Minigastric bypass: short-term results

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Introduction
Roux-en-y gastric bypass is a successful weight loss surgery together with a great impact on metabolic syndrome. Laparoscopic minigastric bypass is a new emerging bariatric surgery procedure with current debates on its efficacy and safety.
Objectives
The aim of this study was to evaluate the effect of laparoscopic minigastric bypass on weight loss, safety, and associated metabolic diseases.
Patients and methods
The study was performed in Menoufia University Hospital and other private hospitals in Kuwait. All patients underwent laparoscopic minigastric bypass and were followed up for 18 months. Its impact on BMI, %excess weight loss (%EWL), and associated metabolic diseases were reported and analyzed at 6, 12, and 18 months.
Results
A total of 80 patients were included in this study, of whom 49 were female. A total of 58 patients were diabetic, 62 patients were hypertensive, and 69 patients were dyslipidemic. The mean operative time was 92 ± 11.73 min. The mean %EWL was 77.3 ± 9.8%. The mean hospital length of stay was 3 days. One patient had anastomotic leak and two patients had biliary gastritis and were managed with Roux-en-Y gastric bypass. One patient showed marginal ulcer. A total of 47 patients with type 2 diabetes returned to normal glucose level. A total of 51 hypertensive patients became normotensives. A total of 59 patients showed complete improvement in lipid profile after 18 months.
Conclusion
Minigastric bypass is provisionally effective as other standard bariatric surgery procedures, with good impact on associated metabolic diseases.

Keywords:
bypass, metabolic comorbidities, minigastric

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Introduction

Obesity is a worldwide health problem in both developed and developing countries.

Laparoscopic Roux-en-Y bypass (LRYGBP) has been reported as a safe bariatric procedure [1–4]. The learning curve is very steep and associated with longer operating times and higher perioperative complication rates on the upward portion of the curve [5,6]. The 'minigastric bypass,' was introduced by Rutledge [7]. This alternative in the field of bariatric and metabolic surgery has gained increasing attention lately due to its simplicity and claimed safety and effectiveness [8–12].

However, there is controversy surrounding this method concerning the possible harmful and in the long-term even carcinogenic effects of bile reflux in the gastric pouch [6,13]. Symptomatic biliary reflux, gastritis, and esophagitis have been reported after minigastric bypass (MGB) as well [1,9,13]; however, the longer, lesser curvature-based gastric pouch is believed to reduce reflux to a greater extent compared with the Mason loop gastric bypass [5,14,15]. The long pouch has some resemblance with the Magenstrasse–Mill operation [16] but is more effective due to the added bypass. Nevertheless, concerns have been raised about chronic alkaline reflux and the risk for gastric cancer in the long term [6,13,17,18]. laparoscopic minigastric bypass (LMGB) also has some advantages, such as one less anastomosis, shorter operative time (OT), lower risk for anastomotic leakage and internal herniation, shorter learning curve, and the ease of reversibility [7,19]. Bariatric surgery was demonstrated to induce significant and long-term remission of type 2 diabetes mellitus (T2DM) [20,21] and improvement of metabolic/cardiovascular risk factors in severely obese patients [22]. The short-term (decreased caloric intake) and long-term results (decreased fat mass

and body weight) of bariatric surgery complementarily lead to improvement in glucose metabolism, insulin resistance, change in adipocytokine release [23], and quality of life [24]. The objective of this study was to evaluate this operation as regards weight loss, impact on metabolic comorbidities related to obesity, complications, and safety.

Materials and methods

The study was conducted in the Department of Surgery in Menoufia University Hospital and other private hospitals in Egypt and Kuwait (Al Omoma Hospital and Al Seif and Hadi Hospital) (from October 2009 to April 2015). Approval of the study was obtained from the ethics committee. The risk factors, associated comorbidities, and motivations for surgery were evaluated. Patients were enrolled from the outpatient clinic and all types of bariatric procedures were discussed with them. Written informed consent was obtained from all patients who agreed to be involved in this trial. Patients who fulfilled the IFSO criteria were included in the study. The inclusion criteria were as follows: a history of obesity of 5 years or greater duration; BMI greater than 40 kg/m^2 or BMI greater than 35 kg/m^2 with one or more obesity-related comorbidities; documented weight loss attempts in the past; and good motivation for surgery. The age of patients was restricted from 18 to 60 years. Exclusion criteria were as follows: previous bariatric surgery, pregnancy, previous gastric surgery, large abdominal ventral hernia, psychiatric illness, or BMI greater than 60 kg/m^2.

