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Obesity Surgery
The Journal of Metabolic Surgery and Allied Care

ISSN 0960-8923

OBES SURG
DOI 10.1007/s11695-019-04002-3

Springer

Obesity Surgery
https://doi.org/10.1007/s11695-019-04002-3

ORIGINAL CONTRIBUTIONS

Twelve-Year Experience with Roux-en-Y Gastric Bypass as a Conversional Procedure for Vertical Banded Gastroplasty: Are We on the Right Track?

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Abstract

Background Vertical banded gastroplasty (VBG) has high rates of long-term complications. Conversion to Roux-en-Y gastric bypass (RYGB) is considered optimal; however, there are limited data on the late results of these conversions. We aimed to analyze our single-center long-term outcomes of patients requiring conversional RYGB for a failed VBG.

Methods The records of patients who underwent RYGB as a conversional procedure after VBG from November 2004 to December 2016 were reviewed. Follow-up data were obtained by direct telephone calls with patients, electronic files, and general practitioner reports. Characteristics, indications of conversion, long-term (> 30 days) morbidities, weight records, obesity-related comorbidities, and overall patient satisfaction were analyzed.

Results Overall, 305 VBG patients (82% female) underwent conversional RYGB during the study period. The mean pre-RYGB body mass index (BMI) was 35.6 (23–66) kg/m^2. Conversions were indicated in 61% of patients because of simultaneous VBG complications and weight regain. After a median follow-up of 74.3 (5–151) months, 225 (73.8%) patients agreed to participate. The mean BMI and percentage of total weight loss (%TWL) were 28.6 (18–45) kg/m^2 and 17.4%, respectively. Nearly all conversion indications were addressed effectively. Surgical reintervention was mandatory in 28 of 225 patients (12.4%) due to complications. Approximately 85% of patients reported complete remission of obesity-related comorbidities, and four-fifths were fully satisfied.

Conclusion RYGB resolves VBG complications, improves quality of life, and results in prolonged stable weight loss. It has a key role in the management of obesity-related comorbidities and in expert hands is the preferred conversional procedure for patients with failed VBG.

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

Introduction

Obesity is currently a growing major chronic illness. It has become a challenge for all healthcare systems across the globe. Millions of deaths, billions of disabilities, and trillions of dollars are lost every year due to obesity. In 2016, 1.9 billion people—nearly 39% of the world's adult's population—were either obese or overweight. Moreover, obesity is a serious risk factor for a variety of diseases, such as diabetes and hypertension [1, 2]. Today, bariatric surgery is the only evident treatment with the highest success rate in terms of weight reduction, comorbidity-risk control, and overall decrease in mortality rates [3–5]. Furthermore, Zhou et al. [6] recently concluded that bariatric surgery may play a role in cancer incidence reduction among obese individuals.

Vertical banded gastroplasty (VBG) was one of the most popular restrictive procedures in bariatric fields in the 1980s and 1990s, with brilliant short- and medium-term results [7, 8]. Mason described the open VBG for the first

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Published online: 11 June 2019

time in 1982 [9]. Then, the procedure was modified by MacLean [10] in 1993. The latter performed it with stomach transection and the replacement of mesh with a more inert silastic ring. Since then, thousands of patients have been operated on with satisfactory initial outcomes. Gradually, problems started to appear, and a high number of patients had either gastric outlet obstruction complications or weight regain, which led to a ban on this procedure in many parts of the world [11–14]. The treatment options varied between surgeons. However, most bariatric experts supported the choice of Roux-en-Y gastric bypass (RYGB), as it was approved as a safe, feasible procedure with excellent and durable results [15–18].

Many authors reported their experience with RYGB as a secondary procedure after failed VBGs. Overall, the results were encouraging [19, 20]. However, a close look at the literature indicates that only a few studies included a substantial number of patients, and the largest sample consisted of 203 patients in a multicenter study reported by Suter et al. [21]. Furthermore, the maximum reported follow-up period was not more than 9 years [21].

The aim of this retrospective single-center study was to evaluate in detail the long-term outcomes of RYGB as a conversional bariatric procedure after failed VBG for 305 patients with a follow-up period extending up to 12 years. To our knowledge, this study represents the largest number of patients and the longest follow-up period reported thus far.

