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ORIGINAL CONTRIBUTIONS

Conversion of both Versions of Vertical Banded Gastroplasty to Laparoscopic Roux-en-Y Gastric Bypass: Analysis of Short-term Outcomes

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Abstract

Background Conversional bariatric surgery has relatively high rates of complications. We aimed to analyze our single-center experience with patients requiring conversional laparoscopic Roux-en-Y gastric bypass (LRYGB) following a failed primary open or laparoscopic vertical banded gastroplasty (OVBG or LVBG, respectively).

Methods The records of patients who underwent LRYGB as a conversional procedure after VBG between November 2004 and December 2017 were reviewed. Characteristics, body mass index (BMI), operation time, intraoperative problems, length of hospitalization, and early (< 30 days) morbidity and mortality were analyzed. Data were expressed as mean ± standard deviation or frequency.

Results A total of 329 patients (81.76% females) who underwent conversional RYGB were included. For the LVBG group (224 patients) and OVBG group (105 patients), respectively, BMI was 34.15 ± 6.38 and 37.79 ± 6.31 kg/m2 ($p < 0.05$), the operation time was 96.00 ± 31.40 and 123.15 ± 40.26 min ($p < 0.05$), hospitalization duration was 2.96 ± 1.13 and 3.20 ± 1.20 days ($p = 0.08$), the early complication rate was 7.14 and 11.43% ($p = 0.19$), and the reoperation rate was 2.23 and 2.86% ($p = 0.73$). There were no major intraoperative problems. Three patients with OVBG were converted to open RYGB (2.86%). There was no mortality.

Conclusion The conversion of OVBG and LVBG to laparoscopic RYGB is technically feasible and provides comparably low early morbidity rates and length of hospitalization. However, compared to LVBG, conversional laparoscopic RYGB following OVBG is technically more challenging and time-consuming, with a slightly higher risk of conversion to open surgery. We support the use of such conversional bariatric surgery in specialized, high-volume bariatric centers.

Keywords Vertical banded gastroplasty · Conversion surgery · Mason procedure · MacLean procedure · RYGB · High-volume center

Introduction

Morbid obesity is a major health problem worldwide and its prevalence has tripled since 1975. In 2016, more than 1.9 billion adults aged 18 years and older were overweight. Of these, over 650 million were obese. Furthermore, most of the world's population lives in countries where being overweight or obese is associated with higher mortality rates than those associated with malnourishment [1]. Currently, only bariatric surgery provides long-term effective treatment and improves quality of life in patients with obesity [2]. As the number of bariatric procedures increases, the number of patients requiring revisional or conversional procedures is also increasing. Vertical banded gastroplasty (VBG) is a restrictive bariatric procedure that used to be popular in the 1980s and 1990s but has fallen out of favor because of associated late complications (i.e., band erosion and stenosis) and insufficient long-term weight loss.

In 1982, Mason described the open VBG (OVBG) for the first time as a purely restrictive procedure [3]. Specifically, OVBG was performed via midline laparotomy and creating

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a window through both walls of the stomach just above the crow's foot, which allowed the application of staples up to the angle of His to create a tiny pouch (< 50 mL). The stomach was stapled but not transected, resulting in a 65% long-term staple line failure rate (gastro-gastric fistula) [4, 5]. A neo-pylorus was constructed with a polypropylene mesh collar that was sutured to itself but not to the stomach [6]. MacLean revised the procedure and performed it laparoscopically (LVBG) with complete transection of the stomach and using a more inert small silastic ring instead of a mesh [7]. This approach significantly reduced the risk of staple line failure and formation of gastro-gastric fistulas. The development and widespread adoption of laparoscopic surgery led the LVBG to become an easy-to-perform, less invasive, safe, and effective restrictive option in bariatric surgery [8]. However, long-term gastric outlet obstruction and weight regain persisted in a high number of patients [9]. Vomiting, dysphagia, or reflux symptoms could not be managed via medical treatment. Over time, these symptoms affected the patients' eating habits and encouraged the adoption of a high-caloric liquid diet, which passes easily through the narrowed neo-pylorus junction, resulting in weight regain. In fact, many studies have documented that more than half of VBG patients (21–65%) ultimately require a revisional and/or conversional procedure [4, 5, 10–14].