Preoperative preparation

Full clinical examination was carried out, followed by recording of the preoperative BMI, baseline measures of fasting (fasting blood glucose), postprandial blood glucose (PPG) level and glycated hemoglobin (HbA1c), serum triglyceride level, and baseline diastolic blood pressure.

Routine laboratory investigation, morning and evening serum cortisol and thyroid stimulating hormone level were evaluated. Patients were administered a dose of low molecular weight heparin subcutaneously and 1.2 g amoxycillin. Clavulanic acid intravenously with premedication was administered. Calf muscle compressors were applied. Antibiotic, low molecular weight heparin, and analgesia were continued for 1 week.

The surgical technique

The original technique has been described by Rutledge [7] in detail. In short, five ports were used and the stomach was stapled along the lesser curvature with a calibration tube 36 inserted and starting from the gastric incisura to create a long tube. The jejunum is lifted usually 200 cm from the ligament of Treitz and anastomosed to the long gastric tube (Figs. 1–5). The length of the biliopancreatic limb may be tailored according to baseline BMI [25]. The OT, length of hospital stay, and operative complications were reported and assessed. Complications, changes in body weight loss, BMI, quality of life, and comorbidities were determined at follow-up. Changes in quality of life were assessed using the Gastrointestinal Quality of Life Index.

Postoperative care

All of the patients received care under a standard clinical pathway. The nasogastric tube was removed on the first postoperative day, and patients were encouraged to ambulate as soon as they felt able to walk. Oral feeding was allowed starting on the third postoperative day, provided the patient had flatus passage and a normal gastrografin contrast study. Patients were discharged on the fourth postoperative day if they were able to return home. Patients were advised to take liquid diet for 3 weeks and semisolids for 3 weeks and then regular diet later on. Proton pump inhibitors were prescribed for 6 months postoperatively. The outpatient clinic visits were scheduled once a month for the first 3 postoperative months and every 3 months thereafter. BMI, fasting plasma glucose (FPG), 2 h-PPG level, HbA1c, glucose tolerance, diastolic blood pressure, and lipid profile were evaluated at 6, 12, and 18 months postoperatively. Patients were advised to take multivitamin capsule and iron tablet daily, and vitamin B_{12} injection every 3 weeks.

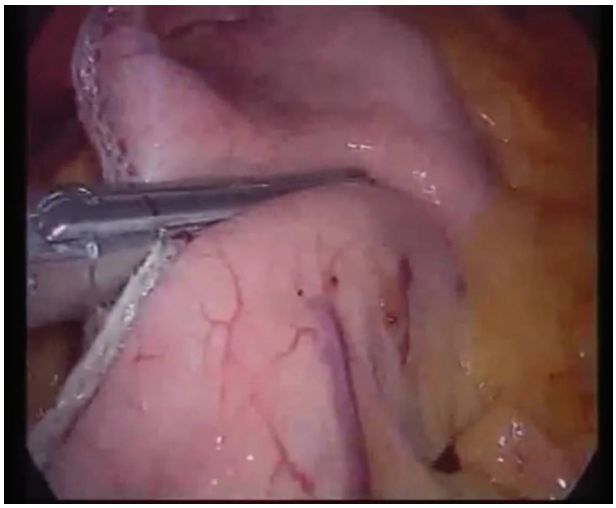
Results

A total of 80 patients were included in this study, of whom 49 were female and 31 were male. A total of 58 of 80 patients were diabetic, 62 patients were hypertensive, and 69 patients were dyslipidemic (Tables 1–4).

The mean OT was 92 ± 11.73 min. The mean %excess weight loss (%EWL) was 29.5 ± 13.3, 49 ± 8.6, and 77.3 ± 9.8% at 6, 12, and 18 months. Mean preoperative HbA1c, FPG, and 2 h-PPG level were 10.2%, 289 ± 14.2, and 378 ± 22 mg/dl, respectively. The mean preoperative diastolic blood pressure was 109 ± 8.8. The mean preoperative triglyceride level was 386.5 ± 19.