Materials and Methods

Study Design

The Obesity Surgery Center in our hospital is a high-volume referral unit, performing over 1400 bariatric procedures a year. Of these, 20% are conversional cases, mostly after former restrictive or primarily restrictive procedures, such as gastric banding, VBG, and sleeve gastrectomy [22].

During the period from November 2004 to December 2016, 12,465 patients had an RYGB at our center, either as a primary surgery or as a conversional procedure. Of these, 305 patients underwent a conversional RYGB for a failed VBG procedure (either Mason or MacLean) performed at our center or at another institution. A retrospective analysis of these patients' records was performed. Demographic data, late (> 30 days) complications, weight statistics, and obesity-related comorbidities were collected. Follow-up data, further bariatric procedures, and overall patient satisfaction rates were collected via direct telephone contact with the patient and a retrospective meticulous review of all hard/electronic files, laboratory tests, and general practitioner/family doctor (GP/FD) reports and visits.

The indication for conversion of the previous VBG in terms of weight evolution was defined as less than 50% excess weight loss according to the criteria described by Reinhold [23]. In terms of complications, conversion was indicated in patients vomiting three or more times a day or exhibiting symptoms of dysphagia, in patients with severe reflux or evidence of gastroesophageal reflux (GERD), or in patients with intolerance, or all of the above. Weight data in kilograms were obtained on five occasions: pre-VBG, minimum after VBG, pre-RYGB, minimum after RYGB, and the last follow-up weight. The ideal body weight (IBW) was recalculated to a body mass index (BMI) of 25 kg/m^2. The excess weight (EW) and percentage of excess weight loss (%EWL) were calculated as reported by Deitel et al. [24]. The terms percent excess BMI loss (%EBMIL), percent of total weight loss (%TWL), remission, partial remission, improvement, and no change were standardized as outlined recently by Brethauer et al. [25]. Patient satisfaction rate was evaluated generally by asking the patient to rate his/her experience on a 5-point scale since converting from VBG to RYGB, where 1 was very unsatisfied.

The long-term follow-up data were collected via direct phone calls with the patients in May 2017. Then, the data of these patients was matched with that of our hospital/national hard and electronic files, GP/FD reports, laboratory tests, medication prescriptions, and other follow-ups. The call usually started by introducing ourselves and our purpose, assuring the patient that the conversation was confidential and asking for permission to use the patient's data anonymously for this paper. Then, the identity of the patient was confirmed with our hospital records. All questions were planned in a systematic manner for all patients, and the answers were collected in a predesigned Excel database.

Treatment

All procedures were carried out laparoscopically under general anesthesia in the same center by the same surgeon or under his supervision. The gastric pouch (< 30 ml) was created well above the scar tissue of the mesh/ring in an area where the tissue looked healthy. The gastrojejunostomy (G-J) was created by using a 25-mm-diameter circular stapler inserted via the abdominal wall. The staple height was 3.5 or 4.8 mm and was adapted according to the thickness of the gastric tissue. The alimentary limb was pulled up in an antecolic antegastric manner in all patients (except in two patients where it was placed retrocolic retrogastric to avoid tension on the G-J) and measured to a length of 130 cm. The biliopancreatic limb was 70 cm. The alimentary limb was increased to 200 cm in 3.9% ($n = 12/305$) of patients whose BMI was above 50. The jejunojejunostomy was constructed in a fully stapled manner. We started closing the Petersen's space from 2008 on and the mesentery gaps from 2012 on except in cases

where widespread adhesions were present from previous VBG or other surgeries, which, in our opinion, can carry a very low risk of an internal hernia. Therefore, neither the Petersen's space nor the mesentery gaps were closed in 18.7% ($n = 57/305$) of patients. Only the Petersen's space was closed in 29.5% ($n = 90/305$) of patients, and both defects were closed in 37.4% ($n = 114/305$) of patients using titanium clips. However, such procedures were not performed in 14.4% ($n = 44/305$) of patients with extensive adhesions. Trocar sites > 15 mm were usually closed using absorbable multifilament threads.

Results

Between November 2004 and December 2016, 305 patients underwent conversional RYGB after a failed primary VBG. Of these, 250 were females (82%). Overall, the mean age was 45.6 ± 10.6 (18–75) years, the mean pre-RYGB BMI was 35.6 ± 6.6 (23–66) kg/m^2, and the mean time interval between both bariatric procedures was 106.8 ± 61.2 (8–377) months. The patient demographics are listed in Table 1.

