

# Gastropexy after sleeve gastrectomy

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## Background

As the gastrocolic, gastrophrenic, gastrosplenic, and posterior gastric attachments are cut during laparoscopic sleeve gastrectomy (LSG), it increases the possibility of turning, twisting, or folding. In some cases, the fixation of the stomach will keep it in the correct position. Gastric twist can be suspected after surgery in those complaining of any degree of obstructive symptoms in the postoperative course. The objective of our study was to evaluate the value of gastropexy after LSG to the pancreatic fascia and its effect on intraoperative and postoperative morbidities.

## Patients and methods

This prospective randomized study was conducted in Kasr El Ainy Hospital from May 2018 to November 2018. A total of 40 patients were subdivided into two groups. Group A included cases with LSG, whereas group B included cases with LSG with sleeve reattachment to the pancreatic fascia. Assessments of intraoperative twisting, bleeding, time consumed, postoperative vomiting, epigastric pain, gastrografin meal, and upper gastrointestinal endoscopy were done.

## Results

A statistically significant difference regarding vomiting ( $P=0.003$ ), epigastric pain ( $P=0.035$ ), and operative time ( $P<0.001$ ) was noticed between both groups.

## Conclusion

Adding pancreatic attachment to the procedure posed no harm and did not increase any surgical morbidity. It reduced postoperative gastric pain and vomiting.

## Keywords:

gastropexy, pancreatic attachment, sleeve gastrectomy

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## Introduction

Worldwide, overweight is considered a main health concern and is known to be a universal pandemic [1].

Obesity is associated with many comorbidities such as cardiovascular disease, diabetes mellitus type 2, and fatty liver disease [2].

Today, obesity surgery is the first choice of treatment for patients failing to lose weight by conservative measures and the sole method with high success rate of relief of obesity-related comorbidities and long-lasting weight loss and decreased deaths [3].

Worldwide, a large number of obesity procedures were performed, reaching 340 000 per year [4].

The commonly done bariatric surgeries in United States are laparoscopic sleeve gastrectomy (LSG) and laparoscopic Roux-en-y gastric bypass showing low incidence of hazards [5,6].

Normally, the stomach is positioned and fixed by gastrohepatic, gastrosplenic, and gastrocolic ligaments. Gastric volvulus (GV) occurs when stomach shows twisting on itself due to elongation

or laxity of these ligaments or due to attachments at a certain point such as tumor, adhesions or hiatus and diaphragmatic hernias. GV can be of organoaxial type, mesenteroaxial type, and mixed one [7].

The commonly encountered complications occurring in sleeve gastrectomy (SG) and their incidences are gastric leakage (0.7%), hemorrhages (0.7%), and strictures (0.7%) [8].

Owing to the rapid growth of numbers of LSG performed in past years, reaching an incidence of 27.8% of surgeries done, new complications arise, as stomach pouch is no longer fixed along the whole greater curvature predisposing to volvulus [9].

The term GV cannot be used and is no more valid once SG is done, and the stomach tube left turns, twists, or folds as the ligaments are disrupted, making the stomach pouch vulnerable to this complication [10].

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A better term after any gastric procedure or SG is gastric torsion (GT) that surgically disconnect stomach from ligaments causing fixation [11].

During procedure, surgeons may notice a liability of the remaining gastric tube to twist forming a coil causing symptoms of obstruction. To prevent this twisting or coiling, surgeons recommend fixing the pouch to greater omentum, keeping the pouch in place.

GT should be suspected after SG in patients complaining of any symptoms of obstruction during postoperative course, as SG alters the normal stomach attachments [12].

Upper gastrointestinal endoscopy is the most important diagnostic method.

Reduction of the twist laparoscopically by adhesiolysis and fixing stomach tube was successful.

Progressive rotation of the staple line in an anterior to posterior plane causing a spiral or twisted gastric pouch can lead to a functional obstruction despite a normal diameter of the lumen. This functional obstruction is an obstacle for gastric contents to pass through, in spite of passage of balloon dilator or endoscope easily through narrowed area [12].