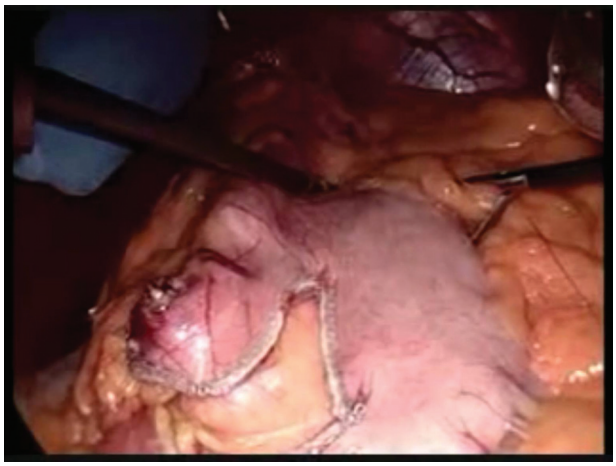
The mean hospital length of stay was 70 ± 6–12.8 h. One patient had anastomotic leak, two patients had gastritis related to biliary reflux, one responded to

Figure 1



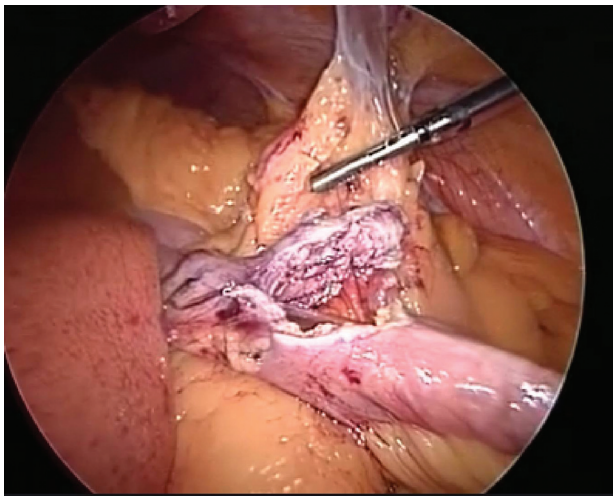
Stapling along the lesser curve of the stomach.

Figure 2



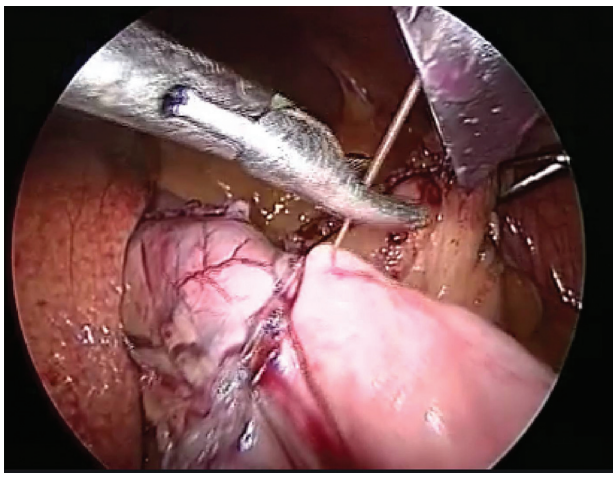
Creation of a long gastric pouch.

Figure 3



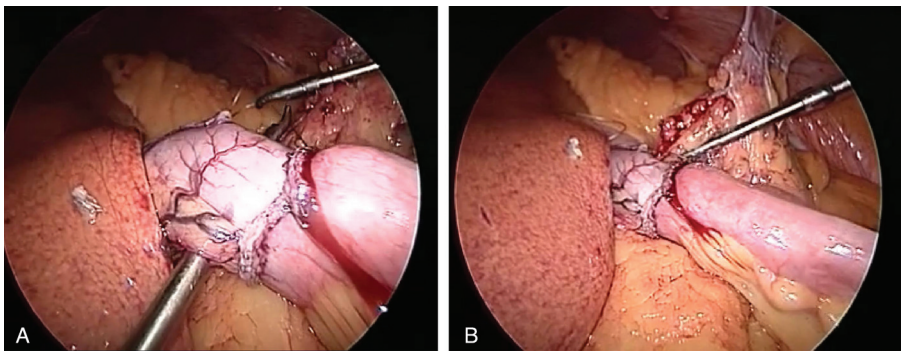
Anastomosis between the jejunal loop and the gastric pouch.

Figure 5



Suturing of the gastrojejunostomy.

Figure 4



(a, b) Completion of the antecolic gastrojejunostomy.

Table 1 Demography of the patients

	Age	Preoperative BMI	Operative duration	Hospital stay
Mean	29±11.7	45±8.35	92±11.73	2.9±0.533 days 70±12.8 h
Range	20–51	43.3–61.7	88–180 min	2–22

Table 2 Impact on BMI and related comorbidities

	Preoperative level	6 Months	12 Months	18 Months	*P* value at 18th months
BMI	45±8.35	29.5±13.3%	54±8.6%	77.3±9.8%	<0.001
FPG (mg/dl)	289±14.2	218	133.7±10.4	88±11	<0.001
2 h PPG	378±22	316.7±21.5	218±17	152±8.2	<0.001
HbA1c	10.2%	9.1%	6.35±1.73	5.3±0.8	<0.001
Serum triglycerides (mg/dl)	386.5±19	334.7±26.3	233±17.5	137±11	<0.001
DBP (mmHg)	109±8.8	103.4±7.2	86.2±13	80±2	<0.001

DBP, diastolic blood pressure; FPG, fasting plasma glucose; HbA1c, glycated hemoglobin; PPG, postprandial glucose.

