Laparoscopic mini-gastric bypass versus laparoscopic Roux-en-Y gastric bypass in redosurgery after failed vertical banded gastroplasty with long gastric pouch

Mohamed H. Zaid, Ahmed M. Sabry, Ahmed Khalil

Department of General Surgery, Ain Shams University, Cairo, Egypt

Correspondence to Mohamed H. Zaid, Assistant professor of general surgery, Department of General Surgery, Faculty of Medicine, Ain Shams University, Cairo, Egypt. Tel: +201223809457; e-mail: hamdymhz@gmail.com

Received: 8 November 2023
Revised: 19 November 2023
Accepted: 27 November 2023
Published: 31 January 2024

The Egyptian Journal of Surgery 2024, 43:124–130

Background
Up to 50% of patients who undergo vertical band gastroplasty (VBG) experienced weight regain or complications, like band erosion or slippage, within 5–10 years of the procedure, the aim of the study to evaluate laparoscopic mini-gastric bypass versus laparoscopic Roux-en-Y gastric bypass as a redosurgery after failed VBG.

Patients and methods
We analyzed the data of 102 patients (38 males and 64 females) underwent revisional surgery after failed VBGs from July 2021 to August 2022, with mean age 45.92 years, follow up for 1 year in Ain Shams University Hospitals.

Results
The mean hospital stay was 1.8 days (1–4 days), 2.9 days (2–7 days) in Redo laparoscopic mini gastric bypass (R-LMNGB) and Redo laparoscopic roux en Y gastric bypass (R-LRYGB) respectively. Postoperative BMI after 1 year 31.16 ±27.83 and 31.94±3.69 in R-LMNGB and R-LRYGB, respectively, %EWL show significant difference between two groups after 3 months and 1 year. Postoperative complications rates were 3.92% in R-LRYGB.

Conclusions
R-LMNGB after failed VBG has almost the same results of R-LRYGB as regard weight loss, improvement of obesity-related comorbidities with less operative time, hospital stay, less anastomosis, and complications.

Keywords:
laparoscopic mini-gastric bypass, laparoscopic Roux-en-Y gastric bypass, vertical banded gastroplasty

Egyptian J Surgery 43:124–130

1110-1121

Introduction

Morbid obesity is a major public health problem worldwide, therefore nowadays bariatric surgery is established as an effective treatment option for patients with morbid obesity who were unable to lose enough weight with nonsurgical treatment. Vertical band gastroplasty (VBG) was a popular bariatric procedure used few years ago, but it has high failure rate which led to a decline in its use. Studies reported that up to 50% of patients who underwent VBG experienced weight regain or complications, like band erosion or slippage, within 5–10 years of the procedure [1,2].

Revision of VBG surgery may be necessary for patients who have experienced weight regain or complications. Roux-en-Y gastric bypass (RYGB) has traditionally been considered the gold standard for redosurgery after failed VBG, because it has shown to be effective in weight loss and resolving comorbidities [3]. However, RYGB is technically challenging and has a higher complications rate compared with other primary bariatric procedures [4].

Mini-gastric bypass (MGB) has evolved as another surgical option for redo after failed VBG. MGB is single anastomosis gastric bypass which is a simpler and quicker surgery than RYGB, with a short operative time, less blood loss, and fewer anastomoses (one anastomosis) [5,6]. MGB also has a lower risk of complications compared with RYGB, such as anastomotic leaks and strictures [7].

Many studies have compared RYGB and MGB as primary bariatric procedures, but there is limited data on the safety and efficacy of these procedures as redosurgery after failed VBG. Therefore, the purpose of this study is to compare the outcomes of RYGB and MGB as revision surgery for failed VBG. Specifically, this study aims to compare outcome of weight loss, resolution of comorbidities, nutritional defects on long-term follow up, and complication

rates of RYGB and MGB in patients who have undergone redosurgery after failed VBG.

Patients and methods

One hundred and two patients (38 males and 64 females) underwent revisional surgery after failed VBGs due to regain of weight, failure of weight loss, or VBG-related complications from July 2021 to August 2022, with mean age 45.92 years, follow up for 1 year in Ain Shams University Hospitals. This research was performed at the Department of General Surgery, Ain Shams University. Ethical Committee approval and written, informed consent were obtained from all patients.

Fourteen patients underwent laparoscopic VBGs and other 88 patients had open VBGs. Preoperative evaluation as regard weight loss, weight regain, obesity-related comorbidities (type 2 diabetes mellitus, hypertension, obstructive sleep apnea) and dysphagia after VBG.