The preferred conversional bariatric procedure after failed restrictive options including VBG is the Roux-en-Y gastric bypass (RYGB) [15–19], which has been described as the most effective surgical option in achieving substantial and sustainable weight loss, resolving gastric outlet obstruction, and improving obesity-related comorbidities. According to the guidelines of the American Society for Metabolic and Bariatric Surgery, RYGB is still considered as the gold standard in bariatric surgery [20].

Previous studies have evaluated the outcome of RYGB as a conversional procedure after failed VBG. However, very few included a substantial number of patients or focused on the technical issues related to the surgical procedure itself. Therefore, the aim of the present single-center study of 329 patients was to investigate and to compare in detail the outcomes of OVBG and LVBG conversion to LRYGB. To our knowledge, the present study investigated the largest cohort of VBG patients converted to LRYGB and described so far in the published literature.

Materials and Methods

Study Design and Preoperative Work-Up

The Obesity Surgery Center of AZ Sint-Jan Hospital in Brugge (Belgium) is a high-volume referral unit, performing over 1400 bariatric procedures a year. Of these, 20% are conversional cases that previously underwent restrictive or primarily restrictive procedures such as gastric banding, VBG, and gastric sleeve [21]. During the period from November 2004 to December 2017, 13,065 patients had RYGB at our center, either as a primary surgery or as a conversional procedure. Of these, 329 patients underwent conversional LRYGB for failed VBG (either OVBG or LVBG) performed at our center or at another institution. The records of these patients were collected and retrospectively analyzed. Demographic data, operation time, intraoperative details, length of hospitalization, 30-day follow-up data collected at the outpatient unit, and mortality data were obtained. The failure of the previous VBG in terms of weight evolution was defined as less than 50% excess weight loss, as described by Reinhold [22]. In terms of complications, failure was defined as the patient vomiting three or more times a day or experiencing symptoms of dysphagia and reflux.

As part of the preoperative evaluation, all patients underwent upper gastrointestinal endoscopy with *Helicobacter pylori* testing and, if necessary, eradication, as well as upper gastrointestinal contrast studies. The aim of these studies was to evaluate the altered gastric anatomy, to locate a stricture or kinking at the level of the ring/mesh, to determine the pouch construction/size, and to exclude a gastro-gastric fistula. Detailed dietary history was obtained by a bariatric dietician in all cases, and patients were required to keep food logs for review. Assessment by the multidisciplinary team was carried out prior to each operation and the conversional procedure was performed upon their approval.

Surgical Procedure

All procedures were started laparoscopically after induction and intubation with a 34-French orogastric tube and antibiotic prophylaxis. The patient was placed in a 30° reverse Trendelenburg beach-chair position with split-legs. Pneumoperitoneum was established after Veress needle insertion. The procedure began with perigastric adhesiolysis using sharp scissors and ultrasonic shears. This part of the operation was often time-consuming in patients who had received OVBG. The ring or mesh could be identified in all cases unless they had been removed or cut previously. The silastic ring was removed if it was easily accessible; however, no effort was made to remove the polypropylene mesh.

The gastric pouch was created after horizontal transection of the stomach with a 60-mm long, thick linear stapler perpendicular to the lesser curvature, well above the previous ring/mesh site, where the tissues appeared healthy and the circulation was not impaired because of scarring. The vertical portion of the gastric pouch was created with one or two 60-mm long stapler cartridges. In most cases, a staple height of 4.8 mm or higher was used, depending on the thickness of the tissues and the level of scarring. Staple line reinforcement was never used.

On the one hand, if the original surgery was a laparoscopic MacLean procedure with divided staple lines and if a clear dissection plane was present between the old staple lines, the procedure was straightforward. In 47.77% ($n = 107/224$) of patients with pouch dilatation, the pouch was trimmed with resection of a small de-vascularized remnant of the dilated pouch (Fig. 1). Thirteen patients 5.80% ($n = 13/224$) had received Nissen fundoplication at the time of the primary VBG. In these patients, the wrap was released upon pouch creation.

On the other hand, when the original operation was an open Mason procedure, more difficulties were encountered due to dense adhesions and the non-divided part of the former gastroplasty. A complete pouch reconstruction was performed with routine resection of the old staple line and the non-separated part of the fundus. Fundectomy, or even partial gastrectomy, was necessary for the majority of patients 84.76% ($n = 89/105$) with dilated pouch and/or gastro-gastric fistulas. However, these resections were tailored intraoperatively (Fig. 2).