Table 3 Impact of LMGB on metabolic comorbidities

Comorbidities	Number of patients	Number of cured patients	Cured patients (%)	*P* value
Type 2 diabetes	58	47	81	<0.001
Dyslipidemia	69	59	85.5	<0.001
Hypertension	62	51	82.2	<0.001

LMGB, laparoscopic minigastric bypass.

Table 4 Complications of LMGB

			Number of hospital readmission (days)		Reoperation rate	
Intraoperative complications	Early postoperative complication	Late postoperative complications	<30	>30	Early	Late
	Anastomotic leak (1.25%)	Biliary gastritis in two patients (2.5%)	One patient with persistent vomiting (1.25%)	Three patients (3.75%)	One patient (1.25%) Repair of anastomotic leak	One of the two patients with biliary gastritis needed conversion to LRYGB
	Wound infection (1.25%)	Marginal ulcer (1.25%)				
	Acute bronchitis (1.25)	Anemia (0%)				

LMGB, laparoscopic minigastric bypass; LRYGB, laparoscopic Roux-en-Y bypass.

medical treatment, and the other one was managed with LRYGB.

One patient (1.25%) showed marginal ulcer. A total of 47 of 58 type 2 diabetes patients (81%) returned to normal glucose level by the end of the 18th month and had negative glucose tolerance test ($P<0.001$). A total of 51 of 62 patients (82.2%) became normotensive by the 18th month postoperatively ($P<0.001$) (Tables 1 and 3). A total of 59 of 69 patients (85.5%) had normal lipid profile by the 18th month ($P<0.001$) (Tables 2 and 3). All patients had better quality of life at 18 months postoperatively. Only 71 patients continued to follow-up in the outpatient clinic and nine patients were kept in regular contact through telephone and/or electronic mailing due to lack of compliance to attend the clinic due to their distant accommodation or traveling.

Discussion

Conflicts on the utility of LMGB in weight loss and safety still exist. LMGB was believed to be technically easier compared with the standard LRYGB due to one less anastomosis. Indeed, LMGB could be quickly learned: the learning curve for LMGB was 30 cases less than that for LRYGB [26], and it was estimated that 50 cases were needed to reach a stable OT. Wang *et al.*[27] found that the operations which took longer than 150 min were mainly the first 30 cases and the OT curve decreased to a plateau after 50 cases. Rutledge and Walsh and Piazza and colleagues reported that the OT stabilized at 30.3 and 50 min, respectively, in the later stage of their studies, shorter than the mean time of the whole study period [9,10]. The simplification in the surgical process of LMGB might causally decrease the OT. In addition, in studies that reported the OTs of LMGB and other bariatric surgeries, LMGB always needed short time to be performed [5,12,23,26,28]. In this study the mean OT was 92 ± 11.73 min. Some authors reported that the simplified surgical technique also resulted in less blood loss [12,19], shorter hospitalization [5,26], and faster bowel recovery [12].

The highest overall complication rate was 9% among all enrolled studies [9], and, in studies with a large cohort, it decreased to 5%, much lower than the overall complication rate (17%) of bariatric surgeries recently reported [29]. Moreover, studies with LMGB surgeries, more than 1000 cases, reported a mortality of 0.2%, lower than the average 0.31% death rate of bariatric surgeries [29] and 0.5% in LRYGB [30]. Anastomosis leakage and bleeding were the most frequent early complications of LMGB. Although one less anastomosis compared with LRYGB would surely reduce the risk for anastomotic leakage and bleeding, the long staple line on gastric pouch and remnant stomach might in turn increase such possibility [19]. Lee *et al.*[12] reported 0.2% major bleeding rate in patients undergoing LMGB, whereas it was 1% in LRYGB. In contrast with the early complication rate of 11.8% in laparoscopic sleeve gastrectomy (LSG), LMGB achieved a much lower rate of 4.8% [5]. As direct data comparing the bleeding and leakage rates of LMGB with those of other bariatric surgeries has not been reported, these results provisionally indicated the noninferiority of LMGB to other bariatric procedures concerning morbidity and mortality. In this study we, did not encounter bleeding, but we had one patient (1.25%) who showed leak, and this denoted a comparable rate of leakage to both LRYGB and LSG.

