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Biliary Reflux Following Conventional Laparoscopic Mini Gastric Bypass

Matkuliev U.I.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Abduganiev J.A.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Fayzullaev E.R.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Kuchkarov A.A.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Ubaydullaev Z.B.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Urinov O.N.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Usmonov B.B.

Department of General and Pediatric Surgery No. 1, Tashkent State Medical University,
Tashkent, Uzbekistan

Abstract: Background: Laparoscopic mini gastric bypass is widely performed for the treatment of morbid obesity due to its metabolic efficacy and technical simplicity. However, concerns remain regarding postoperative bile reflux associated with its loop configuration.

Objective: To evaluate the incidence and clinical significance of bile reflux following conventional laparoscopic mini gastric bypass in a single-center cohort.

Methods: A retrospective analysis was conducted on 68 consecutive patients who underwent conventional mini gastric bypass between 2021 and 2023. Patients were stratified according to pre-operative gastroesophageal reflux status. Early postoperative outcomes were assessed at 30 days, including endoscopic visualization of bile in the gastric pouch and reflux-related symptoms. Mid-term outcomes at 12 months included excess weight loss (%EWL), reflux dynamics, and quality-of-life evaluation.

RESEARCH ARTICLE

Results: At 30 days, bile was visualized endoscopically in 90.6% of patients with preoperative reflux and in 47.2% of those without prior reflux ($p < 0.001$). De novo reflux symptoms developed in 27.8% of previously asymptomatic patients. Most patients in both subgroups achieved $\geq 50\%$ EWL at 12 months, with greater weight loss seen in those without preoperative reflux. Complete resolution of reflux symptoms occurred in 18.8% of patients with baseline reflux, whereas persistent or partially regressed symptoms remained common. Quality-of-life improvement was observed overall but was lower in patients with ongoing reflux manifestations.

Conclusion: Conventional mini gastric bypass ensures effective weight loss but is associated with a high incidence of early bile reflux, particularly in patients with preoperative gastroesophageal reflux disease, and not negligible even in initially asymptomatic individuals.

Key words: Mini gastric bypass; bile reflux; gastroesophageal reflux; bariatric surgery; excess weight loss.

INTRODUCTION

Laparoscopic mini gastric bypass, also referred to as one anastomosis gastric bypass, has become an established metabolic procedure for the treatment of morbid obesity. The operation combines restrictive and malabsorptive components while maintaining technical simplicity, requiring only a single gastrojejunostomy. Multiple clinical series and meta-analyses have confirmed substantial excess weight loss and high rates of remission of type 2 diabetes mellitus, dyslipidemia, and arterial hypertension after this procedure [1,2]. Owing to shorter operative time and reduced technical complexity compared with Roux-en-Y gastric bypass, conventional mini gastric bypass has been widely adopted in both high-volume and resource-limited settings [3].

Despite its metabolic effectiveness, concerns persist regarding the absence of a dedicated antireflux mechanism in the standard configuration of the procedure. In contrast to Roux-en-Y gastric bypass, where alimentary and biliopancreatic streams are separated, mini gastric bypass allows direct communication between the gastric pouch and the biliopancreatic limb. This anatomical configuration theoretically facilitates retrograde flow of bile and pancreatic secretions into the gastric pouch and, in predisposed individuals, into the distal esophagus [4,5]. The clinical relevance of this phenomenon remains debated, particularly in relation to symptomatic bile

reflux, endoscopic evidence of bile pooling, and long-term mucosal changes.

Reported rates of postoperative bile reflux after mini gastric bypass vary widely in the literature, ranging from less than 10% to over 30%, depending on diagnostic criteria and follow-up protocols [6,7]. Some studies rely predominantly on symptom-based assessment, while others incorporate endoscopic findings or pH-impedance monitoring. The heterogeneity of definitions and follow-up strategies has contributed to inconsistent estimations of the true incidence of bile reflux after conventional surgery. Importantly, a subset of patients without preoperative gastroesophageal reflux symptoms may develop reflux manifestations de novo after surgery, raising additional questions about patient selection and anatomical predisposition [8].

From a clinical perspective, bile reflux may manifest as epigastric discomfort, bitter regurgitation, nausea, nocturnal symptoms, or persistent need for antisecretory or prokinetic medication. Endoscopically, the presence of bile within the gastric pouch, inflammatory changes of the mucosa, or signs of esophagitis may be documented even in the absence of pronounced subjective complaints [9]. Although the long-term oncologic implications remain controversial, chronic exposure of the esophagogastric mucosa to bile acids has been

RESEARCH ARTICLE

associated with structural alterations and impaired quality of life in selected patient cohorts [10].

