperative complications | Sec | Prim | *P* |
|---|---|---|---|
| Early (<30 days) | | | |
| Leakage gastrojejunostomy | 0 (0%) | 5 (0.77%) | 1 |
| Intra-abdominal abscess | 0 (0%) | 1 (0.15%) | 1 |
| Incarcerated port site hernia | 0 (0%) | 2 (0.31%) | 1 |
| Internal hernia | 0 (0%) | 1 (0.15%) | 1 |
| Marginal ulcer | 1 (1.39%) | 4 (0.61%) | 0.4086 |
| Port site infection | 6 (8.33%) | 20 (3.07%) | 0.036 |
| Bleeding | 3 (4.17%) | 8 (1.23%) | 0.0869 |
| Total patients | 8/72 (11.11%) | 36/652 (5.52%) | 0.0687 |
| Total complications | 10 | 41 | – |
| Late (>30 days) | | | |
| Intra-abdominal abscess | 0 (0%) | 2 (0.31%) | 1 |
| Perforation | 0 (0%) | 9 (1.38%) | 1 |
| Gastrogastric fistula | 0 (0%) | 3 (0.46%) | 1 |
| Port site hernia | 2 (2.78%) | 14 (2.15%) | 0.6678 |
| Obstruction (adhesions) | 1 (1.39%) | 14 (2.15%) | 1 |
| Erosion GJ stomy | 1 (1.39%) | 7 (1.07%) | 0.5693 |
| Pain with laparoscopy | 1 (1.39%) | 14 (2.15%) | 1 |
| Internal hernia | 3 (4.17%) | 47 (7.21%) | 0.464 |
| Stenosis GJ stomy | 1 (1.39%) | 9 (1.38%) | 1 |
| Marginal ulcer | 6 (8.33%) | 61 (9.36%) | 1 |
| Wound infection | 1 (1.39%) | 3 (0.46%) | 0.3429 |
| Total patients | 14/72 (19.44%) | 158/652 (24.23%) | 0.4654 |
| Total complications | 16 | 183 | – |

**Table 1** Reasons for conversion to RYGB

| Reason conversion | Type specific | Dysphagia/ reflux | Weight gain | GG fistula | Total |
|---|---|---|---|---|---|
| Banding | 3 band problems | 9 | 16 | 0 | 28 (38.9%) |
| Sleeve | 0 | 0 | 6 | 0 | 6 (8.3%) |
| Maclean | 0 | 8 | 7 | 4 | 19 (26.4%) |
| Scopinaro/duodenal switch | 16 malabsorption | 0 | 0 | 0 | 16 (22.2%) |
| Redo GBP | 1 refractory ulcer | 1 | 0 | 1 | 3 (4.2%) |
| Total | 20 (27.8%) | 18 (25%) | 29 (40.3%) | 5 (6.9%) | 72 (100%) |

one marginal ulcer, six port site infections, and three bleedings, but all could be treated conservatively. The port site infections were the only problem that was significantly more frequent in the revisional group ($P = 0.036$), but overall there was no statistical difference ($P = 0.0687$) in the number of patients with early postoperative problems.

### Late complications

Fourteen patients (19.44%) in the revisional group presented with 16 problems as opposed to 158 patients (24.23%) with 183 problems in the primary group. There were no statistical significant differences in the type of complications or number of affected patients (Table 2).

Five (7.04%) patients had six major problems that required surgery in the redo group as opposed to 101 patients (15.71%) in the primary group ($P = 0.0513$, $\chi^2$ test). Indications for surgery included three internal hernias (one with port site hernia and one with gastrojejunal stenosis), one laparoscopic investigation for abdominal pain, and one port site hernia. Nine (12.5%) patients had 10 minor problems in the revisional group as opposed to 65 patients (10.11%) in the primary group. There were six ulcers and one erosion at the level of the gastrojejunostomy, one obstruction due to adhesions (conservative treatment), one wound infection, and one gastrojejunal stenosis. There was no mortality.