Preoperative assessment by multidisciplinary team of nutritional, anesthesia, endocrinal, psychiatric, and behavioral.

Multislice computed tomography gastroscopy with volumetry and upper gastrointestinal tract endoscopy were performed to evaluate pouch size, gastrogastric fistula, gastroesophageal reflux disease (GERD), stricture, and hiatus hernia. All patients were informed about risks of revisional surgery and the possibility of conversion to open surgery, other alternatives, and benefits of redosurgery. Informed consent was obtained from all patients in the study. Patients with GERD (clinically or upper gastrointestinal tract finding) after VBG will be excluded from our study, patients with short gastric pouch in preoperative assessment were excluded from the study.

Data collected and reviewed for age, sex, obesity-related comorbidities, electrolytes, operative time, complications, weight, BMI, and %EWL.

Randomization

A computer program for randomization (Random Allocation Software).

Surgical technique

All patients admitted at the morning of operation. Patients received a third-generation cephalosporin 1 h before operation. Subcutaneous low-molecular weight heparin was administrated 12 h preoperatively as a prophylaxis for deep vein thrombosis. The patient placed in the table in supine reverse Trendelenburg position.

Both surgical procedures were performed by the same team laparoscopically using the five-port technique. Any adhesions in the anterior abdominal wall or between stomach and liver were lysed.

The laparoscopic mini-gastric bypass

The gastric pouch was created by dividing the stomach at the lesser curve about 1 cm above the mesh with no crossing of the staple line of VBG using a 60-mm Endo GIA Universal Stapler (black Tri-Staple cartridge; Auto-suture Division of Covidien, Plymouth, Minnesota, USA). The pouch completed by vertical 60-mm Endo GIA Universal Stapler (black Tri-Staple cartridge) medial to previous staple line of VBG (A 36-F bougie was inserted before vertical stapling).

Gastrojejunostomy was created by 45-mm Endo GIA Universal Stapler (3.5-mm blue cartridge) of 180–220 cm from the duodenojejunal junction (180 cm if BMI <45, 200 cm if $45<$BMI<50 and 220 cm if BMI >50). The stapling defect was closed over bougie by continuous V-loc sutures (Autosuture Division of Covidien).

The laparoscopic Roux-en-Y gastric bypass

After creation of gastric pouch as LMGB a 100 cm from the duodenojejunal junction was measured, and a gastrojejunal anastomosis was created with a 45-mm Endo GIA stapler (3.5-mm blue cartridge).

The stapling defect was closed over the bougie with a single continuous layer 2-0 absorbable V-Loc suture (Autosuture Division of Covidien). The biliopancreatic limb was divided just before the gastrojejunostomy with a 60-mm Endo GIA stapler (white cartridge) and then side-to-side anastomosis to a 70-cm alimentary limb using a 60-mm endo stapler (white cartridge).

Then, the stapling defect was closed with single layer continuous 2-0 absorbable V-Loc sutures. The Petersen's space and mesenteric defects were closed with 2-0 nonabsorbable sutures.

Methylene blue test was done through bougie to assess gastrojejunal anastomosis in both surgical procedures followed by removal of bougie. A drain was left in the gastric bed only if indicated.

Four hours after the operation clear oral fluids (Sips) and mobilization were started. Patients were discharged the next day of surgery if they are stable and tolerating oral intake. All patients received low-molecular weight heparin for 14 days postoperative and proton pump inhibitors for 3 months. Patients were scheduled for follow-up appointments by the surgeon and dietitian on day 14 and at 1, 3, 6, 9, and 12-month postoperatively.

Results

There was no significant difference between two groups as regard age, sex, preoperative BMI, and comorbidities (Table 1). There was no significant difference between two groups as regard operative time and intraoperative blood loss but in Redo laparoscopic roux en Y gastric bypass (R-LRYGB) more operative time and blood loss than Redo laparoscopic mini gastric bypass (R-LMNGB) (Table 2). The mean hospital stay was 1.8 days (1–4 days), 2.9 days (2–7 days) in R-LMNGB and R-LRYGB, respectively. One patient in R-LRYGB were converted to open surgery due to severe adhesions between liver and stomach. Postoperative complications rates were 3.92% in R-LRYGB as there was one patient who had postoperative bleeding that did not respond to conservative management (packed red blood cells and fresh frozen plasma) and need laparoscopic lavage of hematoma and control of bleeding and other patient was developed leakage from enteroenterostomy which managed by exploration and reanastomosis (Table 2).

