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CLINICAL REPORT

Laparoscopic Gastric Bypass for Failure of Adjustable Gastric Banding: A Review of 85 Cases

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Abstract Laparoscopic adjustable gastric banding (LAGB) is the first bariatric procedure in Europe and is becoming more and more popular in North America. However, the failure rate at 5 years can reach 50%. Although there is still no consensus on revisional surgery, the trend seems to be in favor of conversion to gastric bypass (GBP) with encouraging results. The aim of this study was to assess the results, the risks of conversion into GBP after failure of gastric banding. From January 2003 to July 2010, 85 patients had a revisional GBP after failure of LAGB, performed by two experienced surgeons. Post-operative morbidity, functional results, and weight loss were analyzed. The conversion rate was 2.3%. The mean operative time was 166 min. The mean length of stay was 5.2 days. The early morbidity rate was 7% and the mortality rate was nil. The mean body mass index (BMI) at the time of LAGB was 47.2 kg/m^2 with the lowest BMI reached at 35. The mean BMI at conversion into GBP was 42.9 and the final BMI after a mean follow-up of 22 months was 34.8. Of the patients, 57.7% had a final BMI inferior to 35 and 15.3% had a final BMI superior to 40 and these were super obese and older patients. Super-obesity and advanced age appear to be factors of failure of LAGB and revisional GBP. However, conversion into GBP currently remains the choice procedure in case of gastric banding failure with satisfactory results and acceptable morbidity.

Keywords Morbid obesity · Laparoscopic surgery · Band failure · Revisional surgery · Gastric bypass

Introduction

While laparoscopic adjustable gastric banding (LAGB) is the most commonly used bariatric procedure in Europe and is ever more popular in North America, a 40% to 50% failure rate at 5 years was reported in terms of weight loss and/or bad functional results [1–4]. In case of failure, revisional surgery remains the best option with reported revisional procedure rates of 22% to 25% [5–9].

Several studies have observed the poor results of re-banding [10] and although revisional gastric bypass (GBP) seems efficient in terms of weight loss, there is still no standard of care, especially as we lack standardized studies.

Our study was based on a series of 85 patients who underwent a revisional laparoscopic GBP after LAGB failure from January 2003 to July 2010. The aim was to analyze the risks, the results, and the right indications of conversion into GBP and what the best management was in case of weight loss failure.

Methods

Population

From January 2003 to July 2010, 348 laparoscopic GBP were performed by two experienced surgeons in two high-

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volume bariatric surgery centers. Out of the 348 GBP, 85 were revisional GBP after gastric band failure and are the subject of this study. A retrospective analysis of prospectively collected data was made. Out of these 85 patients, 68% were operated on between January 2008 and July 2010. The mean age was 39.3 years (extremes 20–56) with 84.7% of females (13 males, 72 females).

At the time of LAGB, the mean body mass index (BMI) was 47.2 kg/m^2 (median, 46.3; extremes 33–67) with 32% of super obese (BMI>50). Seventy-nine percent of the patients had one or more co-morbidities, the prevalence of which is summarized in Table 1. The lowest BMI reached with the band was 35 on average (extremes 23–53.3). The mean delay for conversion into GBP was 6.2 years (extremes 1–13).

At the time of conversion into GBP, the mean BMI was 32.9 kg/m^2 (median 42, extremes 27–72). Eight percent of the patients had a re-banding before the conversion and 14% had the band removed on average 4 years before the conversion (details of the indications are summarized in Table 2). Indications of conversion into GBP were: insufficient weight loss or persistence of co-morbidities in 56.5% of the cases, band-related complications in 34% of the cases, a two-stage procedure proposed to super obese in 6% of the cases, and food intolerance with patient request in 3.5% of the cases (indications are summarized in Table 3).

Pre-operative Assessment

All the operated patients benefited from a multi-disciplinary evaluation similar to the one carried out at the time of LAGB. The patients complaining from gastro-esophageal reflux with heart burn or dysphagia had a gastrografin esophagram and an esophageal manometry to detect any band-related complication or esophageal motility disorders. A new gastroscopy with systematic biopsies was done to detect a possible *Helicobacter pylori* infestation or presence of dysplasia (which contra-indicates surgery). The pre-albumin was measured to detect malnutrition.