## Discussion

Up to now surgery has provided several solutions for obesity. Some of these patients, however, are unsatisfied with the result. Different types of primary surgery lead to different reasons for conversion but, as in our series, weight regain is the most frequent reason for revisional bariatric surgery [10, 11].

Other reasons are more type-specific and include band-associated problems (migration, slipping after gastric banding), gastrogastric fistula (VBG, RYGB), refractory marginal ulceration (RYGB), stricture/stenosis with dysphagia, and/or reflux (AGB, Maclean, RYGB) and malabsorption (Sopinaro, JIB). In our series the most common reason for conversion was weight regain (40.3%) followed by type-specific problems (27.8%), dysphagia/reflux (25%), and gastrogastric fistula (6.9%). It should be noted that a lot of patients have a combination of these complaints. Band migration or slipping leads to dysphagia and gastrogastric fistula often result in weight regain. In our series, we took the most important medical reason as reason for conversion and patients were only subdivided in the fistula group when confirmed with barium swallow.

Different strategies are possible if revisional bariatric surgery is indicated. One would be restoration of normal anatomy. It has been established however that this option will eventually result in important weight regain and recurrence of obesity-related comorbidities [12]. In case of restrictive bariatric surgery, the literature has shown that revisional restrictive procedures seldom offer good results [13, 14]. The choice between conversion to RYGB and Scopinaro is less obvious. Gumbs et al. [15] suggested that conversion to Scopinaro is the way to go for failed restrictive procedures. Topart et al. [16] have shown that conversion to duodenal switch has a higher morbidity and operating time. So they, like others [17, 26], prefer conversion to RYGB, which also is our remedial surgery of choice.

More and more authors are publishing their experiences with open and laparoscopic revisional surgery. This has led to a great variety in types of articles. The overall conclusion is that revisional surgery has a higher complexity and is technically more demanding [12, 16–19], implicating that the risk-benefit ratio for revisional bariatric surgery is higher than when primary surgery is performed. In our series, we also encountered a higher frequency of peroperative complications in the revisional group (11.11% vs. 3.22%, $P = 0.005$). No conversion was needed and there was no significant difference in length of stay ($5.375 \pm 1.64$ days vs. $4.95 \pm 2.72$ days, $P = 0.0579$).

Regarding postoperative complications, we did not find significant differences in early or late complications ($P = 0.0687$ and $P = 0.0513$). Even though statistically not significant, it is interesting to point out that there were more patients with late complications in the primary group (24.23%) than patients in the revisional group (19.44%). Main reasons for this striking difference are the fact that follow-up rates differ (45 vs. 35 months) and the high rate of IH (7.21% vs. 4.17%, $P = 0.464$) in the primary group. This difference in IH rate can partially be explained by the fact that IH sites were closed when open revision was performed (16 Scopinaro procedures: 3 IH/(72–16) = 5.4%<>4.17%).

This also implicates that we can achieve an important reduction in late postoperative complications (47/183 or 25.68% of complications in the primary group), because Steele et al. [20] reported no IH in 205 patients with minimal follow-up of 18 months when using an antecolic antegastric gastrojejunostomy with meticulous closure of all mesenteric defects. This has lead to a change in our policy, and nonabsorbable closure of the mesenteric defects is now standard procedure.

A PubMed search using the MESH terms “reoperation gastric bypass” and the terms “revisional gastric bypass” limited to articles published from January 1, 2005 to January 1, 2011 retrieved seven articles that presented conversions of various primary bariatric procedures to RYGB (Table 3).