Preoperative weight show that no difference between two groups (107.41±16.72 and 110.59±14.12, respectively) but there is significant difference after 1 year as regard weight (Table 3, Fig. 1). There was no significant difference between two groups as regard preoperative BMI, postoperative BMI after 1 year (31.16±27.83 and 31.94±3.69, respectively) (Table 3, Fig. 2). %EWL show significant difference between two groups after 3 months and 1 year (Table 3). There was improvement in comorbidities postoperative in two groups six (75%) patients and five (83.3%) patients showed improvement in hypertension either

Table 1 Demographic characteristics of the patients and preoperative comorbidities

	Groups		Test of significance		
	Mini –bypass	Roux-en-Y			
	Mean±SD/*n* (%)	Mean±SD/*n* (%)	Value	*P* value	Significance
Age	45.88±8.45	45.96±7.86	*t*=–0.049	0.961	NS
Sex					
Male	20 (39.22)	18 (35.29)	χ^2=0.168	0.682	NS
Female	31 (60.78)	33 (64.71)			
Weight	107.41±16.72	110.59±14.12	*t*=–1.036	0.303	NS
Height	165.08±8.61	165.08±8.61	*t*=0.000	1.000	NS
BMI	39.25±3.71	40.55±3.79	*t*=–1.752	0.083	NS
DM	5.5±0.72	5.61±0.7	*t*=–0.767	0.445	NS
HTN					
No	43 (84.3)	45 (88.24)	χ^2=0.33	0.57	NS
Yes	8 (15.7)	6 (11.76)			
OSA					
No	48 (94.12)	46 (90.2)	FE	0.72	NS
Yes	3 (5.88)	5 (9.8)			

DM, diabetes mellitus; HTN, hypertension; OSA, obstructive sleep apnea. *t*, Student *t* test of significance. χ^2, χ^2 test of significance (χ^2).

Table 2 Operative time, blood loss, and complications

	Groups		Test of significance		
	Mini –bypass	Roux-en-Y			
	Mean±SD/*n* (%)	Mean±SD/*n* (%)	Value	*P* value	Significance
Operation time	4.25±0.32	4.44±0.78	*t*=0.000	1.000	NS
Blood loss	227.67±37.14	236.54±42.10	*t*=0.000	1.000	NS
Leakage	0	1 (1.96)	FE	1.00	NS
Bleeding	0	1 (1.96)	FE	1.00	NS
Conversion to open	0	1 (1.96)	FE	1.00	NS

t, Student *t* test of significance. FE, Fisher's exact test of significance.

Table 3 Postoperative weight, BMI, comorbidities, and %EWL

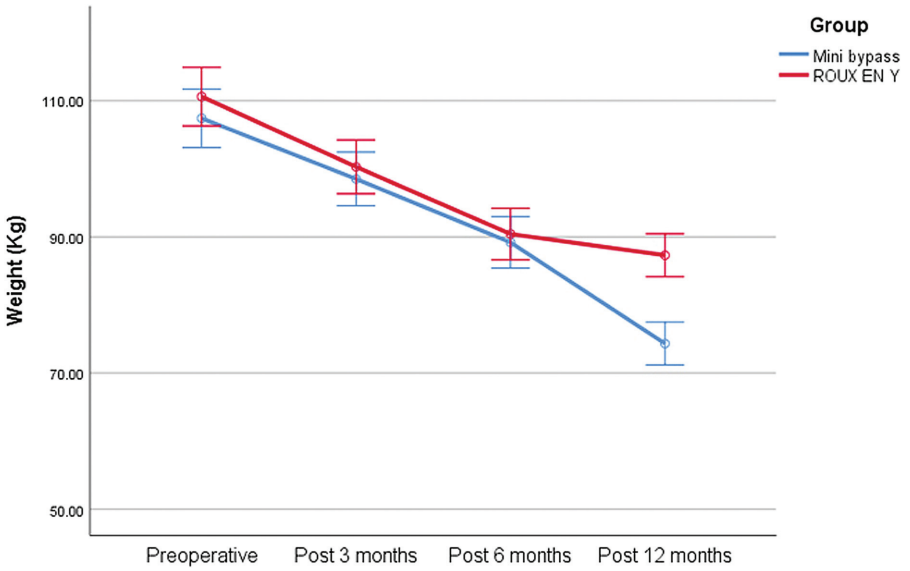
	Groups		Student *t* test		
	Mini bypass	Roux-en-Y			
	Mean±SD	Mean±SD	*t*	*P* value	Significance
Weight					
Preoperative	107.41±16.72	110.59±14.12	*t*=−1.036	0.303	NS
3 months	98.5±14.42	100.27±14.01	*t*=−0.632	0.529	NS
6 months	89.18±12.55	90.41±14.59	*t*=−0.457	0.649	NS
12 months	74.32±8	87.29±13.96	*t*=−5.757	<0.001	S
P value	<0.001[(A1)]	<0.001[(A1)]			
BMI					
Preoperative	39.25±3.71	40.55±3.79	*t*=−1.752	0.083	NS
3 months	36.01±3.2	36.73±3.65	*t*=−1.061	0.291	NS
6 months	32.63±2.88	33.07±3.81	*t*=−0.658	0.512	NS
12 months	31.16±27.83	31.94±3.69	*t*=−0.198	0.843	NS
P value	<0.001[(A2)]	<0.001[(A1)]			
DM					
Pre	5.5±0.72	5.61±0.7	*t*=−0.767	0.445	NS
Post	4.46±0.7	4.56±0.7	*t*=−0.734	0.464	NS
P value	<0.001	<0.001			
% EWL					
3 months	22.6±5.3%	28.1±7.1%	*t*=−4.354	<0.001	S
6 months	47±8.8%	46.5±6.1%	*t*=0.328	0.744	NS
12 months	83.8%±11.2%	76.6%±3.8%	*t*=4.319	<0.001	S
P value	<0.001[(A1)]	<0.001[(A1)]			