The median follow-up in this study was 74.3 (5–151) months. All patients were contacted directly by phone in May 2017. Out of 305 calls, 245 (80.3%) were answered. The remaining 33 patients (10.8%) did not respond to the calls despite several attempts at separate times, and 27 patients (8.9%) had incorrect numbers.

Out of 245 answered calls, 13 patients (4.3%) did not want to be included in the study and 7 patients (2.3%) were deceased because of causes unrelated to the procedures. Thus, only 225 patients (73.8%) were included in the long-term follow-up data analysis.

According to the available information from hospital/national medical charts, direct telephone contact with patients, or GPs/FDs reports, a total of 32 of 225 patients (14.2%) suffered from late complications (> 30 days). The most common complication was internal hernia in 12 patients (5.3%), followed by trocar site hernia in 7 patients (3.1%). The mean time interval between RYGB and the onset of any complications was 45.3 months. Table 2 gives further information.

A subgroup analysis of the 12 patients with an internal hernia, in which either closure of the Peterson's space and/or mesentery gaps or no closure was performed, showed no significant difference.

Long-Term Follow-up Data

Indication for Surgery

Conversion was indicated because of weight regain in 28.5% of patients ($n = 87$) or gastric outlet obstruction complications (i.e., GERD, recurrent vomiting, and dysphagia) in 10.5% of patients ($n = 32$), or both reasons in 61% of patients ($n = 186$). However, there was a complete resolution of gastric outlet obstruction complications and an excellent weight reduction in the vast majority of included patients.

Weight Loss

The primary VBG procedure resulted in substantial weight loss with a decrease in mean initial BMI from 38.8 to a minimum 27.6 kg/m^2, maximum mean %EWL was 71.6%, and mean %EBMIL was 81.3%. Then, the mean BMI increased to 35.6 kg/m^2 prior to conversion to RYGB. Afterward, the mean BMI dropped to a minimum of 26.1 kg/m^2, and the maximum mean %EWL and %EBMIL were 77.3% and 89.1%, respectively.

Out of 223 patients, after a median follow-up of 74.3 (5–151) months, the mean BMI was 28.6 kg/m^2, the mean %TWL was 17.4%, the mean %EBMIL was 65.6%, and the mean %EWL was 51.6%. For two patients, the weight was not clearly given, and they were excluded from the weight results.

Moreover, the patients were divided into three subgroups according to the follow-up period. The first group of patients (57/225, 25.3%) were operated on between 2004 and 2008, with a mean follow-up of 119 (101–151) months; the second group of patients (90/225, 40%) were operated on between 2009 and 2012, with a mean follow-up of 77 (53–101) months;

Table 1 Patient demographics

Variable		*N* (%)
Age, years	Mean ± SD (range)	45.6 ± 10.6 (18–75)
Gender	Male	55 (18)
	Female	250 (82)
VBG procedure	Done in the same center	212 (69.5)
	Open/laparoscopy	96/209 (31.5/68.5)
Revision prior to RYGB	Removal of the band	30 (9.8)
Time interval, months	VBG to RYGB	106.8 ± 61.2 (8–377)

RYGB Roux-en-Y gastric bypass, *VBG* vertical banded gastroplasty

Table 2 Late morbidity rate (> 30 days)

Late complications (Clavien-Dindo classification)	*N* = 225 *N* (%)	Time after RYGB, months Mean (range)
Grade I	3 (1.3)	N/A
Dumping syndrome (early)[a]	2 (0.9)	9–N/A
Marginal ulcer	1 (0.4)	N/A
Grade II	1 (0.4)	(87)
Malabsorption ± total parenteral nutrition (TPN)	1 (0.4)	(87)
Grade IIIa	0	–
Grade IIIb	28 (12.4)	44.7 (4–123)
Internal hernia treated laparoscopically	12 (5.3)	37.8 (9–85)
Trocar site hernia treated laparoscopically	7 (3.1)	42.4 (4–82)
Perforated marginal ulcer treated laparoscopically	4 (1.8)	83.3 (45–123)
Bowel obstruction treated surgically	3 (1.3)	20 (16–27)
Pouch-gastric fistula treated laparoscopically	1 (0.4)	104
Stricture at gastrojejunostomy treated laparoscopically	1 (0.4)	16
Total	32 (14.2)	45.3 (4–123)

N/A not available, *RYGB* Roux-en-Y gastric bypass

[a] Dependent on the available data and may be underestimated

and the third group of patients (78/225, 34.7%) were operated on between 2013 and 2016, with a mean follow-up of 30 (5–53) months. The mean %TWL were 14.7%, 16.7%, and 20.1%, respectively, in these three groups.