Recently, loss of ligament fixations along the greater curvature of the stomach may be implicated, so regaining normal anatomical attachments of the greater curvature to the gastrocolic and gastrosplenic ligaments may solve this problem [13].

GT after SG is similar to the organoaxial volvulus. Symmetric stapling of the posterior and anterior wall of the stomach is essential to avoid twisting of remnant stomach tube. To achieve this, a proper posterior dissection of the stomach is recommended [14].

Fixation of omentum to the remnant of the stomach can aid to avoid torsion after SG. For the twist to complete to an extent of obstruction is attributed to a long tubular remnant with no supports.

Improper gastric pouch positioning owing to loss of ligament fixations of the stomach causes persistent reflux and food intolerance [15].

The objective of this study is to evaluate the benefit of fixation of sleeve to pancreatic fascia to decrease the risk of GT, repeated vomiting, and epigastric pain

following LSG and compare with other cases of LSG who have not had fixation.

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## Patients and methods

This prospective randomized study included 40 patients. All underwent LSG over 6-month period in Kasr El Ainy Hospital during the period from May 2018 to November 2018.

Preoperative evaluation included a thorough personal, medical, and surgical history; complete endocrine workup; psychological assessment and counseling by dietician; and followed by a low caloric diet for 1–3 weeks according to BMI.

All comorbidities increasing preoperative risk were controlled before surgery as far as possible.

The patients were considered appropriate candidates for the present study, if 18–65 years of age, of both sexes, of BMI of 40 kg/m<sup>2</sup> or more or between 35 and 40 kg/m<sup>2</sup> with significant comorbidity that could be improved if they lost weight. Patients willing to give consent and comply with the evaluation and treatment schedule were also enrolled.

Patients were informed about the nature of the study, and each patient agreed to the procedure, and informed written consent was obtained from all participants after approval of Kasr El Ainy Hospital ethical committee.

Standard blood tests were done preoperatively such as complete blood picture, glycosylated hemoglobin, serum albumin, liver functions, kidney functions, prothrombin time and concentration, abdominal ultrasonography, chest radiograph, pulmonary function tests, and upper endoscopy.

Thromboembolic prophylaxis with subcutaneous low-molecular-weight heparin was administered on the evening before the surgery and continued daily from the first postoperative day until the patient was ambulant for a maximum of 14 days postoperatively.

The patients were randomly divided into two groups by a closed envelope method.

Group A included 20 patients with LSG without fixation to pancreatic fascia.

Group B included 20 patients with LSG with fixation to pancreatic fascia.

Under general anesthesia, prophylactic antibiotic was given, and elastic compression stockings were placed on the legs.

Laparoscopic technique began with CO<sub>2</sub> insufflations with pressure 14–16 mmHg. The insufflation site was 2 cm below the left costal margin along the midclavicular line.

The camera (30° optic scope) port was placed slightly above and to the left of the umbilicus using a 10 mm port.

After entering abdominal cavity, the position of Veress needle was inspected to exclude the possible organ injury, with exploration of the abdomen with particular attention to adhesions, mobility of omentum, and small intestine mesentery.

Two 12-mm ports were placed in both right and left hypochondria in midclavicular time for working hands, and a fourth 5-mm port was placed in left anterior axillary line for assistant. A fifth 10-mm port according to the liver size in the epigastrium as a liver retractor may be inserted.

In steep reverse Trendelenburg position or modified Lithotomy position (Lloyd-Davies), using an ultrasonic dissector starts with opening of the greater omentum 6 cm proximal to the pylorus and along the greater curvatures of the stomach.

The dissection continued cephalad to the gastroesophageal junction and left crus.

The short gastric vessels were sealed and divided carefully, and care was taken to avoid injury to the spleen. The left crus was completely freed of any attachments to avoid leaving a posterior gastric pouch or a sagging fundus when constructing the sleeve in this region. The dissection proceeded toward the pylorus.

Devascularization ended 2–3 cm proximal to the pylorus. The dissection was completed by freeing any posterior attachments of the stomach to the pancreas. Once the dissection was over, a 36-Fr bougie was introduced orally by the anesthesiologist through the esophagus and inside the stomach, guided by the surgeon along the lesser curvature into the pyloric channel and duodenal bulb.

