Anterior gastrojejunostomy versus posterior gastrojejunostomy in mini-gastric bypass: a comparative study in bile reflux

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Introduction
An alternative to the gold standard Roux-en-Y gastric bypass is the one-anastomosis gastric bypass procedure. Although the safety and effectiveness of this method are widely recognized, there are still many unanswered issues about the prospective long-term dangers owing to biliary reflux and its potential complications.
However, problems from the mini-gastric bypass (MGB) surgery have drawn attention, particularly the reflux of jejunal contents, including bile and pancreatic secretions, into the gastric tube or even the esophagus, a condition known as bile reflux in the literature.
Aim
To determine whether the incidence of bile reflux differs between anterior and posterior gastrojejunostomies.
Patients and methods
A total of 50 patients without gastroesophageal reflux disease symptoms or a hiatus hernia who were scheduled for MGB surgery at our facility between August 2021 and April 2022 were included in the research. Patients received hepatobiliary scintigraphy 6 months following the procedure. The patients were divided into two groups: group A consisted of 25 patients who underwent anterior antecolic gastrojejunostomy, and group B consisted of 25 patients who underwent posterior retrocolic gastrojejunostomy.
Results
After being divided into two groups randomly, 50 patients were recruited in the study. The included patients had a mean age of 38.55 years, a mean weight of 125.36 kg, and a mean BMI of 50.1 kg/m^2, with 86% of them being females. In 24 (48%) individuals with Bile reflux scintigraphy (BRS), there was no evidence of bile reflux into the stomach or esophageal pouch. In group A with an anterior antecolic gastrojejunostomy, 14 (28%) patients had a positive BRS, whereas in group B with a posterior retrocolic gastrojejunostomy, 12 (24%) patients showed bile reflux activity.
Conclusion
Our findings show that temporary bile reflux after MGB occurs often in the gastric tube and maybe in the esophagus and that the location of the gastrojejunostomy has no bearing on the presence of bile reflux.

Keywords:
bariatric, bile reflux, mini-gastric bypass, scintigraphy

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Introduction

In 1997, Mason's gastric bypass gave rise to laparoscopic mini-gastric bypass (MGB) [1]. MGB has recently gained popularity among surgeons and is now practiced all over the world.

Many studies have shown positive outcomes with MGB regarding weight reduction and influence on related comorbidities, notably type 2 diabetes [1–4]. It was originally reported by Rutledge and colleagues. Additionally, MGB has been said to be quicker and less likely to result in surgical problems than internal hernias [3,4].

MGB accounted for 4.8% of all bariatric surgeries performed in 2016 and was the third most popular procedure after sleeve gastrectomy (53.6%) and Roux-en-Y gastric bypass (RYGB) (30.1%) [5]. MGB accounted for 3.7% of all bariatric procedures in 2019, according to the fifth IFSO registry report.

However, there has been a great deal of worry expressed about the reflux of jejunal contents, including bile and pancreatic secretions, into the gastric pouch or even the esophagus, a condition known as bile reflux in the literature [5,6].

According to recent research [7], the worry that bile reflux would result in metaplasia or cancer in the esophagus or gastric pouch is the reason that many surgeons avoid doing MGB surgeries.

Bile reflux following MGB is not known to cause cancer; however, postoperative de novo reflux symptoms are frequent [8].

Bile reflux can be identified by hepatobiliary scintigraphy, which is a secure and noninvasive procedure [7,8]. In comparison with examinations in previous studies, it has demonstrated greater sensitivity and specificity for the identification of bile reflux [9].

Patients and methods

In this prospective comparison research, which took place between August 2021 and April 2022, patients who were scheduled for MGB were included. The institutional research ethics committee of Kasr Al-Ainy Hospitals examined and approved the study protocol.

The Helsinki Declaration was followed when conducting the study. Before the trial began, each included patient provided an informed written consent.

In our facility, adult patients with a BMI of more than 40 or 35 kg/m^2 with comorbidities and in general surgically fit were eligible for bariatric surgery. According to the departmental procedure, patients who were chosen for MGB were enrolled in the study. According to where the gastrojejunostomy was placed, the patients were split into two groups: group A included 25 patients who had anterior antecolic gastrojejunostomies, whereas group B included 25 patients who had posterior retrocolic gastrojejunostomies.