Given the expanding use of conventional mini gastric bypass and the ongoing discussion regarding its refluxogenic potential, real-world data from single centers remain valuable. Standard-ized assessment of early and mid-term outcomes, including objective endoscopic confirmation of bile reflux, may contribute to a clearer understanding of the clinical magnitude of this issue.

The present retrospective study aimed to evaluate the incidence and clinical significance of bile reflux following conventional laparoscopic mini gastric bypass in a single-center cohort, with specific attention to early postoperative findings and 12-month functional outcomes.

METHODS

Study Design and Setting. This retrospective single-center cohort study was conducted at a specialized bariatric surgery unit between 2021 and 2023. The analysis included consecutive patients who underwent conventional laparoscopic mini gastric bypass for morbid obesity. Institutional protocols for perioperative management and follow-up were uniform throughout the study period.

The study was performed in accordance with the principles of the Declaration of Helsinki. All patients provided informed consent for surgery and for the use of anonymized clinical data for research purposes.

Patient Population. A total of 68 patients who underwent conventional laparoscopic mini gastric bypass were included in the analysis. Inclusion criteria were age between 18 and 60 years, body mass index (BMI) ≥ 40 kg/m² or ≥ 35 kg/m² with obesity-related comorbidities, and availability of complete perioperative and follow-up data for at least 12 months.

Patients with decompensated systemic disease, active peptic ulcer disease, severe psychiatric disorders, malignancy, or incomplete follow-up were excluded.

For analytical purposes, patients were stratified into two subgroups according to the presence or absence of clinically and/or instrumentally confirmed gastroesophageal reflux before surgery. Preoperative reflux status was determined based on symptoms, upper endoscopy findings, and, when indicated, pH monitoring.

Surgical Technique. All procedures were performed laparoscopically using the standard conventional mini gastric bypass technique. A long, narrow gastric pouch was created along the lesser curvature. A loop gastrojejunostomy was constructed in a side-to-side fashion with the biliopancreatic limb, without Roux-en-Y diversion and without additional antireflux modifications.

No specific mechanical antireflux mechanisms, fundoplication, or intentional angulation of the biliopancreatic limb were incorporated into the standard technique.

Follow-Up Protocol. Patients were evaluated in the early postoperative period at 3, 7, 14, and 30 days. Mid-term follow-up assessments were performed at 3, 6, and 12 months after surgery. Follow-up included clinical examination, laboratory assessment, and structured symptom evaluation.

Upper gastrointestinal endoscopy was routinely performed preoperatively in all patients. Postoperative endoscopy was conducted at 30 days in patients with clinically significant symptoms and in selected cases during follow-up to assess the presence of bile in the gastric pouch and inflammatory changes.

Outcome Measures. The primary outcome of the study was the incidence of bile reflux following conventional mini gastric bypass, defined as endoscopic visualization of bile in the gastric pouch within the first 30 postoperative days.

Secondary outcomes included: incidence of postoperative reflux-related symptoms; development of de novo reflux in previously asymptomatic patients; persistence or worsening of reflux at 12 months; excess weight loss percentage (%EWL); quality-of-life assessment using the BAROS framework.

RESEARCH ARTICLE

Excess weight loss was calculated using a reference BMI of 25 kg/m². Reflux symptom dynamics were categorized as improvement, no change, worsening, or de novo development.

Statistical Analysis. Continuous variables are presented as mean $\pm$ standard deviation. Categorical variables are expressed as numbers and percentages.

Comparisons between patients with and without preoperative reflux were performed using Student's t-test for normally distributed variables and the Mann-Whitney U test for non-normally distributed variables. Categorical variables were compared using the chi-square test or Fisher's ex-act test when appropriate.

A p-value <0.05 was considered statistically significant. Statistical analysis was performed using standard statistical software.

RESULTS

Baseline Characteristics. The study included 68 consecutive patients who underwent conventional laparoscopic mini gastric bypass. According to preoperative clinical and endoscopic evaluation, 32 patients (47.1%) had confirmed gastroesophageal reflux disease, while 36 patients (52.9%) had no clinical signs of reflux prior to surgery.

Baseline demographic and anthropometric parameters were comparable between the two subgroups. Mean age, sex distribution, and preoperative body mass index (BMI) did not differ significantly. Endoscopic findings, however, demonstrated clear structural differences in the reflux group, including higher rates of esophagitis, bile visualization, and cardia insufficiency (table 1).