Considering the pre-VBG weight as the initial weight, out of 223 patients, 156 (70%) had a > 20% TWL and only 67 patients (30%) had a < 20% TWL. Table 3 and Figs. 1, 2, and 3 show the weight loss follow-up.

A subgroup analysis comparing the long-term outcomes of patients with 130 cm and 200 cm alimentary limbs revealed no significant difference between the two groups.

Unsatisfactory weight loss or weight regain occurred in 9 of 223 (4%) patients in a median time frame of 52 months after RYGB. Dietary modification and behavioral counseling were carried out for all patients. Six of these patients (2.7%) underwent adjustable band placement over the gastric pouch in order to restore the lost restriction. In two patients (1%), gastrojejunal sleeve reduction and application of a Minimizer Ring® were performed. In only one patient (0.5%) was distalization of small bowel anastomosis necessary for further weight control. Weight data for these patients did not show any significant changes in the overall results.

Evolution of Comorbidities

A total of 460 obesity-related comorbidities were recorded in this patient series among 229 of 305 patients (75.1%) who had one or more at the same time. The most common was dyspnea in nearly half of patients (43.3%), followed by dyslipidemia in 29.2% of patients. Twenty-three patients (7.5%) had type 2 diabetes mellitus (T2DM) and were either using oral medications or insulin, and two patients (0.7%) had type 1 diabetes mellitus (T1DM). Hypertension, obstructive sleep apnea, and others (back pain, arthritis, psychological disorders, etc.) were also recorded in 22%, 6.7%, and 41.6%, respectively.

After a median follow-up of 74.3 (5–151) months, 72.2% of patients with obesity-related comorbidities responded to our calls; almost all patients had complete remission or improvement.

Out of 25 diabetic patients, 16 (64%) responded to our calls (14 T2DM and 2 T1DM). T2DM was evidently in complete remission (i.e., glycosylated hemoglobin (HbA1c) < 6%, fasting blood glucose (FBG) < 100 mg/dl, and no anti-diabetic medications) in 8 of 14 patients (57.1%), 1 of 14 patients (7.1%) had partial remission (i.e., HbA1c 6–6.4%, FBG 100–125 mg/dl, and no anti-diabetic medications), 3 of 14 patients (21.4%) improved (2 patients converted from insulin to oral medications and the other patient had better FBG control), and 2 of 14 patients (14.3%) had no change in their T2DM. For T1DM, two patients reported a reduction in insulin doses. However, out of 225 patients, T2DM was newly diagnosed in two patients (0.9%) de novo.

Hypertension was in complete remission (i.e., normotensive (blood pressure < 120/80) and off anti-hypertensive medications) in 51.9% of patients according to the patient information and any available data from the charts, GP/FD visits, and other data sources. Hypertension was better controlled for the rest. However, 12 of 225 patients (5.3%) reported de novo onset of hypertension after RYGB.

Dyslipidemia was diagnosed in 89 of 305 (29.2%) patients in this study cohort. Of those patients, 70 of 305 (78.7%)