A gastrojejunostomy was created by using a 25-mm diameter circular stapler inserted via the abdominal wall. Staple heights were 3.5 or 4.8 mm adapted according to the thickness of the gastric tissue. The alimentary limb was pulled up in the antecolic, anti-gastric direction in all patients, except in two patients where it was placed retrocolic, retrogastric to avoid tension at the gastrojejunostomy and was measured to a length of 130 cm. The bypassed jejunum length was increased to 200 cm in 4.26% ($n = 14/329$) of patients when the BMI was above 50 kg/m^2. The biliopancreatic limb was routinely measured to a length of 70 cm in all cases. The jejunojejunostomy was constructed in a fully stapled manner. An intraoperative methylene blue leak test was carried out in each case. In our institution's practice, closure of the Petersen's space was introduced in 2008, whereas closure of the mesentery gaps was introduced in 2012. Therefore, neither Petersen's space nor mesentery gaps were closed in 17.33% ($n = 57/329$) of cases. Only the Petersen's space was closed in 27.36% ($n = 90/329$) and both defects were closed in 41.95% ($n = 138/329$) of patients using titanium clips. However, such procedures were not performed in 13.37% ($n = 44/329$) of patients with extensive adhesions between the small bowel loops and the abdominal wall from previous VBG or other surgery which—in our opinion—can carry a very low risk of an internal hernia. We routinely left a drain in between the pouch and the remnant stomach. Our fully stapled standardized laparoscopic RYGB technique has been extensively described previously [23, 24].

Postoperative Care and Follow-Up

Postoperatively, patients were kept nil by mouth till next morning. No routine upper gastrointestinal imaging was performed. Oral intake was restarted on the first postoperative day and the drain was routinely removed later on. The patients were discharged not earlier than the second postoperative day with specific dietary instructions. To prevent deep venous

