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Original Research

Surgical technique of laparoscopic mini-gastric bypass with obstructive stapleless pouch creation: A case series

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ABSTRACT

Background: Laparoscopic mini-gastric bypass (MGB) is a bariatric procedure which is gaining popularity worldwide. The original Rutledge technique is known to have good outcomes, but this and other surgical procedures that involve the use of staplers are very expensive for use in low-income countries. For this reason, the laparoscopic band-separated gastric bypass was developed. This paper aimed to describe a modified MGB technique without the use of staplers.

Methods: We present a modification of the MGB with the use of an obstructive stapleless pouch and anastomosis (MGB–Ospanov procedure). The technique is based on our experience in 32 patients who underwent the procedure involving this technique between January 2016 and December 2018.

Results: As in the original Rutledge version that uses staples, a long conduit is created below the crow's foot, extending up to the angle of His. The main differences between the MGB-Ospanov procedure and the stapler technique are as follows: creation of a gastric pouch from the anterior wall of the stomach; non-use of staplers; non-intersection of the stomach; use of semi-absorbable (or absorbable) strips of mesh; use of gastroplication to obstruct the communication between the gastric pouch and the bypassed greater part of the stomach. Gastrojejunostomy is performed using a hand-sewn suture at 150–200 cm distal from the ligament of Treitz. The body mass index (kg/m^2) was 26.36 ± 4.0 after surgery vs 41.6 ± 6.1 before surgery ($P < 0.0001$).

Conclusion: The MGB–Ospanov procedure with an obstructive stapleless pouch and hand-sewn anastomosis is more feasible and cheaper than the stapler technique. Not using staplers could potentially help in avoiding bleeding and leakage along the stapler line when creating a gastric pouch. However, further research is warranted to confirm these results.

1. Introduction

The laparoscopic mini-gastric bypass (MGB) and one-anastomosis gastric bypass (OAGB) has increasingly become a popular bariatric procedure worldwide. Hundreds of published papers have shown the superiority of the MGB-OAGB, which is now the second most common bariatric operations in many countries [1]. The MGB was first performed by Rutledge in 1997 [2]. The MGB is advantageous because it is a "non-obstructive" restrictive procedure with a significant fatty food intolerance component and minimal malabsorption [3]. This Carbajo's modified procedure was termed OAGB [4].

In Kazakhstan, more than 4000 operations are required per year. However, only approximately 100–200 operations are performed annually. The reasons for the insufficient number of bariatric operations, similar to those in other low-income countries, are insufficient financing of the health care system and the low value of the national currency. For this reason, a laparoscopic band-separated gastric bypass was introduced in 2016 [5]. However, recently, in 2016, the routine use of an adjustable band was changed to the use of a strip of absorbable or semi-absorbable mesh intended for hernias. The tightness between the gastric pouch and the greater part of the stomach is obtained by obstructive plication of the greater curvature of the stomach.

Despite the significant differences in technique, the MGB and obstructive stapleless pouch and anastomosis (Ospanov procedure) is considered a variation of MGB without stapler and cutter use. This is basically a gastrojejunal loop bypass above an obstructive pouch in the upper stomach.

This paper aimed to describe a modified MGB technique without the use of staplers.

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2. Methods

This study is a prospective consecutive case series from a single center. The original technique was based on our experience in 32 patients (29 female patients) between January 2016 and December 2018 in our institution.

The participant inclusion criteria were as follows: obese patients with body mass index (BMI) of $\geq 35\ kg/m^2$; aged between 18 and 60 years; with physical status of I or II according to the ASA grading. The following are the participant exclusion criteria: obese patients with BMI of $\geq 60\ kg/m^2$; and aged < 18 years and > 60 years.

All patients were then followed up one month after surgery and again at 3, 6, 12, and 24 months postoperatively. Changes in weight loss and comorbidity are assessed.

This work has been reported in line with the PROCESS criteria [6]. The study protocol was approved by the Ethics Committee of our institution (17/07/2015, ref: No. 7). Informed consent was obtained from patients prior to participation in the study. Work on human complied with the principles set out in the “Helsinki Declaration ".