Table 3 Weight loss follow-up

Variable	All patients $n = 225$ (n) mean (range), (%)	2004 to 2008 $n = 57$ (n) mean (range), (%)	2009 to 2012 $n = 90$ (n) mean (range), (%)	2013–2016 $n = 78$ (n) mean (range), (%)
Median follow-up (months)	74.3 (5–151)	119 (101–151)	77 (53–101)	30 (5–53)
BMI (kg/m^2)				
Pre-VBG	(225) 38.9 (26–68)	(57) 38.2 (26–63)	(90) 39.2 (29–68)	(78) 39.1 (28–57)
Minimum after VBG[a]	(197) 27.3 (17–45)	(43) 27.3 (17–40)	(80) 27.9 (17–45)	(74) 26.7 (17–43)
Pre-RYGB	(224) 35.1 (24–61)	(56) 33.7 (24–50)	(90) 35.5 (27–54)	(78) 35.7 (24–61)
Minimum after RYGB	(223) 26.1 (16–42)	(56) 24.7 (18–31)	(89) 26.3 (16–42)	(78) 27 (19–42)
Last follow-up[b]	(223) 28.6 (18–45)	(56) 28.6 (21–39)	(89) 29.1 (18–45)	(78) 28.2 (19–45)
BMI < 25	49 (22%)	11 (19.6%)	17 (19.1%)	21 (26.9%)
BMI > 25 and < 35	149 (66.8%)	40 (71.4%)	62 (69.7%)	47 (60.3%)
BMI > 35	25 (11.2%)	5 (8.9%)	10 (11.2%)	10 (12.8%)
Pre-RYGB to last follow-up				
Weight (kg)	(224) 97.6 (61–191)	(56) 92.3 (61–154)	(90) 98.4 (63–191)	(78) 100.4 (63–161)
Last follow-up %TWL[b]	(223) 17.4 (− 21 to 56)	(56) 14.7 (− 16 to 46)	(89) 16.7 (− 13 to 56)	(78) 20.1 (− 21 to 42)
Last follow-up %EWL[b]	(223) 51.6 (− 103 to 175)	(56) 46.4 (− 103 to 162)	(89) 41.4 (1–42)	(78) 61.1 (−53–175)
%EWL > 50	118 (52.9%)	24 (42.9%)	41 (46.1%)	53 (68%)
%EWL > 25 and < 50	60 (26.9%)	31 (55.4%)	27 (30.3%)	16 (20.5%)
%EWL < 25	45 (20.2%)	1 (1.8%)	21 (23.6%)	9 (11.5%)
Pre-VBG to last follow-up				
Weight (kg)	(225) 108.2 (68–188)	(57) 105 (73–160)	(90) 108.7 (68–188)	(78) 110 (76–186)
%TWL[b]	(223) 25.4 (− 6 to 54)	(56) 23.7 (− 3 to 49)	(89) 24.7 (− 6 to 54)	(78) 27.3 (0–49)
%TWL < 20	67 (30%)	21 (37.5%)	26 (29.2%)	20 (25.6%)
%TWL > 20 and < 30	80 (35.9%)	20 (35.7%)	36 (40.5%)	24 (30.8%)
%TWL > 30	76 (34.1%)	15 (26.8%)	27 (30.3%)	34 (43.6%)

RYGB Roux-en-Y gastric bypass, *VBG* vertical banded gastroplasty, *BMI* body mass index, *%EWL* percentage of excess weight loss, *%TWL* percent of total weight loss

[a] The minimum weight after VBG was not recorded in the files of 28 patients; these patients were excluded from the analysis

[b] For two patients, the weight was not clear, and these patients were excluded from the analysis

responded to our calls. According to the available data from the patient contacts, medical records, laboratory tests, and GP/FD visits, 60 of 225 (85.7%) patients were found to be off medications, off labeled as dyslipidemia patients, and/or had recent normal levels of low-density lipoprotein cholesterol (LDL), high-density lipoprotein cholesterol (HDL), and/or triglyceride. However, dyslipidemia was de novo diagnosed in 5 of 225 (2.2%) of patients.

Obstructive sleep apnea (OSA) was documented in 20 of 305 patient files, and 13 of 20 (65%) patients agreed to participate in this study. Five patients had severe preoperative symptoms and were on continuous positive airway pressure (CPAP). Out of those five patients, two patients evidently had complete remission (i.e., repeated polysomnography (PSG) showed an apnea hypopnea index/respiratory disturbance index (AHI/RDI) < 5 and off CPAP), two patients had a subjective complete remission (i.e., PSG was not repeated and off CPAP), and one patient had objectively improved (AHI/RDI drop from 58 preoperatively to 21 and off CPAP postoperatively). The other eight patients had documented subjective complete remission. Table 4 provides additional details on these patients.

A general view of the patients' satisfaction regarding their experiences of undergoing the VBG and RYGB procedures and current quality of life was examined using a scale of five categories. The results were as follows: 12 (5.3%) patients were very unsatisfied and reported very poor quality of life, 21 (9.3%) patients were unsatisfied, 23 (10.2%) patients were neutral, 64 (28.4%) patients were satisfied, and 105 (46.7%) patients were very satisfied with a very good quality of life. The mean rating was 4, satisfied with a good quality of life, among the 225 responding patients.