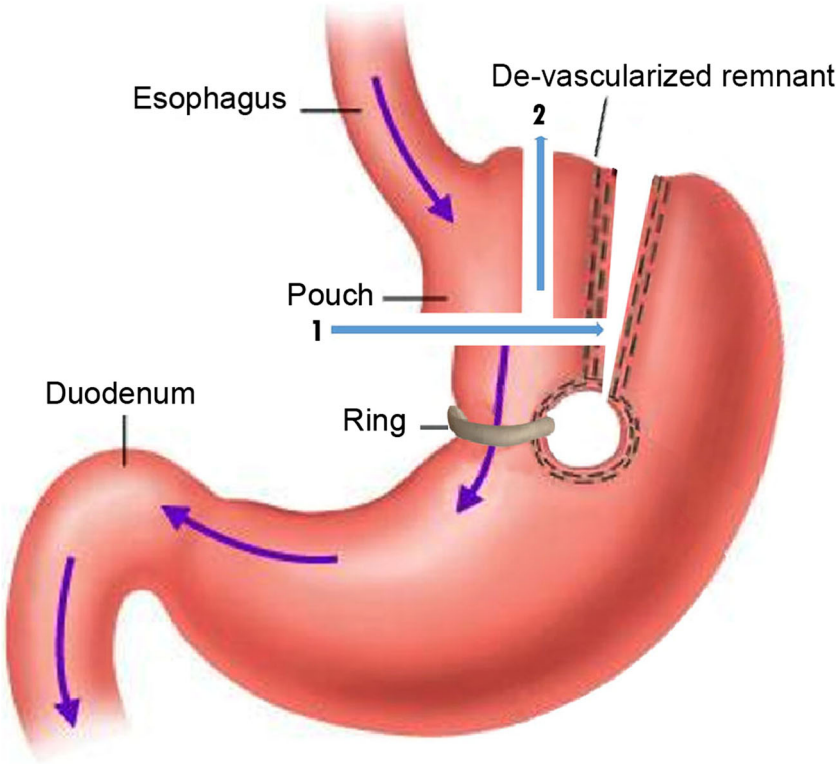

Fig. 1 Pouch construction in laparoscopic vertical banded gastroplasty

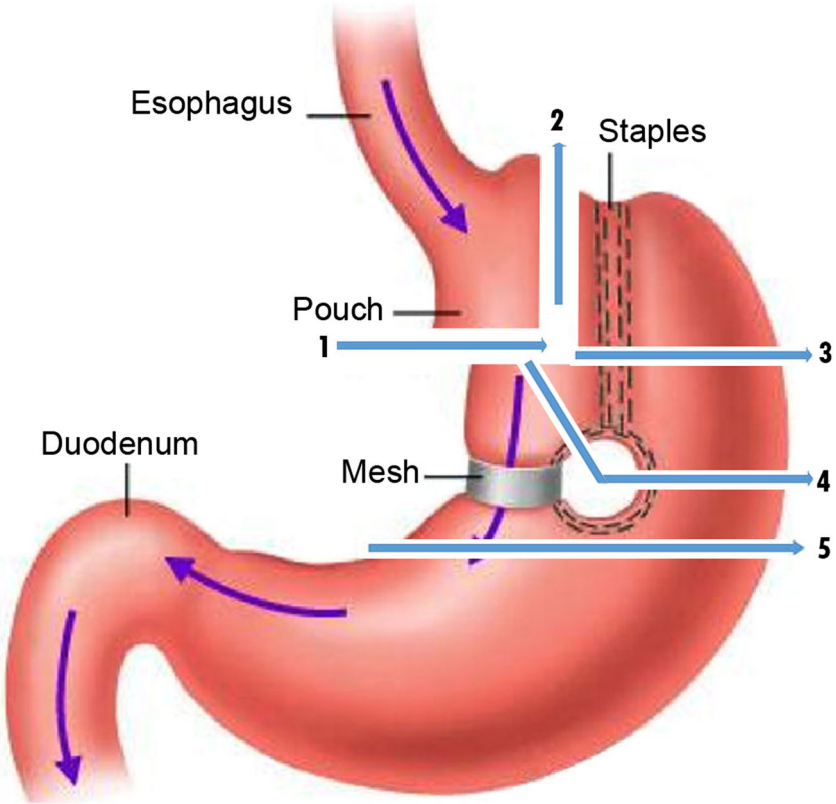

Fig. 2 Procedure for open vertical banded gastroplasty. (1–2) Pouch construction. (3) Hemi-fundectomy. (4) Fundectomy. (5) Partial gastrectomy

thrombosis, patients received a daily subcutaneous injection with low-molecular-weight heparin for 10 days postoperatively. In addition, a proton pump inhibitor (omeprazole, 20 mg) was started and continued for 3 months (lifelong for smokers) to prevent marginal ulcer formation. The first follow-up visit was scheduled after 6 weeks and multivitamins/minerals were started to all patients and continued for the first year. Thereafter, visits were planned after 6 months, 12 months, and then annually.

Statistical Analyses

The database of patient data was designed in Excel 2016 (Microsoft, Redmond, WA). Statistical analysis was performed using GraphPad Prism 7 for Windows (Graphpad Software, La Jolla, CA) and MedCalc (Medcalc, Belgium). Data, which were expressed as mean ± standard deviation or frequency, were compared using unpaired, two-tailed Student's t tests, and Mann-Whitney *U* tests, as appropriate. Results were considered statistically significant if $p < 0.05$.

Results

Between November 2004 and December 2017 (158 months), 329 patients underwent conversional LRYGB after primary LVBG (group A, $n = 224$) or OVBG (group B, $n = 105$). The conversion was indicated because of gastric outlet obstruction complications, weight regain, or for both reasons at the same time. Among these patients, 269 were female (81.76%). The age was 46.09 ± 10.71 years, the BMI was 35.32 ± 6.57 kg/m^2, and the time interval between the two bariatric procedures was 111.12 ± 62.41 months. The mean BMI was significantly higher in group B than in group A, which may be explained by the longer time interval between the primary and the conversional procedures in group B. In our opinion, the main reason behind this longer time could be that the conversional options such as RYGB were not popular until recent years. The patient demographics are listed in Table 1.

Intraoperative and postoperative data are listed in Table 2. Overall, the average operation time was significantly longer in OVBG patients ($n = 92$) than in LVBG patients ($n = 208$) 123.15 ± 40.26 vs. 96 ± 31.40 min, ($p < 0.05$). In 13 patients of the LVBG group, where a Nissen fundoplication was done at the time of the primary VBG, the operation time was significantly lengthier by 20.61 min to undo the wrap compared to the rest of patients in the same group. However, this additional time did not affect, significantly, the overall time of operation, the complication rate, or the length of hospitalization in LVBG patients. The operation time in 29 patient's files was not recorded in the anesthesia sheet.