Table 1 Prevalence of pre-operative co-morbidities in population

Co-morbidities	Number of patients (n=85)	%
Type II diabetes	26	30.6
Sleep apnea	12	14.1
Arterial hypertension	29	34.1
Arthrosis	32	37.6
Dyslipidemia	11	12.9
None	18	21.2

Table 2 Prevalence and indications of re-banding or band removal before conversion into GBP over 85 patients

Surgery before revisional GBP Indications	Re-banding	Band removal
Slippage/pouch dilatation	6	3
Reflux/esophagitis		3
Sepsis	1	2
Migration		1
Esophageal motility disorders		3
Total	8%	14%

Surgical Procedure

The patients who still had the gastric band had a systematic total deflating 1 month before conversion into GBP so as to avoid gastric pouch dilatation and be in favorable condition before revisional surgery. The conversion into GBP was done by laparoscopy, using a six-port technique. The first stage was the removal of the band: the gastro-gastric valve was dismantled, the left crura was identified and dissected and was the marker of the gastric transection. The fibrous gang covering the band was removed so as to staple the stomach onto healthy tissues. The second stage was the performing of the GBP as described by Lonroth et al. [11]. In case of gastric pouch dilatation, inflammation or severe adhesions, conversion into GBP could be delayed by 3 to 6 months. The smallest possible gastric pouch was made (30 cc) by stapling the stomach using a flexible ETS 45 linear stapler loaded with blue cartridges (Ethicon Endosurgery). The first jejunal loop was used and moved up into antecolic position after epiploic transection so as to perform the gastro-jujenal anastomosis. We performed an end-to-side gastro-jejunal anastomosis using an ETS 45 linear stapler loaded with blue cartridges. Closure of the anterior part of the anastomosis was done using 2/0 Vicryl running suture. A methylene blue test was done to check for the impermeability of the anastomosis. The alimentary limb was 150 cm long. A latero-lateral jejuno-jejunal anastomosis was performed with an ETS 45 linear stapler loaded with vascular cartridges. The closure of the Petersen area was systematic, using a non-resorbable silk suture (2/0). Drainage of the gastro-jejunal anastomosis was systematic.

Post-operative Management and Follow-Up

All the patients had eaten nothing until the gastrografin esophagram on post-operative day 2 performed to detect an anastomotic fistula. Drainage was removed on post-operative day 3 and the patients were fed with mixed and fractionated food.

Table 3 Indications of conversion into GBP

Indications of conversion	Number of patients ($n=85$)	%
Weight loss failure/persistence of co-morbidities	48	56.5
Band-related complications	29	34
Reflux/esophagitis	14	16.5
Esophageal motility disorders	10	11.7
Slippage/pouch dilatation	4	4.7
Migration	1	1.1
2-stage procedure	5	6
Food intolerance/patients' request	3	3.5

Early and delayed (>30 days) post-operative morbidities were registered. All the patients had a post-operative visit at 2 months, then a combined medical and surgical follow-up at 3, 6, and 12 months, then yearly. Weight loss was assessed and various blood measurements were done to detect a possible deficiency or malnutrition. Weight loss was deemed insufficient when BMI was superior to 35 at 12 months after surgery. Diabetes was considered cured when glycemia and HbA1C were normalized in the absence of oral medication or insulin. Improvement was defined as a glycemic balance obtained with reduced dosages of oral medication and insulin. Sleep apnea were considered cured when apnea–hypopnea index (AHI) was inferior to 15 (number of apnea–hypopnea per hour) and improved when AHI was inferior to 30. Arterial hypertension was considered cured when blood pressure was normalized in the absence of oral medication and improved when the medical treatment was reduced.

Quality of life was assessed with a BAROS questionnaire at 1 year. Patients were considered lost to follow-up when they had not been seen for more than a year.

Statistical Analysis

Results are expressed as mean or median and extremes, unless otherwise indicated.

Comparisons between variables were assessed by regression analysis. Distribution of variables between groups were studied by ANOVA or unpaired t test as appropriate. The statistical significance was set at $p<0.05$.

Results

Intra-operative Data

Out of the 85 patients operated on, 71 still had their band at the time of conversion into GBP. We were able to perform the GBP at the same time as the removal of the band in 96% of the cases: the bypass had to be delayed intra-operatively in 4% of the cases due to one gastric injury and two severe dilatations of the gastric pouch. The 14 GBP performed secondarily to the removal of the band were indicated due to weight regain after band removal or as part of a two-stage procedure (6% of the indications). The mean operative time was 166 min (median, 150; extremes, 110–360). Two patients required a laparotomy (2.3%) due to a gastric stapling problem and severe adhesions in a patient with a history of vertical banding gastroplasty (VBG). Concerning the other intra-operative problems: a procedure was prolonged (360min) in a super obese patient (BMI=72) whose biliary limb was confused with the alimentary limb, which required redoing the gastro-jejunal anastomosis during the same laparoscopic procedure. We were unable to perform a Roux-en-Y GBP in one super obese male (IMC=54) because of thick *meso* and too short an alimentary limb to be moved up to a small gastric pouch: we then performed a mini GBP. The operative time was significantly increased when BMI was high ($p<0.0001$; Fig. 1).