2.1. Surgical technique

The main concept of stapleless creation of the gastric pouch for the MGB-Ospanov procedure is shown in Fig. 1.

2.1.1. Patient position and trocar placement

The procedure is performed on the operating table with the patient in a supine position with his or her legs apart and with the inclination of the table at 45°. Safety straps are used to secure the legs and arms. The surgeon stands between the legs or on the left depending on the stage of surgery. The assistant, who handles the camera, stands on the right or between the legs of patient. The Veress needle is inserted into the abdomen and carbon dioxide (CO_2) is insufflated into the abdominal cavity with a pressure of 12–14 mm Hg. Then, the trocars are inserted. For port placement, the followings steps are performed: the first trocar (T1, 11 mm) of the laparoscope is placed at the midline (ML) and midway between the umbilicus and the xiphoidal process; the second trocar (T2, 11 mm) is placed along the left midclavicular line (LMCL) under the costal margin; the third trocar (T3, 6 mm) is placed midway (MW T1-T2) between the first and second trocars; the four trocar (T4, 6 mm) is placed at the right midclavicular line (RMCL) under the costal margin; the fifth trocar (T5, 6 mm) is temporally used under the xiphoidal process (XP) only to create holes for the introduction of the Nathanson liver retractor (Cook Medical) for liver retraction in this point; and the sixth trocar (T6, 6 mm), if necessary, was placed midway between T1 and T4 (MW T1-T4).

2.1.2. Pars flaccida and gastric fundus dissections

The operation begins with the creation of two windows; one window in the hepato-gastric ligament and other in the gastro-diaphragmatic ligament with short gastric vessel division and gastric