Discussion

VBG has been widely performed as a safe and easy restrictive bariatric procedure as described by Edward Mason and altered

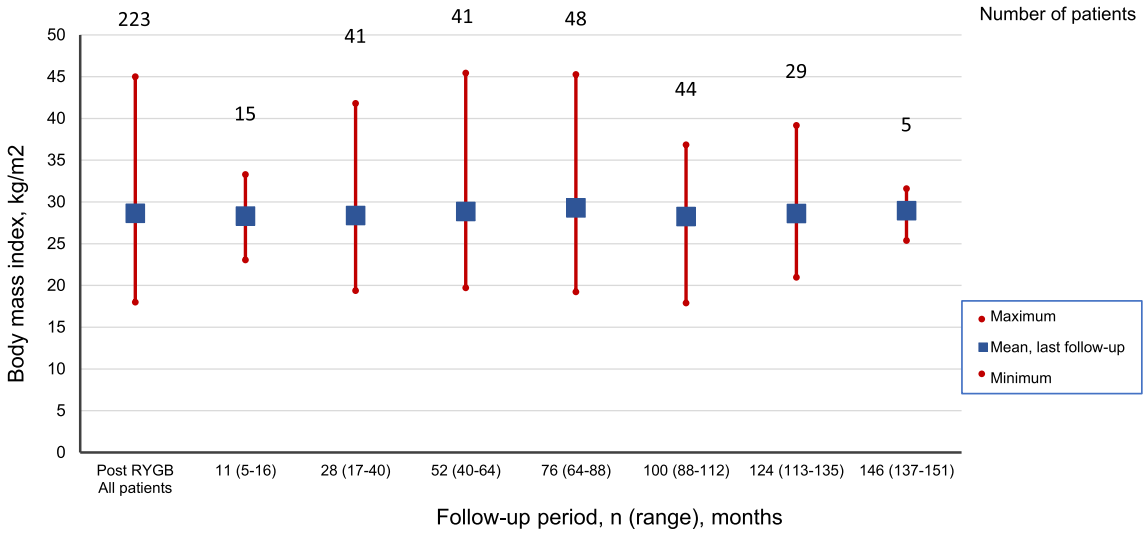

Fig. 1 Body mass index follow-up

later by MacLean [26]. It was the preferred bariatric option in Europe for many years until the beginning of the current century. Furthermore, the initial short- and even medium-term results regarding weight loss were acceptable, as shown in two systematic reviews [27, 28]. However, VBG has been progressively abandoned in the bariatric community for two main reasons: a high long-term failure rate and a disappointingly high complication rate [29–32].

In general, secondary bariatric surgery was described as being more complex and time consuming and having higher overall complication rates than the primary counterparts [15, 17]. However, many authors have documented the possibility, safety, and efficacy of those conversional procedures. Cadiere et al. [33] reported good outcomes in terms of weight loss after secondary RYGB. Vij et al. [34] described revisions as feasible with reasonable early results. Moreover, McKenna et al. [35] concluded that the benefits of improving obesity-related comorbidities are more obvious than inducing further weight loss after revisional surgery.

The conversion to RYGB has been described by different authors as the best option for optimum weight control and resolution of VBG complications, and it is associated with low rates of early or late complications [20, 21, 36]. Furthermore, the published long-term data for this procedure are highly encouraging both in terms of quality of life and overall patient fulfillment [37]. As an alternative, conversion to sleeve gastrectomy (SG), biliopancreatic diversion (BPD)/duodenal switch (DS), or omega loop-mini-gastric bypass (OGB) has also been suggested [38–40]. Moreover, endoscopic revisions were described for failed VBG by some authors with some success [41, 42]. However, the long-term follow-up data for these options are still lacking.