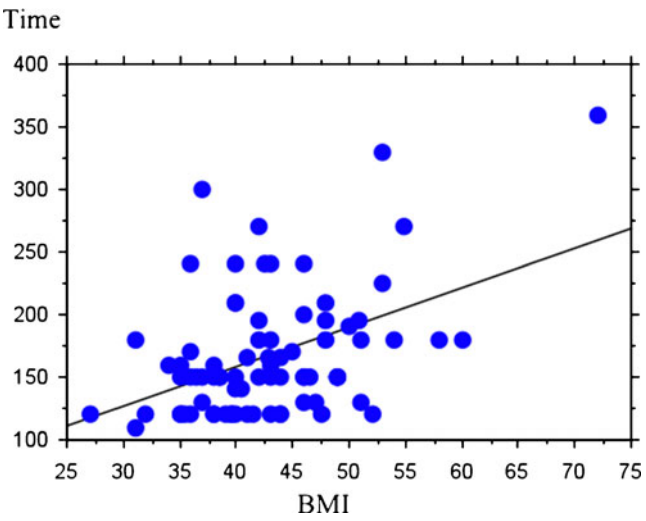

Fig. 1 Operative duration (minutes) and BMI (kilograms per square meter) at time of conversion into GBP

Morbidity and Mortality

The Mean Length of Stay Was 5.2 Days (Median, 4; Extremes, 3–35)

The early morbidity rate was 7% (the complications are summarized in Table 4) with two early redo procedures on post-operative day 2: one by laparoscopy due to a fistula on the part of the stomach left out, and one by laparotomy due to an undetected small bowel injury responsible for peritonitis. The other early complications could be treated medically. No fistula of the gastro-jejunal anastomosis could be identified on the gastrografin esophagram done on post-operative day 2. The delayed morbidity rate was 4.7% with two stenosis of the gastro-jejunal anastomosis treated by endoscopic dilatation and prosthesis. Out of these two patients, one required a new procedure to redo the gastro-jejunal anastomosis due to failure of the endoscopic treatment (Table 4). Five patients had a post-operative dumping syndrome which improved 2 to 3 months after the gastric bypass thanks to modifications of their diet with the dietician's help. The mortality rate was nil.

Follow-Up

Only one patient was lost to follow-up, which corresponds to a follow-up rate of 98.7%. The mean follow-up duration was 22 months (median, 13; extremes, 3–72). It is worth noting that 35.3% of the patients were operated on in the last year and had therefore less than 1 year of follow-up. The mean BMI at the first procedure (LAGB) was 47.2 kg/m^2. The lowest BMI reached with the band was 35 kg/m^2. The mean BMI at the time of conversion into GBP was 42.9 kg/m^2 and the mean final BMI obtained after conversion was 34.8 kg/m^2 (extremes, 22–50) that is to say a mean loss of 8.1 points of BMI after conversion and a mean total loss of 12.4 points of BMI (Fig. 2). Concerning co-morbidities, out of the 30.6% of diabetic patients before GBP, 83% were cured and 17% improved by the conversion. Eighty-two percent of the patients with sleep apnea were cured or improved by the gastric bypass and 58% of arterial hypertensions were also cured or improved. All the patients complaining of gastro-esophageal reflux with esophagitis or esophageal motility disorders were cured by the GBP which markedly improved their feeding comfort. A mean gain of 1.5 points was observed 1 year after revisional surgery in the BAROS questionnaire relative to quality of life. At the end of follow-up, 57.7% of the patients had a BMI inferior to 35 kg/m^2 and 27% of the patients had a BMI between 35 and 40 kg/m^2. Of the patients, 15.3% still had a BMI superior to 40 kg/m^2 and were considered as having insufficient weight loss: this sub-group of patients corresponded to an initial population of super or super-super obese (BMI >50) and older patients (mean age at the time of LAGB, 46 years). There was a significant correlation between initial BMI and final BMI ($p < 0.0001$; Fig. 3); however, there was no significant correlation between initial BMI and the extent of weight loss ($p = 0.02$). In the same way, there was a significant correlation between advanced age and a higher final BMI ($p = 0.04$) but the extent of weight loss was not related to age ($p = 0.3$).

If we arbitrarily consider patients who lose less than 6 points of BMI after the revisional bypass, we count 10 patients out of 85 (11.7%), six of whom (60%) had less than 1 year of follow-up and were still in the decreasing phase of weight loss. These 10 patients had a mean BMI before the revisional bypass of 47 kg/m^2 and three of them (30%) were super obese.