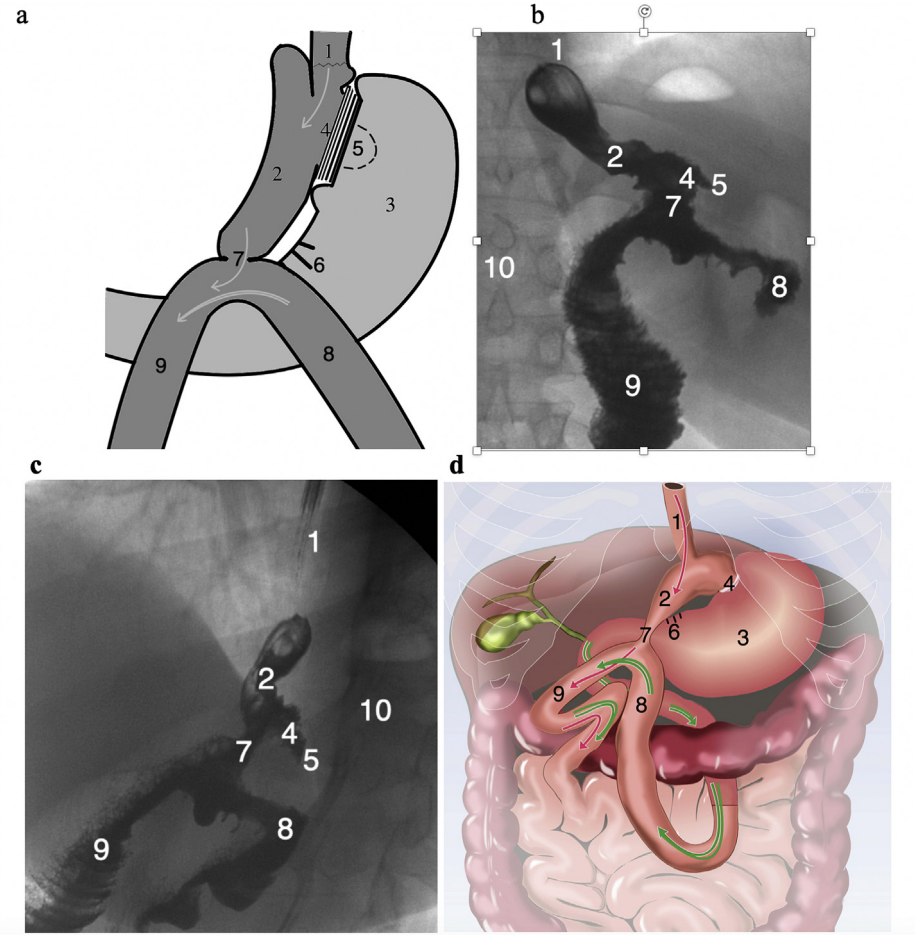

Fig. 1. The MGB–Ospanov procedure. **a.** scheme of procedure (food — single arrow; digestive juice — double arrow). **b.** X-ray image of the gastric pouch with barium contrast, direct projection. **c**. X-ray image of the gastric pouch with barium contrast, side view (projection). **D.** Full view of the MGB Ospanov procedure (food — single arrow; digestive juice — double arrow). Marked on the illustrations: 1—esophagus; 2 — gastric pouch; 3 — bypassed stomach; 4 — gastric band; 5 — obstructive gastroplication; 6 — crow's foot; 7 — gastrojejunostomy; 8 — afferent loop; 9 — efferent loop; 10 — spinal (vertebral) column.

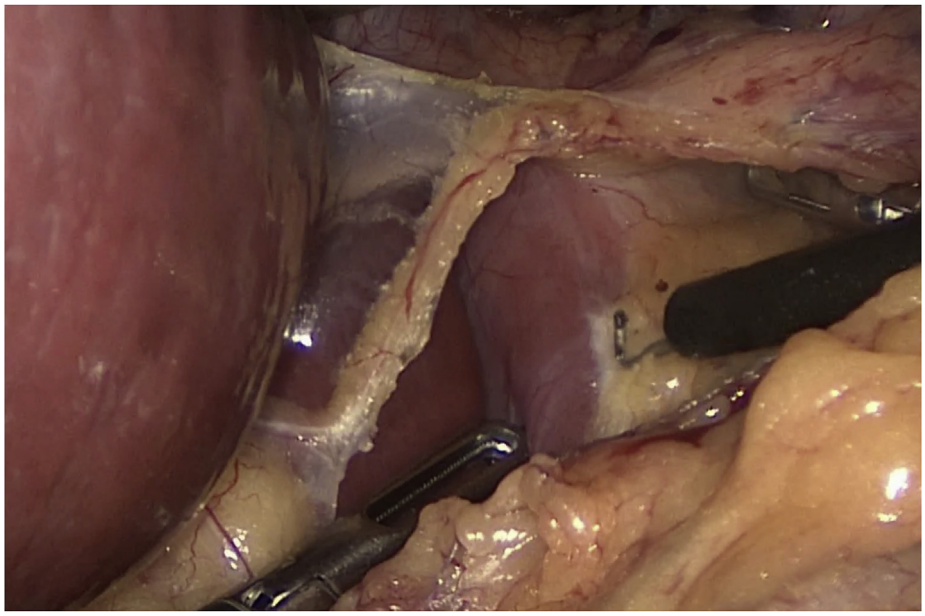

Fig. 2. Retrogastric channel creation start point in the opening of the window of the hepato-gastric ligament (the edge of the hook).

fundus dissection.

This part of the procedure on the left and right sides of the upper part of the stomach is needed to pull the gastric band behind the stomach. The first step includes creating a window in the pars flaccida of the lesser omentum below the hepato-gastric ligament and dissecting the peritoneum between the edge of the right diaphragmatic crus and the wall of the stomach below the junction of the right diaphragmatic crus with the left diaphragmatic crus (Fig. 2).

The second step creates a window in the gastro-diaphragmatic ligament with the division of short gastric vessels, thereby fully mobilizing the gastric fundus. The third step includes the use of a needle holder to create a retrogastric canal to the angle of His between the diaphragmatic crus and posterior wall of stomach. The retrogastric channel should be created above the lesser sac.

2.1.3. Introduction and placement of the band

The jaws of the needle holder capture the edge of the mesh strips, which are 1-cm wide and 10-cm long (non-adjustable band), and pull the mesh strip “Ultrapro” (Ethicon) into the retrogastric canal (Fig. 3a).