All patients had thorough general examinations and history collection. Patients having a history of inflammatory bowel disease, hiatus hernia, upper gastrointestinal tract surgery, upper gastrointestinal tract problems, or those who refused to participate in the trial were excluded.

The surgical techniques

Our technique is essentially similar to the standard MGB technique by Rutledge. We used a long omega loop to achieve a marked effect on diabetes as well as weight loss. All operations were performed under general anesthesia using a standard five-port laparoscopy. After carbon dioxide insufflation, a 15-cm-long gastric tube was divided along the lesser curvature starting at the crow's foot with Endo-GIA (Medtronic, Minneapolis, Minnesota, USA) staplers and calibrated with a 40 Fr bougie. A jejunal loop was lifted 250–275 cm from the ligament of Treitz and anastomosed in group A: antecolic to the anterior surface of gastric tube, whereas in group B, a window in the transverse mesocolon was done using monopolar diathermy and then the small bowel loop was passed through this window to be anastomosed the posterior surface of the gastric pouch with an endo-GIA stapler. The remaining anastomotic defect was sewn with a running 3–0 PDS suture intra-abdominally. Anastomosis was tested with methylene blue. An abdominal drain was inserted in all patients. All patients were mobilized and received oral liquids within 6 h after the operation.

Six months following the procedure, hepatobiliary scintigraphy was performed on each patient who was enrolled. A 12-h fast was followed by the administration of an intravenous bile tracer (99mTcmebrofenin), a 60-min dynamic gamma camera scan, and a 30-min SPECT-CT scan. The amount of bile reflux was calculated as a ratio of the maximum count rate per pixel induced by the tracer in the gastric pouch or esophagus to the maximum count rate per pixel induced by the tracer in the entire liver using the images of the dynamic series to record the beginning and the end of bile reflux activity in the gastric pouch and esophagus.

A nuclear medicine doctor evaluated all scintigraphies after a physicist (T.I.) measured their intensity (AL).

Study outcomes

The study's main findings were the incidence of postoperative bile reflux following MGB with a different location for the gastrojejunostomy and the overall incidence of bile reflux in MGB.

Statistical analysis

The statistical program SPSS (IBM Corp., Armonk, New York, USA), version 22, was used to analyze the data. The results from the preoperative and 1-year postoperative EGD examinations were compared using McNemar's and marginal homogeneity tests. Mann–Whitney U test and χ^2 test were used as necessary to compare patients.

Results

After being divided into two groups randomly, 50 patients were recruited in the study. The included

patients had a mean age of 38.55 years, a mean weight of 125.36 kg, and a mean BMI of 50.1 kg/m^2, with 86% of them being females. Diabetes mellitus, hypertension, and obstructive sleep apnea syndrome were the patients' comorbidities. Table 1 provides patients' demographic information.

In 24 of the 50 individuals we identified neither the gastric pouch nor the esophagus had any evidence of bile reflux. In group A with an anterior antecolic gastrojejunostomy, 14 (28%) patients had a positive Bile reflux scintigraphy (BRS), whereas in group B with a posterior retrocolic gastrojejunostomy, 12 (24%) patients showed bile reflux activity (Table 2).

Table 1 Patients' demographics

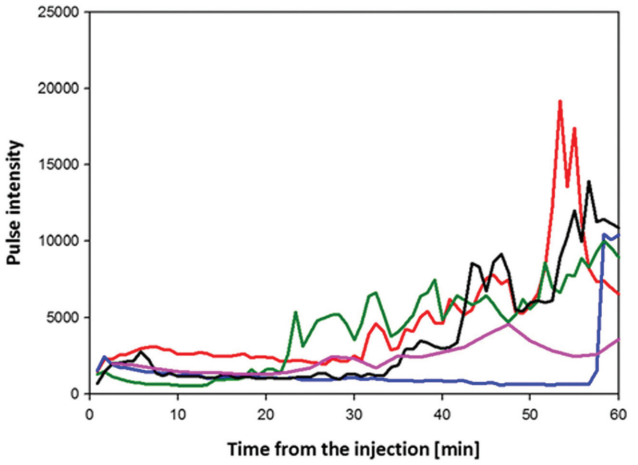
	Mean±SD	
Age (years)	38.55±9.64	
Weight (kg)	125.36±12.4	
BMI (kg/m^2)	50.1±4.61	
	Count	%
Sex		
Female	43	86
Male	7	14
Comorbidities		
Diabetes mellitus	25	50
Hypertension	23	46
Obstructive sleep apnea	27	54

At 37 min, bile reflux activity commenced in the stomach pouch (16–54). At 52 min into the dynamic sequence of BRS, there was the most activity (38–60). By the end of the 90-min scan, bile reflux activity had not totally stopped (Figs 1–3).