Gastro-gastric fistula was diagnosed in 4.86% ($n = 16/329$) of all patients, 13.33% ($n = 14/105$) in OVBG patients, and

Table 1 Patient demographics

Variable	All VBG	LVBG (group A)	OVBG (group B)	*p* value
Age, years	46.09 ± 10.71 (18–75)	45.09 ± 11.22(18–75)	48.22 ± 9.22 (30–70)	–
Sex, *n*	329	224	105	–
Male	60 (18.24%)	43 (19.20%)	17 (16.19%)	
Female	269 (81.76%)	181 (80.80%)	88 (83.81%)	
Body mass index, *n*, kg/m^2	*n* = 323[a]	*n* = 219	*n* = 104	*< 0.0001*
	35.32 ± 6.57 (21–66)	34.15 ± 6.38 (21–66)	37.79 ± 6.31 (26–55)	
Time from VBG to RYGB, months	*n* = 325[b]	*n* = 222	*n* = 103	*< 0.0001*
	111.12 ± 62.41 (8–377)	88.25 ± 44.98 (8–210)	160.41 ± 66.32 (20–377)	

[a] Body mass index was not clearly determined in the files of six patients who were therefore excluded from the analysis

[b] The date of primary VBG was not documented in the files of four patients who were therefore excluded from the analysis

RYGB, Roux-en-Y gastric bypass; *VBG*, vertical banded gastroplasty; *LVBG*, laparoscopic vertical banded gastroplasty; *OVBG*, open vertical banded gastroplasty

0.89% ($n = 2/224$) in LVBG patients, ($p < 0.05$). However, statistical analysis of this subgroup of patients showed no significant difference regarding the operation time, the complication rate, or the length of hospitalization.

Due to dense adhesions and practical difficulties, LRYGB was converted to open RYGB in three patients from the OVBG group, but in none of the patients in the LVBG group. Of the three OVBG patients who required conversion to open RYGB, one had band erosion to the stomach wall and adhesions in the gastro-hepatic area. The procedure was aborted and the band was removed endoscopically after 1 week. Three months later, a trial of laparoscopic exploration led to the decision to convert the procedure to open RYGB. In the other two patients, we noted dense adhesions and had technical difficulties in performing LRYGB.

The mean length of hospitalization was not significantly different between the groups, with 2.96 ± 1.13 and 3.20 ± 1.20 days in groups A and B, respectively ($p = 0.08$).

The rate of early (≤ 30 days) complications was 8.51% ($n = 28/329$) overall, 11.43% in group B, and 7.14% in group A ($p = 0.19$). Bleeding was the most frequent complication, noted in 2.74% ($n = 9/329$) of all patients, with 4.76% ($n = 5/105$) in group B and 1.79% ($n = 4/224$) in group A ($p = 0.12$). However, most of these patients were treated conservatively by close monitoring, rehydration, and blood transfusion or endoscopy if indicated. Two patients (0.61%) were re-explored on the same day for control of bleeding.

Three patients had trocar site hernia and were treated laparoscopically during the second and third postoperative week. One patient had an intraperitoneal abscess drained surgically on day 21. Another patient had jejunojejunostomy leak operated on the next day. Finally, one patient had an internal hernia on the 26th postoperative day.

In total, the reoperation rates in groups A and B were 2.23 and 2.86% respectively ($p = 0.73$). There were no leaks at the gastrojejunostomy level or at the staple line transections. There was no mortality in this patient's series. Details regarding early morbidity are shown in Table 3.

A subgroup analysis compared the short-term outcomes of patients with 130 cm alimentary limb and 200 cm revealed no significant difference. A second subgroup analysis concerned the patients with a closure of the Peterson's space and/or mesentery gaps, or no closure showed no significant difference in < 30 days outcomes.

Table 2 Operative time, conversion rate, morbidity rate, reoperation rate, and hospital stay

Variable	All VBG	LVBG (group A)	OVBG (group B)	*p* value
Operative time, minutes	*n* = 300 [a]	*n* = 208	*n* = 92	*< 0.0001*
	104.32 ± 36.50	96 ± 31.40	123.15 ± 40.26	
Conversion rate (LRYGB to ORYGB)	*n* = 3/329	*n* = 0/224	*n* = 3/105	*0.0111*
	0.91%	0	2.86%	
Early morbidity rate	*n* = 28	n = 16	*n* = 12	0.1943
	8.51%	7.14%	11.43%	
Early reoperation rate	*n* = 8	n = 5	*n* = 3	0.7298
	2.43%	2.23%	2.86%	
Hospitalization, days	*n* = 329	n = 224	*n* = 105	0.0780
	3.04 ± 1.15	2.96 ± 1.13	3.20 ± 1.20	