2.1.4. Creation and calibration of the gastric pouch

The mesh strip is connected by forming a ring using the stitches on the edges of the mesh (Fig. 3b). Then, the gastric bougie with a size of 32 Fr is pushed along the length from the esophagogastric junction to the crow's foot of lesser curvature of the stomach to calibrate the size of the created gastric pouch (Fig. 3c). The length of gastric conduit must not be less 10 cm. The pouch is created only from the front wall of the stomach to the portion that is medial to the vertical line connecting the angle of His and the crow's foot. The width of the conduit (pouch) should be not more than 4 cm (similar to an anatomical canal of the pylorus) (Fig. 3d).

2.1.5. Gastroplication around the band

Gastroplication is performed to achieve tightness between the gastric pouch and the remaining (bypassed) stomach. To prevent the development of leakage between the lumen of the pouch and the lumen of the disconnected part of the stomach, gastroplication between the gastric fundus and lesser curvature, which has become mobile after dissection of short gastric vessels should be performed (Fig. 4).

For additional sealing, not less than two separate continuous sutures should be used. Two running sutures alternately beginning from the posterior wall to the anterior wall of the gastric bottom parallel and less than 1–3 cm from the obstructive band (the strip of the mesh) are used. We used the non-absorbable suture material Ethibond 2/0 (Ethicon).

The creation of the gastric pouch was subsequently completed to create a gastro-gastro suture for closure of the band and to create a tubular shape of the pouch (Fig. 4).

2.1.6. Creation of bypassed gastrojejunostomy

A jejunal loop measuring approximately 150 cm (BMI $< 40\ kg/m^2$)-200 cm (BMI $> 40\ kg/m^2$) from the ligament of Treitz was anastomosed to the gastric pouch. The two-layer hand-sewn gastrojejunostomy was created by using absorbable sutures (Vicryl 2/0) (Ethicon) (Fig. 3).

The pouch was moved closer to the jejunum on the principle of “end to side” and a first posterior layer of anastomoses was performed (Fig. 5a). The size of the anastomosis was measured with hook notches, and the anastomosis width was planned to be 2 cm in size. A hook line was planned at the opening of the two organs (Fig. 5b). After opening the lumen of the two organs, a second row of stitches was performed on the posterior layer of the anastomosis (Fig. 5c). The creation of the bypassed anastomosis was completed by stitching the anterior layer (Fig. 5d). The completed MGB-Ospanov procedure is shown in Fig. 6.

The anastomoses were then tested under air insufflation and subsequently with methylene blue injection, and the port sites were closed using standard closure techniques. A drainage tube was introduced into the abdominal cavity in each case near the gastroenteroanastomosis for one day to assess bleeding.

3. Results

All procedures were performed by a single surgeon.

The mean follow-up duration was 18 months. No laparoscopic MGB–Ospanov procedure required conversion to the open approach. There was no morbidity and mortality case. The detailed results are presented in Table 1.

The weight loss outcomes are presented in Table 2.

The results of comorbidity changes are presented in Table 3.

In each surgical procedure using our method, we saved more than 2500 US dollars on staplers and reloads.