DM, diabetes mellitus. [(A)]Repeated measured analysis of variance test of significance. [(A1)]Post hoc Bonferroni test was significant between all follow up. [(A2)]Pre versus 3 and 6 months and 3 months versus 6 months.

reduce or stop drug intake, all patients presented with obstructive sleep apnea improved with reduction of weight, preoperative glycated hemoglobin was 5.5 ±0.72 and 5.61±0.7 that show postoperative improvement in two groups (Table 3).

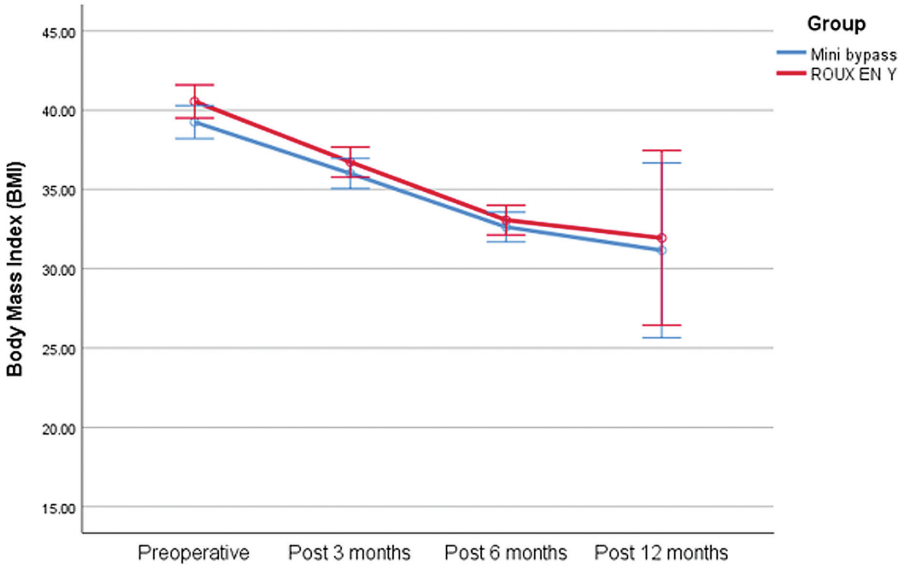
Postoperative albumin level showed significant difference between two groups (Table 4). There was no statistical difference in postoperative iron and calcium but in RYGB showed that less decrease in iron and calcium level than MGB (Table 4). No

Figure 1



Weight preoperative and postoperative in two groups.

Figure 2



BMI preoperative and postoperative in two groups.

statistical difference in postoperative parathyroid hormone (PTH) in two groups (Table 4).

Discussion

Open VBG was mostly used as a restrictive procedure for weight loss before laparoscopic era [8]. Laparoscopic VBG or open VBG had good results in weight loss in short-term and medium-term outcome [3,9]. But it has high failure rate which led to a decline in its use. Studies reported that up to 50% of patients who underwent VBG experienced weight regain or complications, like severe GERD, band erosion, or slippage, within 5–10 years of the procedure [1,2]. Most of patients who underwent VBG need revisional surgery within 12 years that is reported by van Gemert *et al.* [10].