[a] Operation time was not recorded in the files of 29 patients who were excluded from the analysis

LRYGB, laparoscopic Roux-en-Y gastric bypass; *ORYGB*, open Roux-en-Y gastric bypass; *VBG*, vertical banded gastroplasty; *LVBG*, laparoscopic vertical banded gastroplasty; *OVBG*, open vertical banded gastroplasty

Table 3 Early morbidity rate (≤ 30 days)

Early complications (Clavien-Dindo classification)	All patients $n = 329$ n (%)	LVBG group A $n = 224$ n (%)	OVBG group B $n = 105n$ (%)	p value
Grade I	*11 (3.34)*	*6 (2.68)*	*5 (4.76)*	*0.3806*
Abdominal pain	3 (0.91)	2 (0.89)	1 (0.95)	
Wound infection	6 (1.82)	4 (1.79)	2 (1.90)	
Intraperitoneal abscess	2 (0.61)	0	2 (1.90)	
Grade II	*5 (1.52)*	*2 (0.89)*	*3 (2.86)*	*0.1739*
Bleeding managed conservatively	4 (1.22)	1 (0.45)	3 (2.86)	
Iatrogenic pancreatic injury, conservative management	1 (0.30)	1 (0.45)	0	
Grade IIIa	*4 (1.21)*	*3 (1.34)*	*1 (0.95)*	*0.7638*
Bleeding managed endoscopically	3 (0.91)	2 (0.89)	1 (0.95)	
Pneumothorax, chest tube, and intensive care	1 (0.30)	1 (0.45)	0	
Grade IIIb	*8 (2.43)*	*5 (2.23)*	*3 (2.86)*	*0.7298*
Bleeding treated laparoscopically	2 (0.61)	1 (0.45)	1 (0.95)	
Leak treated laparoscopically	1 (0.30)	1 (0.45)	0	
Trocar site hernia treated laparoscopically	3 (0.91)	2 (0.89)	1 (0.95)	
Internal hernia treated laparoscopically	1 (0.30)	0	1 (0.95)	
Intraperitoneal abscess treated laparoscopically	1 (0.30)	1 (0.45)	0	
Total	*28 (8.51)*	*16 (7.14)*	*12 (11.43)*	*0.1943*

LVBG, laparoscopic vertical banded gastroplasty; *OVBG*, open vertical banded gastroplasty

Discussion

Before the laparoscopic era, OVBG was the most widely used restrictive bariatric procedure [25]. With the development of surgical endoscopic techniques, OVBG evolved to a laparoscopic procedure, as described by MacLean (i.e., LVBG). Regardless of whether the surgical approach was open or laparoscopic, the initial short-term and even medium-term results regarding weight loss were good, as reported in two systematic reviews [26, 27]. However, VBG has been progressively abandoned in the bariatric community for two main reasons: high long-term failure rate [8, 28] and a disappointingly high-complication rate [12, 13]. Revisional options focusing on the treatment of the gastric outlet obstruction include a longitudinal section of the mesh in patients with OVBG, or simple ring removal in patients with LVGB or rarely, complete restoration of the normal anatomy via gastro-gastrostomy is necessary. Evidently, these revisional options will eventually result in significant weight regain and the recurrence of obesity-related comorbidities [29, 30].

Conversion to sleeve gastrectomy, which is the most common bariatric procedure nowadays, has been amply described [31–33]. Despite the reported safety and feasibility of sleeve gastrectomy as a secondary procedure after failed VBG, we believe that these patients with long-standing gastric outlet obstruction at the area of ring/mesh may have a higher risk of reflux or even Barrett's esophagus, on the long-term, if converted to sleeve gastrectomy [34, 35]. The option of

Table 4 Comparison between previously published and presently determined outcomes of VBG conversion to RYGB