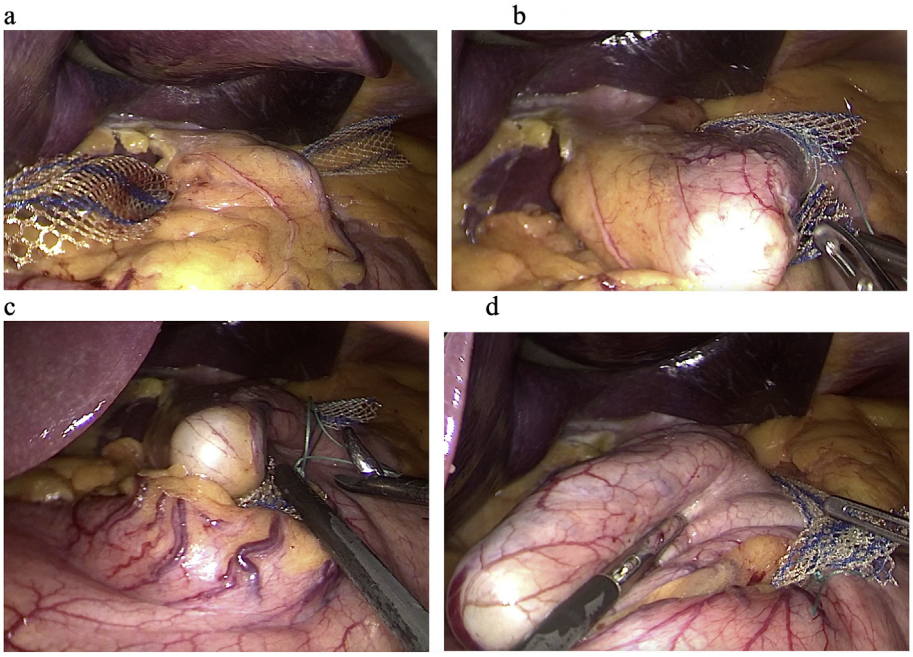

Fig. 3. a. Mesh strips pulled into the retrogastric canal. **b.** Calibration of the gastric pouch with use of the gastric bougie. **c.** Length of the gastric conduit reaches the crow's foot. **d.** Width of the gastric conduit along the vertical line connecting the crow's foot and the angle of His.

4. Discussion

The MGB has been introduced to bariatric practice in many countries. The International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) commissioned a task force to determine whether the MGB-OAGB is an effective and safe procedure and whether it should be considered a surgical option for the treatment of obesity and metabolic diseases [7]. Biliary reflux - a critical disadvantage of the MGB, remains a serious drawback to OAGB. However, the excellent results in the publications of many authors have changed the “angry attitude” to the “tolerant attitude” to this procedure. MGB is an excellent metabolic procedure with a short learning curve [8,9].

The proposed development of the MGB–Ospanov procedure is intended for surgeons who have problems with the availability of stapling devices. However, this is not relevant to surgeons from high-income countries.

The combination of gastroplication and gastric bypass increases the likelihood of a good result with the MGB–Ospanov procedure because of its similar cost of expenses to gastric plication procedures performed separately.

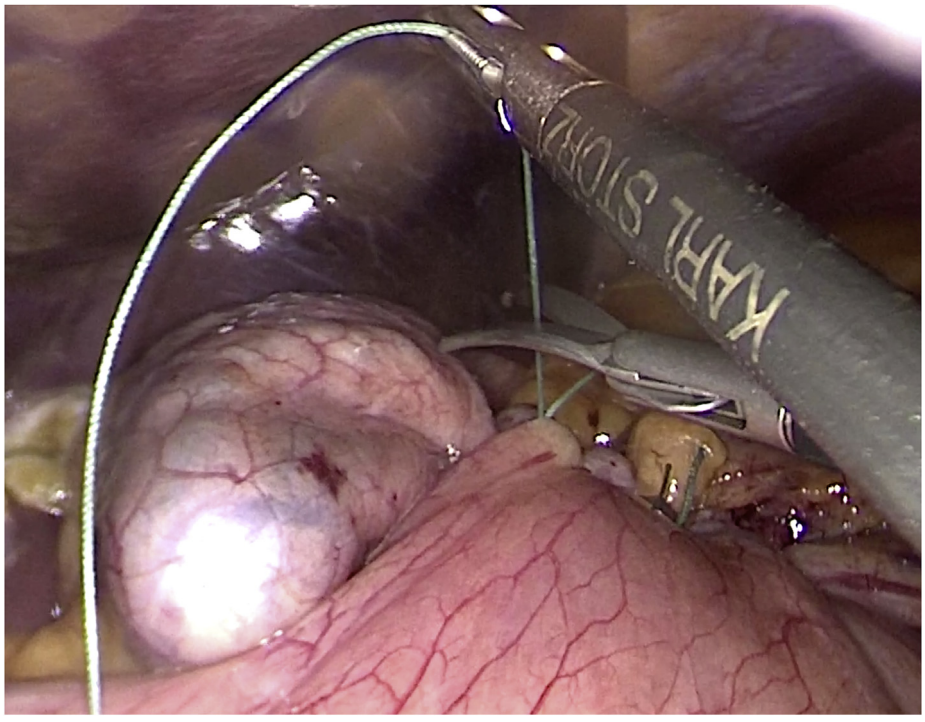

Fig. 4. Gastroplication is completed.