Revisional bariatric surgery is challenging due to multiple difficulties as disturbed anatomy and adhesions between stomach and liver in addition to difficulties in identifying previous stapler line and

Table 4 Postoperative albumin, iron, calcium, and parathyroid hormone

	Groups		Student *t* test		
	Mini bypass	Roux-en-Y			
	Mean±SD	Mean±SD	*t*	*P* value	Significance
Albumin					
Pre	3.92±0.28	3.96±0.25	−0.894	0.374	NS
Post	3.26±0.3	3.41±0.27	−2.68	0.009	S
P value	<0.001	<0.001			
Iron					
Pre	72.75±26.92	73.84±26.3	−0.208	0.835	NS
Post	57.9±26.72	67.04±26.38	−1.738	0.085	NS
P value	<0.001	<0.001			
Calcium					
Pre	9.01±0.55	8.96±0.52	0.463	0.644	NS
Post	8.56±0.55	8.77±0.53	−1.972	0.051	NS
P value	<0.001	<0.001			
PTH					
Pre	37.69±14.59	38.49±13.62	−0.288	0.774	NS
Post	43.51±14.48	43.63±13.57	−0.042	0.966	NS
P value	<0.001	<0.001			

PTH, parathyroid hormone.

presence of fibrosis that may lead to increase incidence of leakage [11].

Gys *et al.* [12], reported that morbidity rate in R-LRYGB 12–41% and mortality rate was 0–2%. Suter *et al.* [13] reported that 11.6% complications rate and 0.5% mortality rate. In this series, there was no mortality with overall morbidity were 3.92% in R-LRYGB while there was no morbidity in R-LMGB.

Vasas *et al.* [14] and Iannelli *et al.* [15], reported that the mean hospital stay after R-LRYGB was 6.8 and 4.3 days. In this series, the mean hospital stay was 1.8 days (1–4 days), 2.9 days (2–7 days) in R-LMNGB and R-LRYGB, respectively.

The %EBWL that reported by Gys *et al.* [12], Mognol *et al.* [16] and Suter *et al.* [13], after 1 year in R-LRYGB were 78, 62, and 76%, respectively. In our series the mean %EBWL was 83.8 and 76.6% in R-LMNGB and R-LRYGB, respectively, up to our knowledge there is no literature discussing R-LMNGB after failed VBG.

Khewater *et al.* [17], reported that complete remission from diabetes mellitus in 84.9% and partial improvement in 13.6%. In this series, there was improvement in obesity-related comorbidities, preoperative glycated hemoglobin was 5.5±0.72 and 5.61±0.7 that show postoperative improvement 4.46 ±0.7 and 4.56±0.7 in two groups, respectively (Table 3). Postoperative in two groups six (75%) patients and five (83.3%) patients shown improvement in hypertension either reduce or stop drug intake, all patients presented with obstructive sleep apnea improved with reduction of weight.

LMNGB allows some alkaline biliary reflux to enter the esophagus in contrary to RYGB.

The long gastric pouch with single anastomosis that distal to the cardia reduce alkaline reflux esophagitis, reflux biliary gastritis reported in LMNGB but rarely reported in literature [18].

Bruzzi *et al.* [19] and von Drygalski and Andris [20], reported that primary MNGB is safer and offer more weight loss than RYGB but malnutrition more in MNGB than RYGB. As in primary surgery revisional surgery show the same results as our series show more loss of weight in R-LMNG than R-LRYGB. As regard malnutrition R-LRYGB showed that less decrease in iron and calcium level than R-LMGB, but there was no statistical difference in postoperative iron and calcium (Table 4). No statistical difference in postoperative PTH in two groups (Table 4).

Revisional bariatric procedures are challenging with risk of complications more than primary surgery. If there is long gastric pouch R-LMNGB after failed VBG has almost the same results of R-LRYGB as regard loss of weight, improvement of obesity-related comorbidities with less hospital stay, operative time, less anastomosis, and complications, so R-LMNGB is safer and more feasible than R-LRYGB but need more studies with long-term follow up.

Conclusion

LMNGB is feasible and safe revisional surgery after failed VBG with long gastric pouch as it has the same results of R-LRYGB with less postoperative complications but may be associated with malnutrition.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1 Suter M, Calmes JM, Paroz A, Giusti V. A 10-year experience with laparoscopic gastric banding for morbid obesity: high long-term complication and failure rates. Obes Surg 2006; 16:829–835.