Table 1. Baseline characteristics of patients undergoing conventional mini gastric bypass stratified by preoperative gastroesophageal reflux disease (GERD) status

Parameter	Preoperative GERD (n=32)	No GERD (n=36)	p-value
Age (years, mean $\pm$ SD)	41.2 $\pm$ 5.4	40.1 $\pm$ 5.0	>0.05
Female sex, n (%)	22 (68.7%)	24 (66.7%)	>0.05
BMI (kg/m ² , mean $\pm$ SD)	46.7 $\pm$ 2.0	45.9 $\pm$ 2.3	>0.05
Hiatal hernia, n (%)	11 (34.4%)	7 (19.4%)	<0.05
Esophagitis (any grade), n (%)	25 (78.1%)	4 (11.1%)	<0.001
Bile in stomach preoperatively, n (%)	21 (65.6%)	6 (16.7%)	<0.001

These data confirm that the two subgroups were anthropometrically similar but differed significantly in preoperative esophagogastric status.

Early Postoperative Bile Reflux. At 30 days after surgery, endoscopic assessment re-vealed a high incidence of bile reflux in the overall cohort.

In patients with preoperative GERD, bile was visualized in the gastric pouch in 29 out of 32 cases (90.6%). In contrast, bile presence was documented in 17 out of 36 patients (47.2%)

without prior reflux. The difference between groups was statistically significant (p <0.001).

Clinically, reflux-related symptoms persisted or worsened in the GERD subgroup. Seventy-five percent of these patients reported two or more reflux symptoms at 30 days. In the non-GERD subgroup, 27.8% developed de novo reflux-related complaints during the early postoperative peri-od.

Requirement for symptomatic therapy remained substantially higher in patients with pre-operative reflux (table 2).

Table 2. Early postoperative bile reflux and symptom incidence at 30 days

Outcome at 30 days	Preoperative GERD (n=32)	No GERD (n=36)	p-value
Bile in gastric pouch, n (%)	29 (90.6%)	17 (47.2%)	<0.001
≥ 2 reflux symptoms, n (%)	24 (75.0%)	10 (27.8%)	<0.001
De novo reflux symptoms, n (%)	-	10 (27.8%)	-
Need for medication, n (%)	26 (81.3%)	5 (13.9%)	<0.001

RESEARCH ARTICLE

These findings indicate that conventional mini gastric bypass was associated with a substantial rate of early bile reflux, particularly in patients with preoperative GERD, but not limited to them.

Twelve-Month Outcomes. At 12 months, weight loss outcomes were satisfactory in both subgroups. No cases of weight regain beyond baseline BMI were recorded.

In the GERD subgroup, 15.6% of patients achieved 75–100% excess weight loss, while 46.9% were in the 50–74% EWL range. In the non-GERD subgroup, 30.5% reached the 75–100% EWL category, and 50.0% were in the 50–74% range.

Despite effective weight reduction, reflux dynamics differed between subgroups. At 12 months, complete resolution of reflux symptoms occurred in 18.8% of patients with preoperative GERD. In contrast, 25.0% of patients in the non-GERD subgroup reported absence of reflux symptoms.

Persistent or partially regressed symptoms remained more frequent in patients with baseline GERD.

Quality-of-life assessment demonstrated overall improvement in physical and social domains across the cohort. However, patients with persistent reflux reported lower satisfaction in domains related to food tolerance and daily comfort (table 3).

Table 3. Twelve-month outcomes after conventional mini gastric bypass

12-Month Outcome	Preoperative GERD (n=32)	No GERD (n=36)	p-value
EWL 75–100%, n (%)	5 (15.6%)	11 (30.5%)	<0.05
Persistent reflux symptoms, n (%)	8 (25.0%)	3 (8.3%)	<0.05
Symptom improvement, n (%)	12 (37.5%)	23 (63.9%)	<0.01
Complete absence of symptoms, n (%)	6 (18.8%)	9 (25.0%)	>0.05

Overall, conventional mini gastric bypass provided effective weight loss but was associated with a considerable rate of early and mid-term bile reflux, especially among patients with preoperative gastroesophageal reflux disease.

DISCUSSION

The present single-center retrospective study demonstrates that conventional laparoscopic mini gastric bypass provides substantial weight reduction at 12 months; however, it is associated with a high incidence of early postoperative bile reflux, confirmed endoscopically. The most striking finding of the study is the frequency of bile visualization in the gastric pouch at 30 days, reaching 90.6% in patients with preoperative GERD and 47.2% even among those without prior reflux manifestations.

Mini gastric bypass has consistently shown metabolic efficacy comparable to, and in some series exceeding, that of Roux-en-Y gastric bypass, with significant excess weight loss and

remission of obesity-related comorbidities [1,2]. Its technical simplicity and reduced operative time have contributed to its widespread adoption [3]. At the same time, the absence of alimentary and biliopancreatic stream separation remains the principal anatomical difference compared with Roux-en-Y reconstruction, and this distinction underlies the ongoing concern regarding bile reflux [4,5].