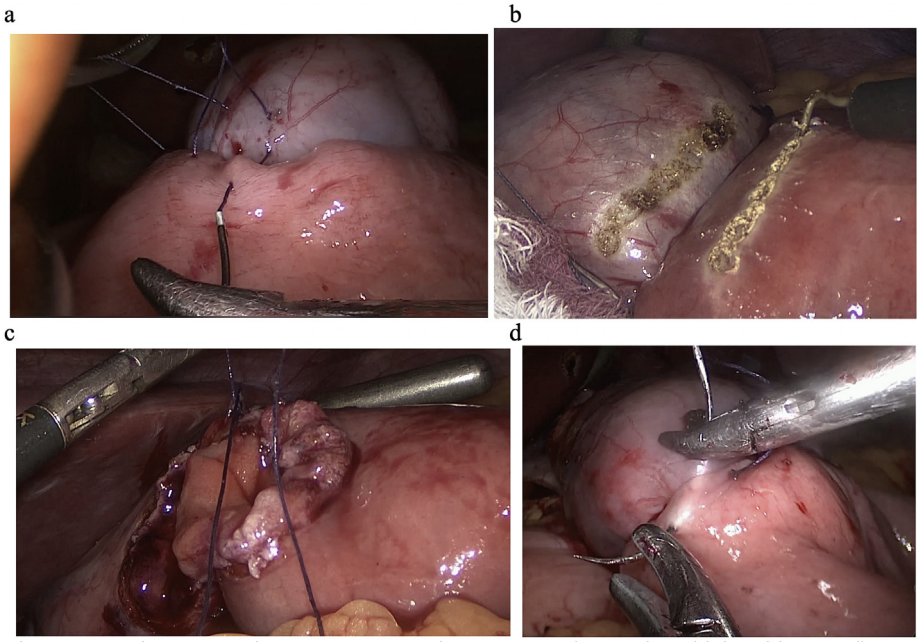

Fig. 5. Hand sewn two-layer anastomoses between the gastric pouch and jejunal loop. **a.** First posterior layer of anastomoses. **b.** Hook line planned at the opening of two organs. **c.** A second posterior layer of anastomoses. **d.** Anterior layer of anastomoses.

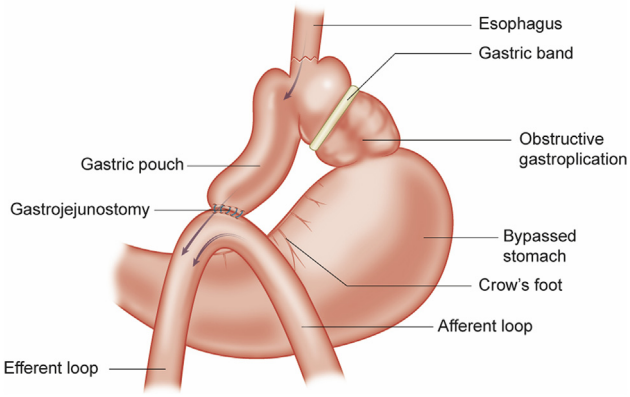

Fig. 6. Complete view of the MGB–Ospanov procedure (food — single arrow; digestive juice — double arrow).

Table 1
Characteristics of the study group and early postoperative outcome.

Variable	Results (n = 32)
Sex	M: 3 (9.4%); F: 29 (90.6%)
Age (year)	36.7 ± 6.7
Approach	Laparoscopic: 32 (100%)
Conversions to the open approach	0
Operative time (minutes)	79.8 (69–120)
Intraperitoneal bleeding (drainage) (mL)	4 (0–9)
Hospital stay (days)	3 (2–4)
Readmissions	0

Historical experience with optimizing Mason's gastric bypass shows an excellent surgical method of weight loss [10,11]. Owing to the severe bile reflux, a reconstruction was proposed with the "Roux-en-Y" loop, which diverts the bile from the stomach and esophagus, and has become the surgical standard [12].