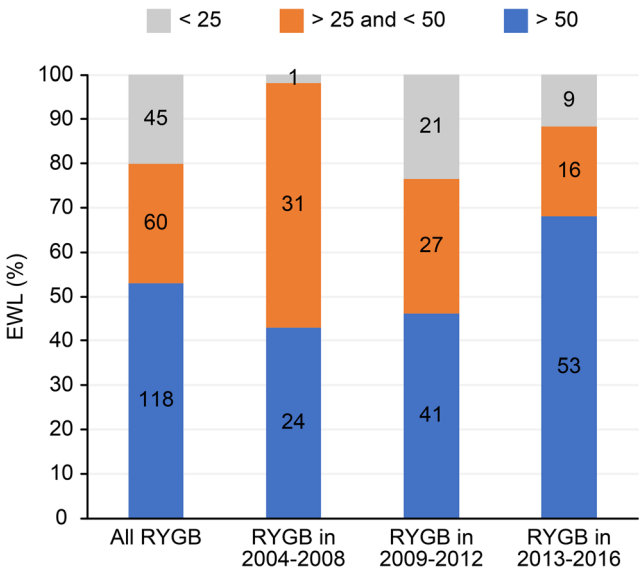

Fig. 2 Distribution of %EWL according to Reinhold's criteria

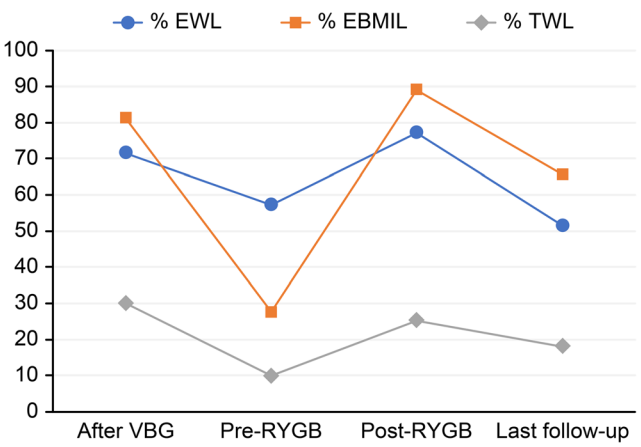

Fig. 3 Long-term weight loss data

Table 4 Obesity-related comorbidities

Variable	Total/305 *n* (%)	Response[a] *n* (%)	Remission *n* (%)	Partial remission *n* (%)	Improvement *n* (%)	No change *n* (%)	De novo[b] *n* (%)
T2DM	23 (7.5)	14 (60.9)	8 (57.1)	1 (7.1)	3 (21.4)	2 (14.3)	2 (0.9)
T1DM	2 (0.7)	2 (100)	0	0	2 (100)	0	0
Dyspnea	132 (43.3)	87 (65.9)	83 (95.4)	0	4 (4.6)	0	1 (0.4)
Dyslipidemia	89 (29.2)	70 (78.7)	60 (85.7)	0	10 (14.3)	0	5 (2.2)
Hypertension	67 (22)	52 (77.6)	27 (51.9)	1 (1.9)	24 (46.2)	0	12 (5.3)
Obstructive sleep apnea	20 (6.6)	13 (65)	12 (92.3)	1 (7.7)	0	0	1 (0.4)
Others[c]	127 (41.6)	94 (74)	92 (97.9)	0	2 (2.1)	0	3 (1.3)
Total	**460**	**332 (72.2)**	**282 (84.9)**	**3 (0.9)**	**45 (13.6)**	**2 (0.6)**	**24 (7.9)**

T2DM type 2 diabetes mellitus, *T1DM* type 1 diabetes mellitus

[a] Patients who agreed to be involved

[b] Percentage of involved patients, 225

[c] Back pain, arthritis, psychological disorders

In this patient series, the authors reported a conversion of 305 patients with failed VBG to RYGB over a period of 12 years. The response rate was 225 of 305 (73.8%). The motives for conversion were addressed in the majority of patients. The combined food restriction with malabsorption and hormonal action mechanisms of the RYGB can explain these outcomes, clearly resulting in further weight reduction and resolution of associated complications and comorbidities.

Long-term complications occurred in 14.2% of patients, and surgical interventions were necessary in 12.4% of patients. The most frequent complications were hernias, at either internal (5.3%) or trocar (3.1%) sites. However, the published rate of late complications varied between authors. Suter et al. [21] reported an 11.6% late complication rate and a 7.1% reintervention rate. Gagne et al. [36] reported a 31.4% long-term complication rate and an 18.1% reintervention rate. The recently published incidence of internal hernia post-primary RYGB was 3.9%, despite closure of all mesenteric defects using permanent sutures at the time of surgery [43]. However, we started closing intermesenteric defects recently in 2012 when there was no tension on the G-J.