The greater curvature of stomach was transected by a linear stapler from the antrum (2–3 cm from pylorus) to

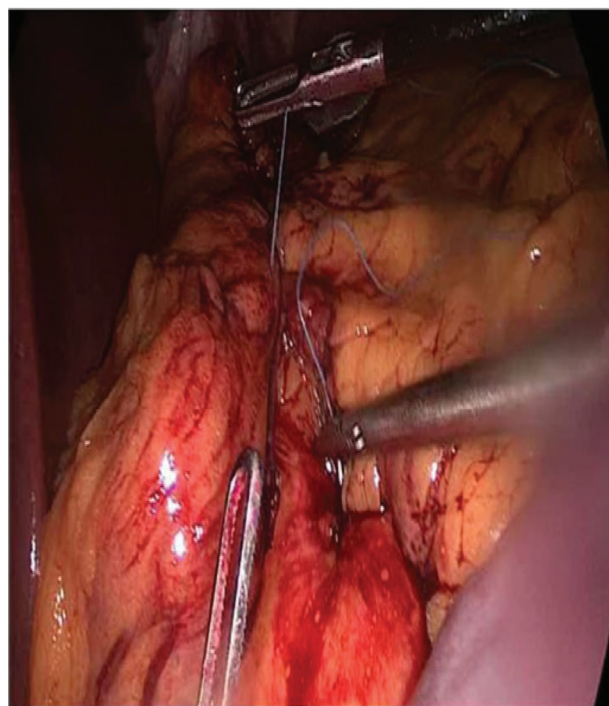
the angle of His. The first stapling cartridge was usually green (4.1 mm) for thicker tissue at the antrum, followed by blue ones (3.5 mm) till reaching the angle of His. A methylene blue test was applied after stapling to check the integrity of the staple line. The distal staple line of the greater curvature of the gastric remnant was sutured to the pancreatic fascia on two or three points by Vicryl (3/0) sutures (Fig. 1), and then removal of the resected gastric tube was done. A drain was inserted at the end of the procedure.

Postoperatively, patients were encouraged of early mobility. Anticoagulation was continued for 14 days (enoxaparin 40 µ/day subcutaneously).

Administration of intravenous proton pump inhibitors was done from first day and continued orally. Patients were started oral fluid on second day postoperative after gastrografin study. Gradually, diet changed from fluid to solid for 6 weeks.

All patients were assessed intraoperatively detecting any staple line bleeding or leak, comparing the incidence in each group and operative time in each group. Postoperative pain and vomiting were assessed, and any persistence of epigastric pain and vomiting after 2 weeks as investigated by gastrografin and endoscopy (Figs 2–5).

Figure 1



Fixation of the sleeve remnant to pancreatic fascia, group B cases.

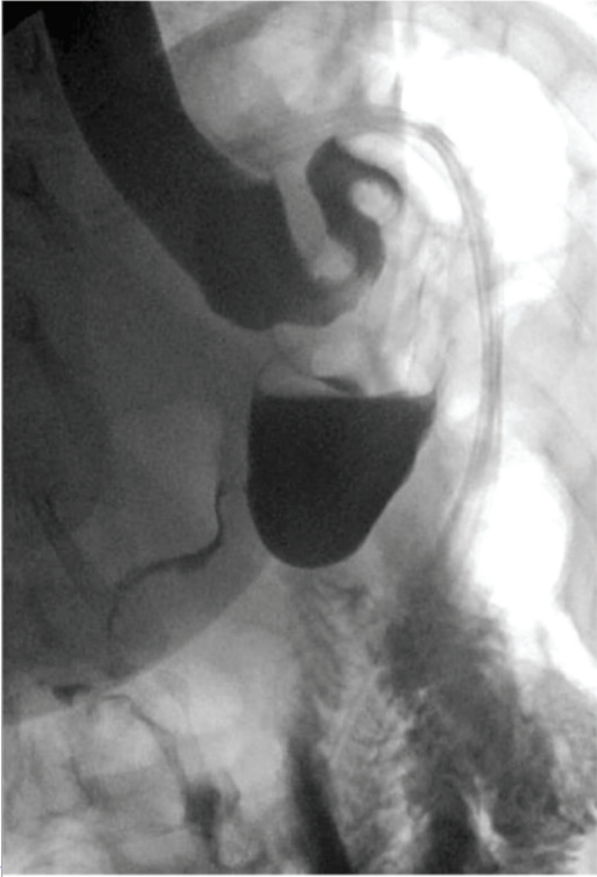


The collected data were analyzed and compared with other variables.