Table 4 Post-operative morbidity

Post-operative morbidity Nb of patients	Early	Delayed (>30 days)	Treatment
1	Gastric fistula		Laparoscopy
1	Small bowel injury		Laparotomy
1	Liver abscess		Antibiotics
1	Peritoneal abscess		Antibiotics
1	Rhabdomyolysis/bilateral brachial plexus		Medical
1	Unexplained fever		Antibiotics
2		Gastro-jejunal anastomosis stenosis	1 Prosthesis 1 Laparotomy
2		Incisional hernia	0
Total	6/85 (7%)	4/85 (4.7%)	

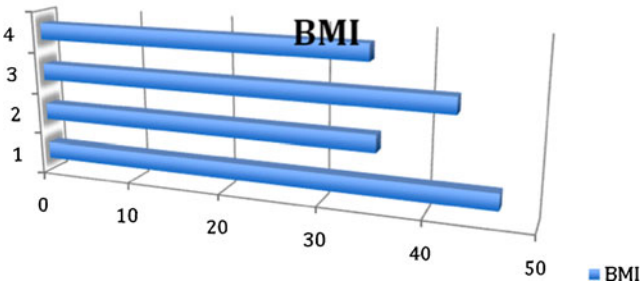

Fig. 2 BMI evolution during the different stages of obesity management. *1* before LAGB, *2* after LAGB, *3* at the time of conversion into GBP, *4* final BMI after conversion

Discussion

LAGB gained greatly in popularity in the 1990s in Europe, due largely to its non-invasive and reversible character [1, 3, 12, 13]. But although it is still the most commonly performed bariatric procedure nowadays, the fact remains that the failure rate at 5 years reaches 50% [1, 3, 4, 10], whether in terms of insufficient weight loss or of failure due to band-related complications (slippage, pouch dilatation, esophageal motility disorders, and reflux). In our series, 34% of the indications of revisional surgery corresponded to band-related complications with a majority of reflux complicated with esophagitis and of esophageal motility disorders. Weight loss failure corresponded to 56.5% of the indications of conversion. After an observation period of nearly 15 years, we arrive at a stage when it becomes unavoidable to manage these band failures. And it concerns mostly patients who have remained obese with co-morbidities and a history of abdominal surgery, which further increases the surgical risk.

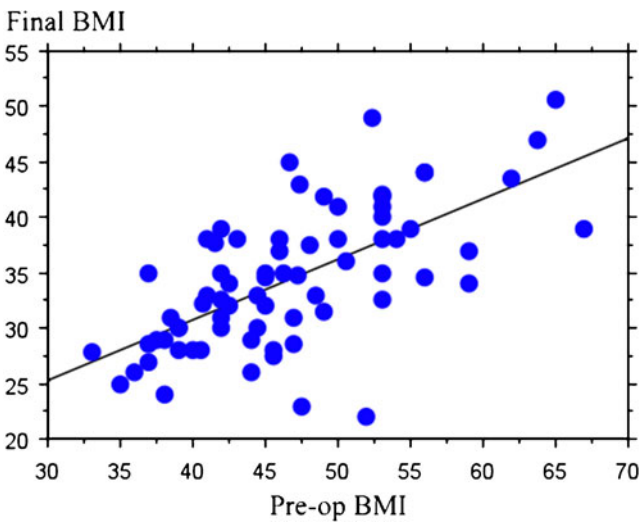

Fig. 3 Correlation between final BMI and pre-operative BMI

In our series, the mean BMI at time of conversion into GBP was 42.9 kg/m^2 and is similar to literature data [2, 7, 14–16]. If the authors agree on the fact that a revisional surgery is the best option in case of weight loss failure [6, 10] with revisional surgery rates close to 25% [5, 7–9], there is still no standard of care concerning the choice procedure due to a lack of significant data. The re-banding option remains controversial and seems doomed to failure in terms of weight loss [4, 15, 17, 18] and the studies tend to prefer procedures with a malabsorptive component [19]. Thus, conversion into GBP appears to be superior in terms of weight loss and seems at present the best option to many authors in case of band failure [4, 10, 12, 15, 17, 18, 20]. Besides, as weight gain seems inevitable after band removal, we may wonder if it would not be better to reduce the delay of conversion (6.2 years in our series): this would make it possible to operate on patients with a lower BMI, which facilitates the procedure and would avoid the deterioration of co-morbidities.