2 O'Brien PE, Dixon JB. The extent of the problem of obesity. Am J Surg 2002; 184(6B):4S–8S.

3 Buchwald H, Avidor Y, Braunwald E, Jensen MD, Pories W, Fahrbach K, *et al.* Bariatric surgery: a systematic review and meta-analysis. JAMA 2004; 292:1724–1737.

4 Nguyen NT, Root J, Zainabadi K, Sabio A, Chalifoux S, Stevens CM, *et al.* Accelerated growth of bariatric surgery with the introduction of minimally invasive surgery. Arch Surg 2005; 140:1198–1202.

5 Rutledge R. The mini-gastric bypass: experience with the first 1,274 cases. Obes Surg 2001; 11:276–280.

6 Lee W, Yu P, Wang W, Chen T, Wei P, Huang M. Laparoscopic Roux-en-Y versus mini-gastric bypass for the treatment of morbid obesity: a prospective randomized controlled trial. Ann Surg 2005; 242:20–28.

7 Mahawar KK, Carr WR, Jennings N, Balupuri S, Small PK. Simpler gastric bypass: a systematic review of the one anastomosis (mini) gastric bypass. Obes Surg 2012; 22:1821–1827.

8 Morino M, Toppino M, Garrone C, Morino F. Laparoscopic adjustable silicone gastric banding for the treatment of morbid obesity. Br J Surg 1994; 81:1169–1170.

9 Buchwald H, Estok R, Fahrbach K, Banel D, Sledge I. Trends in mortality in bariatric surgery: a systematic review and meta-analysis. Surgery 2007; 142:621–632. discussion 632-635.

10 van Gemert WG, van Wersch MM, Greve JW, Soeters PB. Revi- sional surgery after failed vertical banded gastroplasty: restoration of vertical banded gastroplasty or conversion to gastric bypass. Obes Surg 1998; 8:21–28.

11 Roller JE, Provost DA. Revision of failed gastric restrictive opera- tions to Roux-en-Y gastric bypass: impact of multiple prior bariatric operations on outcome. Obes Surg 2006; 16:865–869.

12 Gys B, Haenen F, Ruyssers M, Gys T, Lafullarde T. Conversion of open vertical banded gastroplasty to Roux-en-Y gastric bypass: a single-center,

single-surgeon experience with 6 years of follow-up. Obes Surg 2016; 26:805–809.

13 Suter M, Ralea S, Millo P, Allé JL. Laparoscopic Roux-en-Y gastric bypass after failed vertical banded gastroplasty: a multicenter expe- rience with 203 patients. Obes Surg 2012; 22:1554–1561.

14 Vasas P, Dillemans B, Van Cauwenberge S, De Visschere M, Vercauteren C. Short and long-term outcomes of vertical banded gastroplasty converted to Roux-en-Y gastric bypass. Obes Surg 2013; 23:241–248.

15 Iannelli A, Amato D, Addeo P, Buratti MS, Dahman M, Amor IB, *et al.* Laparoscopic conversion of vertical banded gastroplasty (Mason MacLean) into Roux-en-Y gastric bypass. Obes Surg 2008; 18:43–46.

16 Mognol P, Chosidow D, Marmuse J. Roux-en-Y gastric bypass after failed vertical banded gastroplasty. Obes Surg 2007; 17:1431–1434.

17 Khewater T, Yercovich N, Grymonprez E, Horevoets J, Mulier JP, Dillemans B. Twelve-year ex- perience with Roux-en-Y gastric bypass as a conversional proce- dure for vertical banded gastroplasty: are we on the right track? Obes Surg 2019; 29:3527–3535.

18 Matthieu Bruzzi, Cédric Rau, Thibault Voron, Martino Guenzi, Anne Berger, Jean-Marc Chevallier. Single anastomosis or mini-gastric bypass: long-term results and quality of life after a 5-year follow-up. Surg Obes Relat Dis. 2015; 11:321–7.

19 Bruzzi M, Rau C, Voron T, Guenzi M, Berger A, Chevallier J. Single anastomosis or mini-gastric bypass: long-term results and quality of life after a 5-year follow-up. Surg Obes Relat Dis 2015; 11:321–327.

20 von Drygalski A, Andris DA. Anemia after bariatric surgery: more than just iron deficiency. Nutr Clin Pract 2009; 24:217–226.