**Statistical analysis**

Data were coded and entered using the statistical package SPSS, version 25. Data were summarized

**Figure 2**



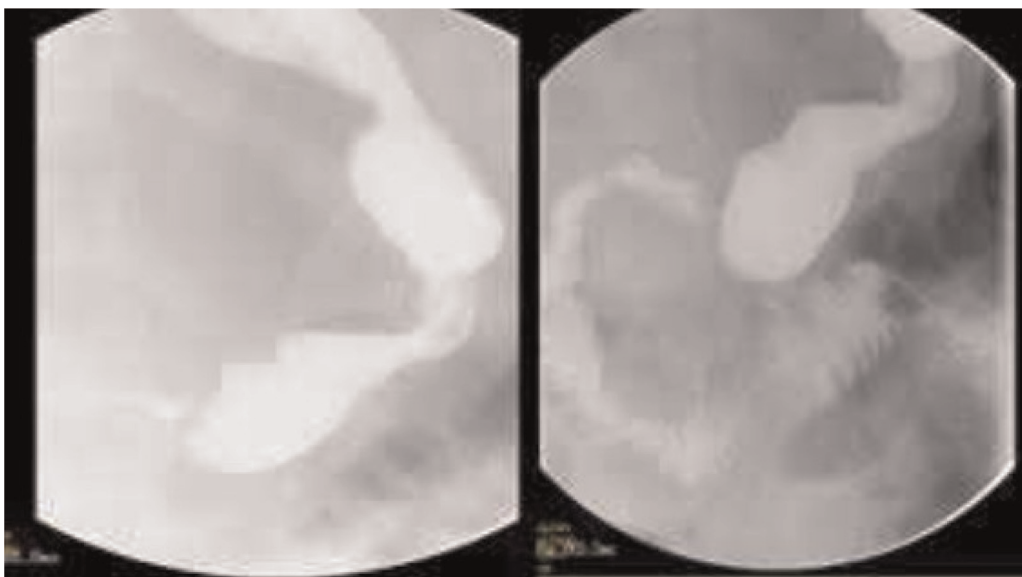
Postoperative UGI of a sleeve gastrectomy patient without gastric fixation, group A case.

**Figure 3**



Postoperative UGI of a sleeve gastrectomy patient with gastric fixation, group B case.

**Figure 4**



Gastrografin meal show twist of the gastric tube follow sleeve gastrectomy, among group A cases (day 20).

Figure 5



Gastrografin meal show normal position of the stomach after sleeve fixation technique, among group B cases.

using mean and SD for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables.

Comparisons between groups were done using unpaired *t* test. For comparing categorical data,  $\chi^2$  test was performed. Exact test was used instead when the expected frequency is less than 5. *P* values less than 0.05 were considered as statistically significant.

## Results

This prospective study has been conducted in Kasr El Ainy Hospital, Cairo University, between May 2018 and November 2018 and included 40 morbidly obese patients. Those patients were randomly divided into two groups by closed envelope method. There was no statistically significant difference regarding age and BMI of both groups, whereas time consumed during operation was statistically significant ( $P < 0.001$ ), with longer time consumed in group B than time consumed in group A.

There was no statistically significant difference regarding sex, comorbidities, preoperative laboratory findings, and upper gastrointestinal tract endoscopy between both groups.

There was a statistically significant difference regarding early postoperative vomiting between

both groups ( $P = 0.003$ ), with group B showing less vomiting during the first 2 days postoperative than group A.