Another major advantage of conversion into GBP is the disappearance of esophageal motility disorders and the cure of gastro-esophageal reflux symptoms already reported by other authors [15, 21]. The band is indeed a cause of esophageal dyskinesia and contribute to reflux in case of inappropriate inflating [22, 23]: in our series, 3.5% of the indications of conversion concerned food intolerance, encouraging the patients to “ask for” a bypass. In the study of Van Wageningen et al. [14], 11% of the indications of conversion corresponded to food intolerance and vomiting. The improvement of feeding comfort and therefore of the quality of life of the patients is one more argument in favor of revisional bypass.

After conversion into GBP, we observed the improvement if not the cure of co-morbidities and in particular type II diabetes: thus the existence of diabetes is now a strong argument in our strategy to perform a gastric bypass as a first procedure [24], reserving indications of LAGB for non-diabetic young patients, without maladaptive eating disorders.

Although the risk of post-operative complications are higher in patients who had a revisional GBP [20, 25, 26], the morbidity rate in case of conversion into laparoscopic GBP remains acceptable according to a review by Gagner et al. with an average of 7%, that can reach 20% [10]. Our series also reports an early morbidity rate of 7% with a low laparotomy conversion rate (2.3%, including one patient with a history of VBG), which confirms the feasibility of this procedure as several studies had already demonstrated [2, 4, 14]. This procedure still remains technically difficult as the long operative time shows (average of 166 min in our series going up to 360 min). This requires a long experience of bariatric and laparoscopic surgery, in high-volume centers, with multi-disciplinary departments making it

possible to manage potential complications (radiologic drainage, endoscopy, and post-operative resuscitation). Even if laparoscopic conversion into GBP is difficult due to adhesions and inflammation secondary to LAGB, it seems feasible at the same time as the removal of the band: we think this option is preferable when it is technically feasible because it avoids weight regain during the time between the band removal and the revisional bypass and it also avoids an additional general anesthesia. In our study, only 4% of the patients with a band required a delayed bypass that could not be done at the same as the removal of the band due to a big pouch dilatation or due to considerable local inflammation. The absence of gastro-jejunal anastomosis fistula in this study is one more argument for performing the GBP at the same time as the removal of the band since it seems to demonstrate that the risks are not significantly increased by fibrosis resulting from the LAGB. In our experience, it is nevertheless essential to totally deflate the band 1 month before the conversion and to totally excise the fibrous gang covering the band so as to staple the stomach onto healthy tissues. We can then make a very small gastric pouch (around 30 cc) so as to avoid the recurrence of obesity due to long-term pouch dilatation. However, we observed two cases of late gastro-jejunal anastomosis stenosis in our series that could result from the gastric stapling onto the stomach tissue damaged by the band.

After a mean follow-up of 22 months, we observed a mean final BMI of 34.8 kg/m^2, that is to say a mean loss of 8.1 points of BMI after the revisional bypass, which is in keeping with the other series [7, 14–16]. Of the patients, 57.7% had a BMI inferior or equal to 35 kg/m^2 and 27% had a BMI between 35 and 40 kg/m^2: however, these results are to be nuanced given that 35% of the patients in our series were operated on in the last year and have therefore less than 1 year of follow-up. This leads us to expect a higher percentage of BMI inferior to 35 kg/m^2 after 12 to 18 months of follow-up. We also identified a sub-group of patients (15.3%) whose final BMI was still superior to 40 corresponding to patients who were initially super and super-super obese as well as older (average of 46 years) at the first procedure. Several series had already identified age and binge-eating disorder as predictive factors of LAGB failure [27–30]. This observation led us to think about the best strategy to adopt in the global management of obesity: while we were proposing to super obese patients a two-stage strategy including LAGB first and then a conversion into GBP (6% of the indications in our series), it would be interesting in the light of these results to propose a sleeve gastrectomy first, which is more efficient in terms of weight loss [31], followed by a conversion into duodenal switch [32–36].

In conclusion, LAGB remains the first bariatric procedure worldwide despite a failure rate of 50% [1, 4, 10]. Thus, the need for revisional surgery is ever-increasing and even if no standard of care is defined at present, laparoscopic conversion into GBP remains the favored one [4, 10, 12, 15, 17, 18, 20] with an acceptable morbidity of 10% on average [10], a benefit that has been proved in terms of weight loss, improvement of co-morbidities, and a major advantage in the cure of esophageal motility disorders and reflux [15, 21]. However, a number of failures are observed in super obese and older patients that could lead to modify the strategy for these patients. Thus LAGB should not be systematically the first procedure anymore and its indications must be reserved for selected patients (BMI<50, neither binge-eating disorder nor metabolic disease), avoiding failure of revisional bypass whose management is still much more complex.

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