The late complications, including marginal ulcer, bile reflux, and iron deficiency anemia, should be noted. Chronic alkaline reflux was associated with postoperative esophagitis and gastritis and would further empower carcinogenesis to the remnant stomach. However, other authors reported that gastric cancer caused by bile reflux was rarely reported [14,31], and reconstruction with Roux-en-Y gastric bypass proved to be quite safe [12,32]. In a study by Lee *et al.*[12] comparing RYGB with MGB, the overall revision rates did not differ significantly in both surgeries (3.6 and 2.8%, respectively).

Collins *et al.* [17] reported that similarity of LMGB to LRYGB does not ensure that the former has similar outcome concerning bile reflux as the effect caused by the absence of a Roux limb is largely unknown, to date. Victorzon [33] reviewed 73 article abstracts on MGB and reported that there were no dysplasia of any grade or remnant gastric cancers. In this study, we actually reported two cases of biliary reflux and gastritis, one of them responded to medical treatment and the other one was managed with RYGB. Endoscopic biopsies were taken from both patients and proved no malignancy. Marginal ulcer of the remnant gastric pouch was another problem. Dallal *et al.* [34] reported an incidence of marginal ulcer of 0.6–1.7% in LMGB. In our study, the incidence of marginal ulcer was 1.25%, which was similar to or even lower than that reported after LRGYB (1.3–4%) [34,35]. This is in agreement with the study by Dallal and Bailey [34], in which marginal ulcer was effectively treated with PPI. In our study, iron supplementation was provided to all our patients throughout the follow-up period and no anemia was reported in our patients. In this study, the mean EWL at 18 months was 77.3 ± 8.4%, which was comparable to RYGB and other standard bariatric surgery procedures. Kim *et al.* [31] reported that the 1-year significant weight loss (% EWL>50) was obtained in all patients after LMGB and the %EWL continued to increase during the follow-up and was stable at 18 months, 2, and 5 years. This clarifies that the surgical effects of LMGB is considered to be significant and durable. Kular *et al.*[5] found that the 1-year %EWL of LMGB was comparable to LSG, whereas 5 years after surgery, %EWL of LMGB was significantly higher than that of LSG. This gives provisional superiority of LMGB on sleeve gastrectomy as regards long-term efficacy on weight loss. Wang *et al.*[36] also reported higher 5-year %EWL for LMGB versus LRYGB, and LMGB was more effective in reducing BMI compared with LAGB during the whole follow-up period. LMGB showed good impact on T2DM remission. It was suggested

that patients with extensive weight loss were more likely to achieve T2DM remission after bariatric surgery [37], and diversionary procedure such as LMGB was more efficient in reducing weight [38]. In some studies (10,14,25,29) the one year remission rate were higher than 80% and even 90% (5,9). Moreover, Wang *et al.*[27] reported that all 79 hyperglycemia patients resolved within 6 months and ceased medication thereafter. Again, Kim and Hur [11] demonstrated the resolution of hyperglycemia in 70% of nonobese T2DM patients (BMI 25–30 kg/m^2). From the above studies, the diversion surgery addressed in LMGB was proved to resolve diabetes not only in obese patient but also in nonobese patients.

The T2DM remission effect of LMGB seemed long-lasting as the HbA1c continued to decrease 3 years after surgery, although BMI had gone to a plateau [31]. In this study, the remission of T2DM was strongly significant (81%) at 18 months ($P < 0.001$). LMGB also showed a significant effect on dyslipidemia and hypertension. One more benefit of LMGB was as follows: for patients with failed sleeve gastrectomy, conversion to LMGB was found to be feasible, safe, and effective [39]. Thus, LMGB could be considered as an acceptable option after failed sleeve gastrectomy. From this study, some of the benefits of LMGB were shorter operating time, lesser rerouting of the intestines, and one fewer anastomosis, which in theory means less chance of a complication. Moreover, it is technically easy for the surgeons, with good impact on weight loss and recovery.

From our study and previous studies, LMGB has good short-term results on weight loss and metabolic syndrome but further studies and longer follow-up are still needed to evaluate long-term efficacy and complications to build a solid conclusion on its future.

Conclusion

Minigastric bypass is an emerging easy and quick technique. It is provisionally effective and safe like other standard bariatric procedures. Moreover, it has good impact on associated metabolic diseases such as type 2 diabetes, dyslipidemia, and hypertension.

Acknowledgements

Conflicts of interest

None declared.

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