In contrast to the Mason procedure, in the MGB–Ospanov procedure, the gastric pouch is created from the anterior wall of the stomach; therefore, the pouch is formed in the shape of a tube. At the same time,

Table 2
Weight loss outcomes of the MGB–Ospanov procedure.[a]

Variable	Before surgery	After surgery	P value
Body mass index (kg/m^2)	41.6 ± 6.18	26.36 ± 4.0	0.000
ΔBMI	–	15.27 ± 5.03	–
%TWL	–	36.12 ± 9.0	–
%EBMIL	–	95.32 ± 24.91	–

[a] Ideal body weight is then simply calculated as 25 × ([the actual patient's height in meters] ^2). Abbreviations: MGB, mini-gastric bypass; BMI, body mass index; %TWL, % total weight loss; %EBMIL, % excess body mass index loss.

the diameter of the created channel corresponds to the diameter of the pyloric channel. The diameters of the pyloric canals are as follows: relaxed = 4.5–8.2 cm, contracted 2.9–7.0 cm, and fully contracted = 0.8–1.8. The diameters of the pyloric aperture are as follows: relaxed = 1.1–1.9 cm, contracted = 0.9–1.5 cm, and fully contracted = 0.6–1.1 [13]. The close correspondence of the technical and functional parameters of the diameter of the gastric pouch, the diameter of gastroenteroanastomosis to the pyloric part of the stomach, and the diameter of the pyloric aperture determined the absence of biliary reflux. However, further research is required to confirm these findings. The conduit (gastric pouch) also creates a longer one and, accordingly, the gastroenteroanastomosis is located at a sufficient distance from the esophageal-gastric junction.

The main differences of the stapler technology and the our technique during the creation of the pouch are as follows: the creation of the gastric pouch from the anterior wall of the stomach; not using a stapler; non-intersection of the stomach; the use of semi-absorbable (or absorbable) strips of mesh; and the use of gastroplication to obstruct the communication between the gastric pouch and the bypassed greater part of the stomach.

The gastrojejunostomy must control the outflow of gastric contents from the gastric pouch into the jejunum similar to the manner on which the pylorus regulates the entry of food from the stomach into the duodenum [14]. It is logical that, ideally, the diameter and other technical characteristics of a gastroenteroanastomosis with gastric bypass should correspond to the diameter of the aperture and functionality of the pyloric sphincter. The diameter of the distal part of the

Table 3
Outcomes after the MGB–Ospanov procedure on comorbid diseases (N = 32).

Comorbidity	Patients with comorbidities n (%)	Remisson n (%)	Improvement n (%)	No change or worsened n (%)
Type II diabetes mellitus	5(25)	4(12.5)	1(3.12)	0
Prediabetes	8(25)	6(18.75)	2(6.25)	0
Hypertension	25(78.12)	22(68.75)	3(9.37)	
Hyperlipidemia	24(75)	23(71.87)	1(3.12)	0
Sleep apnea	13(40.62)	12(37.5)	1(3.12)	0
Osteoarthritis	18(56.25)	8(25)	9(28.12)	1(3.12)

Abbreviation: MGB, mini-gastric bypass.

gastric pouch in the MGB–Ospanov procedure corresponds to the diameter of the canal of the pyloric part of the stomach in normal anatomy, and the diameter of the hand sewn gastrojejunostomy corresponds to the average diameter of the aperture of the pylorus in normal anatomy.

5. Conclusion

The laparoscopic MGB with the obstructive stapleless pouch and hand-sewn anastomosis is feasible and cheaper compared to the stapler technique. It can be assumed that not using staplers helps in avoiding bleeding and leakage along the stapler line when creating a gastric pouch. However, our findings need to be confirmed in future studies.

Declaration of interest

None.

Ethical approval

Ethics Committee of Astana Medical University, 17/07/2015, ref: No. 7.

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Author contribution

Dr. O. Ospanov was involved in the conception, design, and writing of the manuscript.

Conflicts of interest

None.

Reaserch registration number

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Guarantor

Oral Ospanov.

Data statement

I am not linking to or uploading my research data – data will be made available on request.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijsu.2019.05.011.

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