Interestingly, achalasia was diagnosed in one patient 51 months after the conversion to RYGB. This young patient was converted—after 21 months of open Mason—because of weight regain. However, there is no clear explanation for the reasons behind this. This patient did not answer our calls;

Table 5 Long-term series previously published

Author	(*N*) Open/lap RYGB	Center	Follow-up Median (range) months	Late morbidity	Initial BMI kg/m^2	Post-conversion BMI	Mean %EWL	Comorbidity remission	Satisfaction rate
Fronza et al. [49]	(18) 8/10	Single	29 (3–76)	39%	44.9	36.41	46%	N/A	70%
Gagné et al. [36]	(105) 0/105[a]	Single	31 (1–96)	31.4%	42	34	47%	62–96%	N/A
Suter et al. [21]	(203) 0/203	Multi	N/A (6–120)	11.6%	37.4	28.80	76%[b]	N/A	N/A
Apers et al. [16]	(21) 8/13	Single	20 (1–58)	N/A	44	N/A	N/A	N/A	N/A
McKenna et al. [35]	(56) N/A	Single	19.2 ± 8.3	N/A	47	37	46.2%	74.2–100%	N/A
Gys et al. [50]	(90) 50/40	Single	66 (8–165)	18.9%	37.7	29	68.9%	N/A	86.4%
van Wezenbeek et al. [48]	(115) N/A	Single	50 ± 33.3	15.7%	44.1	30.6	43.5%	92.7%	N/A
Current study	**(305) 2/303**	**Single**	**74.3 (5–151)**	**14.2%**	**35.1**	**28.64**	**51.58%**	**84.94%**	**4/5**

N/A not available, *RYGB* Roux-en-Y gastric bypass, *BMI* body mass index, *%EWL* percentage of excess weight loss

[a] "One hand-assisted" adhesiolysis was used for one patient

[b] Presented as the mean percent of excess body mass index loss, %EBMIL

therefore, long-term follow-up data are lacking. Achalasia after bariatric surgery is a rare condition and has been described in very few reports [44].

The mean BMI, %EWL, %EBMIL, and %TWL after a median follow-up of 74.3 (5–151) months were 28.6 kg/m^2, 51.6%, 65.6%, and 17.4%, respectively, considering the pre-RYGB weight as the initial weight. This excellent stable, very long-term weight loss is comparable to that seen after primary RYGB [37]. Nevertheless, some authors reported inferior weight loss for conversional procedures compared with primary RYGB regardless of the initial indication for conversional surgery [45, 46].

Regarding obesity-related comorbidities, the authors reported an overall complete remission among 84.9% of patients and partial remission or improvement in 13.6%. This excellent result was also reported by McKenna et al. [35] and many others [47, 48]. However, a new onset of hypertension, T2DM, and others was noticed in this patient series.

The overall patient assessment of quality of life was excellent despite some variations between patients. Table 5 gives an overview of other long-term series published earlier on the conversion of VBG to RYGB.

To our knowledge, this single-center study of 305 patients over a 12-year period represents the largest sample and the longest follow-up period for laparoscopic conversion of VBG to RYGB published thus far. It also includes a long-term evaluation of obesity-related comorbidities.

However, this study has some limitations including its retrospective nature for a long-term evaluation, which may have led to bias, in either distribution of the study group or patient recall. Additionally, some patients were lost to follow-up and there were some documentation deficiencies. Moreover, in some occasions, objective data was lacking in the patients' files, particularly for the evaluation of comorbidities such as blood pressure, dyspnea, and arthritis. However, the authors made every effort to contact the patients, collect, and verify all of the information included in the study.

Conclusion

After 12 years of experience, RYGB resolves VBG complications and results in prolonged stable weight loss. It has a key role in the treatment and improvement of obesity-related comorbidities and, in expert hands, is the wisest conversional procedure for failed VBG patients, as it is considered safe with a minimal risk of long-term complications and offers an excellent quality of life in the long run.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval Prior to undergoing the conversional procedures, all patients provided written informed consent to have their data used anonymously for academic purposes. 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. The local ethics committee of AZ Sint-Jan Hospital Institutional Review Board approved the study protocol.

Informed Consent Prior to the procedure, all patients provided written and witnessed consent that included their agreement to undergo the procedure, its related details, and the anonymous use of their data for academic purposes. Only patients who gave verbal consent to use their long-term follow-up data when contacted by phone were included in this section.

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