Discussion

With comparisons between the positions of the gastrojejunostomy, either anterior antecolic or posterior retrocolic, utilizing scintigraphic

Figure 1

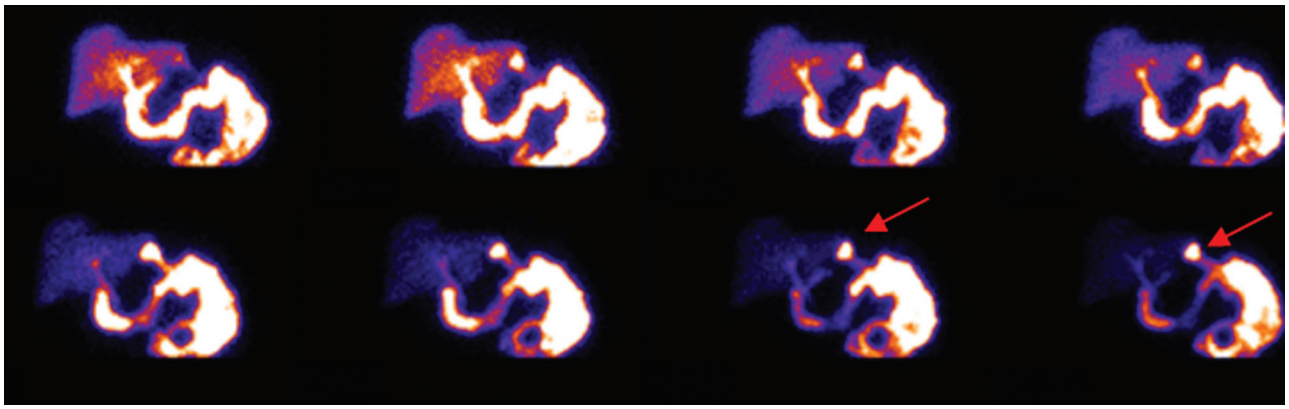


Five studies are shown here, showing the time from tracer injection (on *x*-axis) and the tracer activity or pulse intensity (on *y*-axis).

Table 2 Analysis of the scintigraphy results

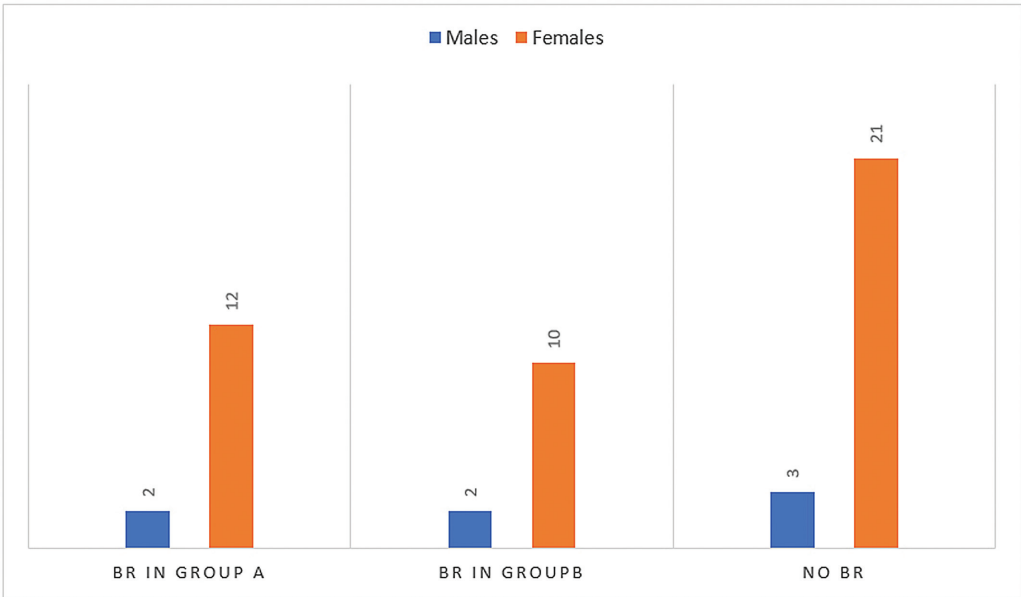
Patients	*n* (%)	Bile reflux in anterior gastrojejunostomy [*n* (%)]	Bile reflux in posterior gastrojejunostomy [*n* (%)]	No bile reflux [*n* (%)]
Males	7 (14)	2 (4)	2 (4)	3 (6)
Females	43 (86)	12 (24)	10 (20)	21(42)
Total	50 (100)	14 (28)	12 (24)	24 (48)

Figure 2



Dynamic scan: showing bile reflux (red arrows).