Author	(Total) VBG converted to open/lap RYGB	Participating centers	Conversion rate	Operative time, min	Reoperation rate	Hospitalization, days	Leak rate	Early morbidity	Mortality rate
Gagne et al. [39]	(105) 0/105 [a]	Single	0	175	9.5%	2	9.5%	19%	0
Suter et al. [41]	(203) 0/203	Multi	0	209	4.5%	N/A	3.9%	11.8%	0.5%
Apers et al. [43]	(21) 0/21	Single	38%	N/A	36%	N/A	14%	33.3%	0
David et al. [47]	(25) 0/25	Single	10%	195	12%	5.4	8%	19%	0
Gys et al. [48]	(90) 45/45	Single	11.1%	130	3.3%	5.5–3.2	1.1%	8.9%	0
van Wezenbeek et al. [49]	(115) N/A	Single	N/A	131	4.3%	4.1	2.6%	13%	0
Current study	*(329) 0/329*	Single	*0.91%*	*104*	*2.43%*	*3.04*	*0.30%*	*8.51%*	*0*

[a] Hand-assisted adhesiolysis was used in one patient

N/A, not available; *RYGB*, Roux-en-Y gastric bypass; *VBG*, vertical banded gastroplasty

conversion to a malabsorptive operation was suggested by Gumbs et al. [36], who stated that conversion to a biliopancreatic diversion procedure should be preferred in patients with failed restrictive procedures. However, Abu-Gazala et al. [37] have shown that conversion to biliopancreatic diversion procedure has a higher complication rate.

Many others prefer conversion to RYGB, which is also our procedure of choice [38–43]. RYGB has been reported to provide excellent results both in terms of weight loss and quality of life. Although RYGB as a primary procedure is now well recognized in the bariatric field, there is also a steep increase in the number of RYGB procedures performed as secondary conversional procedures after prior failed primary procedures. The main reason for this trend is the technical feasibility of RYGB, which combines food restriction with malabsorption and hormonal action mechanisms, resulting in further weight loss and resolution of associated comorbidities. Furthermore, particularly in patients with failed VBG, RYGB resolves the gastric outlet obstruction, treats the reflux, and offers an excellent quality of life. Various authors reported on their experience with LRYGB as a conversional surgery for open or laparoscopic primary bariatric procedures. The overall conclusion is that conversional surgery has higher complexity and is technically more challenging, as indicated by the higher risk-benefit ratio for conversional bariatric surgery than for primary operations [37, 42–45].

In our series, we noted an 8.51% rate of early complications. Of these, only 2.43% had serious complications requiring re-intervention. There was no mortality. Furthermore, we recorded no cases of leak at the gastrojejunostomy or at the staple lines of transections. This very low morbidity rate is comparable to the rate we reported previously in 2606 patients with mainly primary RYGB [24]. In addition to applying our fully stapled and standardized RYGB technique, we believe that other more specific and patient-tailored refinements of the surgical technique are crucial in achieving a low rate of complications, especially in terms of anastomotic leaks. We always construct the gastric pouch by horizontally transecting the stomach well above the location of the scar tissue surrounding the ring/mesh. Even for high-positioned rings or meshes, we would still leave a small gastric pouch in order to perform a gastrojejunostomy instead of an esophagojejunostomy, as described by Suter et al. [41]. However, this approach is probably technically more hazardous and likely annihilates the presumed neurological pathways between the stretch receptors in the gastric pouch and the cerebral appetite centers in the hypothalamus [46]. In OVBG patients, the adhesions located in the area of the previous midline wound are always bothersome, which makes it more challenging to manage such patients than those operated with minimally invasive techniques, resulting in a substantially longer operative time. Interestingly, the length of hospitalization was not significantly different between the groups in our study, It was moreover considered well below the lower end of the ranges published in the literature. Table 4 provides an overview of the comparison between our present findings and those from studies published recently on the conversion of VBG to RYGB.

Conclusion

To our knowledge, the present series of 329 patients represents the largest single-center experience on laparoscopic conversion of VBG to RYGB. We analyzed the peri- and postoperative outcomes of conversion of OVBG and LVBG to LRYGB and found that such a conversional procedure is feasible and associated with low early morbidity rates and reduced lengths of hospitalization. However, in comparison to the LVBG procedure, conversional LRYGB following OVBG is technically more challenging and time-consuming, having a slightly higher risk of conversion to open surgery. We recommend that this type of conversional bariatric surgery should be performed in specialized, high-volume bariatric centers.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflicts of interest or financial ties to disclose.

Informed Consent Informed consent was obtained from all individual participants included in this study prior to the conversional procedures to have their data used anonymously for academic purposes.

Ethical Approval All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Furthermore, the local ethics committee of our hospital had approved this study protocol.

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