Published data on the incidence of bile reflux after conventional mini gastric bypass vary considerably. Reported symptomatic reflux rates range from 18% to 35%, depending on diagnostic criteria and follow-up duration [6,7]. Importantly, many studies rely primarily on symptom-based assessment, whereas systematic endoscopic evaluation is less frequently performed. In this context, our findings suggest that when objective endoscopic assessment is undertaken, the rate of bile presence in the gastric pouch may be higher than symptom-based reports alone would suggest.

RESEARCH ARTICLE

The discrepancy between endoscopic findings and subjective complaints observed in the present study is consistent with prior observations that bile reflux may remain partially asymptomatic or underreported [8,9]. Nearly half of patients without preoperative reflux demonstrated endoscopic bile pooling at 30 days, yet only a subset developed clinically relevant *de novo* symptoms. This supports the concept that anatomical exposure to bile does not uniformly translate into overt clinical manifestations but may nevertheless represent a potential risk factor for long-term mucosal alterations [10].

Patients with preoperative GERD constituted a particularly vulnerable subgroup. In this cohort, early postoperative bile reflux was almost universal, and complete symptom resolution at 12 months was achieved in fewer than one-fifth of cases. Although partial improvement was observed over time, persistent or fluctuating reflux symptoms remained common. These findings align with previous reports indicating that preexisting dysfunction of the gastroesophageal junction may predispose patients to persistent reflux after looping gastric bypass procedures [7,11].

From a weight-loss perspective, conventional mini gastric bypass demonstrated satisfactory results in both subgroups. Many patients achieved $\geq 50\%$ excess weight loss at 12 months, in agreement with published multicenter analyses [1,12]. However, patients without preoperative reflux tended to reach higher EWL categories more frequently. While the study was not designed to establish causality, persistent reflux symptoms may negatively influence food tolerance and eating behavior, potentially affecting long-term metabolic outcomes. Similar associations between postoperative reflux and altered dietary patterns have been described in other cohorts [8].

Quality-of-life assessment revealed overall improvement in physical and social domains across the cohort, reflecting the metabolic benefits of weight reduction. Nevertheless, patients with ongoing reflux symptoms reported lower satisfaction in domains related to food comfort and daily well-being. Previous

studies have emphasized that persistent upper gastrointestinal symptoms may reduce subjective treatment satisfaction despite adequate weight loss [9,13].

The clinical significance of bile reflux after mini gastric bypass remains debated. While some authors consider it a manageable functional consequence of the loop configuration, others have raised concerns regarding chronic mucosal exposure to bile acids and potential long-term sequelae [5,10]. The present data do not allow conclusions regarding long-term histopathological outcomes; however, the high early incidence observed in this cohort highlights the need for careful patient selection and structured postoperative surveillance.

Several limitations should be acknowledged. First, the study was retrospective and conducted in a single center, which may limit generalizability. Second, routine postoperative endoscopy was symptom-driven rather than universally applied, potentially leading to under- or overestimation in specific subgroups. Third, the follow-up period was limited to 12 months, precluding assessment of very long-term mucosal or oncologic consequences.

Despite these limitations, the study provides real-world data on the frequency and dynamics of bile reflux after conventional laparoscopic mini gastric bypass. The findings suggest that while the procedure remains metabolically effective, bile reflux represents a frequent early postoperative phenomenon, particularly in patients with preoperative GERD, and is not negligible even in previously asymptomatic individuals.

CONCLUSION

Conventional laparoscopic mini gastric bypass provides effective weight reduction and meaningful improvement in obesity-related parameters at 12 months; however, it is associated with a high incidence of early postoperative bile reflux, confirmed endoscopically, particularly in patients with preoperative gastroesophageal reflux disease. Nearly half of initially asymptomatic patients also demonstrated bile presence in the gastric pouch, with a subset developing *de novo* reflux

RESEARCH ARTICLE

symptoms. Although weight loss outcomes remained satisfactory, persistent or newly developed reflux manifestations influenced postoperative comfort and selected domains of quality of life. These findings indicate that bile reflux represents a clinically relevant consequence of the conventional loop configuration and should be considered in preoperative evaluation, patient counseling, and postoperative surveillance.

Ethical Approval. The study was conducted in accordance with the principles of the Declaration of Helsinki and approved by the local institutional ethics committee of the participating center. All procedures performed were part of standard clinical care.

Informed Consent. All patients provided written informed consent for surgical treatment and for the use of anonymized clinical data for research and publication purposes.

Conflict of Interest. The authors declare that they have no conflicts of interest related to this study.

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Author Contributions. All authors contributed to the study conception and design. Data collection and analysis were performed by the authors. All authors participated in manuscript preparation, critically revised the content, and approved the final version of the manuscript.

Data Availability. The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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RESEARCH ARTICLE

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