Figure 3



Distribution of bile reflux in different groups.

assessments, our current study is the first prospective investigation on bile reflux following MGB.

According to our study, there was no bile reflux in the gastric pouch in 48% of patients with BRS, and in 26 of these individuals, there was activity in both the gastric pouch and the esophagus.

Another study found bile reflux in BRS in 55.6% of patients but no bile reflux in the esophagus [8]. In the current study, 14 (28%) patients had a positive BRS in group A with anterior antecolic gastrojejunostomy and 12 (24%) had bile reflux activity in posterior retrocolic gastrojejunostomy; all of them had symptoms of gastritis and few complaining of bilious vomiting (2%). Therefore, in our belief, a routine endoscopic follow-up is mandatory in all patients complaining of severe gastritis or bilious vomiting and even hepatobiliary scintigraphy may be used as another modality to diagnose biliary reflux. Only two patients with biliary reflux required conversion to R-Y gastric bypass (4%) the other patients responded well to medical treatment as PPI (Pantoprazole 40 mg twice daily) and prokinetic as Mosapride 5 mg tab twice daily.

After One anastomosis gastric bypass (OAGB) and RYGB, Keleidari and colleagues compared the frequency of biliary reflux. For categorizing histological Upper gastrointestinal endoscopy (UGE) results and self-reported reflux symptoms, they employed the Sydney method. In 7.8% of OAGB patients, they discovered bile reflux symptoms and a positive bile reflux score, and in 4.8%, they discovered UGE results that could indicate bile reflux. Bile reflux occurs as frequently after OAGB as RYGB, according to these findings, which were not significantly different from those of the RYGB group [10].

In contrast, bile was discovered in the gastric pouch of 16% of patients following OAGB and none following RYGB in the YOMEGA experiment [11].

In our investigation, there was a strong correlation between postoperative BRS results and reflux symptoms, although there was no statistically significant difference in the position of the gastrojejunostomy, either anterior antecolic or posterior retrocolic.

However, it should also be noted that in a recent meta-analysis, 0.6–10% of patients experienced gastroesophageal reflux problems following OAGB, according to Mahawar *et al.* [3].

Bile reflux scintigraphy is the sole noninvasive and precise method for measuring bile reflux, which makes it challenging [9]. There are no particular surveys to distinguish between biliary reflux and gastroesophageal reflux symptoms. In a recent publication, Deitel and Rutledge [12] found that without additional testing, all postoperative reflux symptoms following OAGB are quickly diagnosed as biliary reflux as opposed to gastroesophageal reflux.

However, even a large amount of bile reflux following OAGB might be mistaken for gastroesophageal reflux.

Scintigraphies of unoperated individuals with clinically severe duodenogastric reflux disease and healthy controls were examined by Chen *et al.* [13]. However, healthy controls also showed intragastric bile reflux activity in scintigraphies as high as 8%, indicating that gastric bile reflux is also to some extent a physiological phenomenon. Intragastric bile reflux activity was much greater in patients with duodenogastric reflux disease.

In our belief now, the biliary reflux after min-gastric bypass is a quite common presentation and usually self-limited, which does not require surgical intervention unless there is severe intractable gastritis, and also there this no effect of the position of gastrojejunostomy on the incidence of bile reflux. Hepatobiliary scintigraphy is a safe, feasible, and noninvasive technique to diagnose biliary reflux. More studies on bile reflux after bariatric surgeries are required.

Conclusion

After a MGB, bile reflux in the gastric pouch is a frequent finding on scintigraphy. Approximately half of our patients had signs of bile reflux in the stomach pouch, and the occurrence of the condition is unaffected by the position of the gastrojejunostomy, whether anterior antecolic or posterior retrocolic.

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Conflicts of interest
There are no conflicts of interest.

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