**Table 3** Results reported in literature from January 1, 2005 to January 1, 2011

| Study | No. of patients (F/M) | Revision BMI (kg/m$^2$) | Conversion | %compl | %reop | † | LOS (days) |
|---|---|---|---|---|---|---|---|
| Sanchez et al. [12] | 30 (23/7) | 40 ± 7.5 | 2/30 (6.6%) | 33.3 | 20 | 0 | 5.1 |
| Khoursheed et al. [21] | 42 (37/5) | 45.15 ± 7.95 | 1/39 (2.6%)* | 14.2 | 9.5 | 0 | 3.36 ± 1.2 |
| Van Dessel et al. [22] | 36 (32/4) | 37.6 and 40.1 | 10/36 (27.8%) | 47 | 5.6** | 0 | NM |
| Cohen et al. [23] | 62 (19/43) | 38.7–41.8 | 0/62 (0%) | 0 | 0% | 0 | 3.21 |
| Morales et al. [24] | 26 (23/3) | 42.8 ± 10.4 | 1/26 (3.8%) | 26.1 | 11.5 | 0 | 6 |
| Zingg et al. [25] | 61 (53/8) | 39.5 ± 6.5 | 0/9 (0%)* | 39.3 | NM | 0 | NM |
| Khaitan et al. [26] | 37 (32/5) | 43.3 ± 9.9 | 10/21 (47.6%)* | NM | 35.1 | 1 | NM |
| Deylgat et al. (Current study) | 72 (61/11) | 37.7 ± 7.9/ 43.6 ± 8.6 | 0/56 (0%)* | 30.55 | 13.9 | 0 | 5.375 ± 1.64 |

*%compl* % Early and late complications, *%reop* % of patients undergoing reoperation during follow-up, *NM* not mentioned in article, *LOS* length of stay

* Only laparoscopic procedures taken into account

** Only early reoperations mentioned

† Mortality

Sanchez et al. [12] reported 30 laparoscopic conversions after AGB or VBG with a conversion rate of 6.6% (2/30). They had an overall complication rate of 33.3% (10/30). There was no mortality and a mean hospital stay of 5.1 days. Khoursheed et al. [21] reported 42 conversions, of which 39 were laparoscopic, after AGB, VBG, or RYGB. There was one (2.6%) conversion in the laparoscopy group, a 14.2% (6/42) complication rate, a 9.5% (4/42) reoperation rate, no mortality, and a mean hospital stay of 3.36 days. Van Dessel et al. [22] reported 36 conversions after VBG, AGB, or GS with a 27.8% (10/36) conversion rate (10/36). There were 11 patients with early complications, 2 of which needed reoperation and 6 with late complications (overall 17/36 or 47%). There was no mortality. Cohen et al. [23] reported 62 conversions after AGB, (non-)banded RYGB, VBG and biliopancreatic diversion with a 100% follow-up ranging from 3–24 months and excellent results (no conversion, no complications, no deaths, mean hospital stay 77 h). Morales et al. [24] reported 26 conversions after RYGB and GS. There was one (3.8%) conversion, and an overall complication rate of 23% (6/26) of which 11.5% (3/26) needed reintervention. Mean length of stay was 6 days without mortality. Zingg et al. [25] reported 61 conversions after AGB, VBG, RYGB, and GS without mortality. Fifty-two procedures were open, and there was an overall morbidity of 39.9% (24/61). Finally, Khaitan et al. [26] reported 37 patients undergoing 39 conversions. Eighteen procedures were performed open. In the laparoscopic group, there were 10 of 21 (47.6%) conversions. They reported five early and eight late major complications (13/37 or 35.1%) with one death (2.7%).

Overall there was only one report with one death. Length of stay varied from 3.21 to 6 days, 0–35.1% of patients needed reoperation, and overall complication rates varied from 0 to 47%. Fortunately, when revisional RYGBP has been performed successfully, positive effects can be expected on weight loss and comorbidities as reported by several [12, 17, 18, 21, 23].

## Conclusions

In our series, hospital stay, morbidity, and mortality of rRYGB were not significantly higher compared with pLRYGB. Furthermore, we believe that this type of revisional bariatric surgery should be performed in high-volume bariatric centers.

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