There was no statistically difference regarding intraoperative bleeding between both groups.

There was no statistically significant difference regarding postoperative gastrografin between both groups as well as the gastrografin performed once the patients complained of persistent vomiting or epigastric pain late after surgery, which was done in two cases in group A.

Upper gastrointestinal endoscopy showed kink at incisura angularis in the two patients in group A who showed twist in gastrografin, with no statistically significant difference between both groups.

There was a statistically significant difference between both groups regarding epigastric pain in the postoperative period ( $P = 0.035$ ), with increase in pain in group A.

In group B, no patients experienced attacks of pancreatitis after fixation of sleeve to pancreatic fascia.

## Discussion

Recently, LSG became the primary bariatric surgery for morbid obesity. A survey showed recently that the number of LSG performed is 546 368, with a rising incidence, reaching 171 548 surgeries in 2013, with an increase of 37% in incidence per year since 2003 [16].

Fixation of the stomach is at two points: the cardia proximally and by the duodenum positioned retroperitoneally distally. These two ends are supported by the gastrosplenic, gastrocolic, gastrohepatic, and gastrophrenic ligaments [17]. LSG disconnects all ligaments and all attachments posterior to the stomach, increasing the possibility of turning, folding, or twisting [18].

Axial rotation is induced in many cases after the retrieval of the Bougie tube even with a perfect angle control when stapling. Many methods are described to fix the gastric tube to prevent twisting and further complication. In this study, we present fixation of the remnant gastric tube to the pancreatic fascia [19].

Presentation of GV is either acute or chronic. Acute GV presents with triad of Borchardt, including epigastric pain, inability to pass a nasogastric tube,

and unproductive retching. It may not be possible to depend on upper endoscopy if a gastric ischemia is suspected although showing twisting of gastric fold [7].

Minimal rotation causes chronic GV with no vascular insult, which represents by bloating, intermittent mild pain in upper abdomen, and early satiety. Ischemia can lead to gastric necrosis, and shock and death if untreated [11].

In the study by Elbalshy *et al.* [20], 100 morbid obese patients underwent LSG and were subdivided into two groups, with 50 patients each. Group A underwent classic LSG with no fixation and group B underwent LSG with fixation of the greater curvature to the gastrocolic or gastrosplenic ligament even the distal part is fixed to the mesocolon of the transverse colon below pancreas, or even the peritoneal covering of pancreas. In comparison with our study, there was no statistically significance regarding age, sex, and BMI between both studies [20].

In the study by Elbalshy and colleagues, the mean operating time for group A was  $90.6 \pm 15.7$  min (range, 50–159 min) and for group B was  $98.3 \pm 20.1$  min (range, 60–190 min), with *P* value of 0.07. Operative time was shorter in group A than group B, but not significant.

In our study, operative time was statistically significant ( $P < 0.001$ ), with the mean time consumed in group B was more than time consumed in group A.

Assessment of intraoperative twisting of the staple line was done, and assessment postoperatively regarding vomiting and epigastric pain was done by doing gastrografen meal to all patients. In those patients with persisting vomiting and epigastric pain for more than 2 weeks, gastrografen meal and upper gastrointestinal tract endoscopy were essential.

In the study by Elbalshy and colleagues, postoperative gastric axial rotation was detected in six patients, all were in group A. They were diagnosed when suspected clinically of dysphagia, persistent vomiting, epigastric pain, or gastroesophageal reflux resistant to treatment with proton pump inhibitor after the initial LSG, then it was confirmed by both upper gastrointestinal series and gastroendoscopy. All six cases were treated endoscopically. All were functional stenosis; no organic stricture was found. The case detected intraoperatively was in group B, and it was fixed with uneventful postoperative course. Our study showed two cases among group A that had gastric

twist at incisura angularis and were managed conservatively, showing improvement.

According to Kafkas study, 62 patients (43 female and 19 male) underwent LSG. Four patients were admitted with a complaint of nausea, vomiting, and liquid intolerance 10 days after discharge from hospital. The patients were hospitalized, oral fluid and food intake was stopped, and parenteral nutrition was given. Upper gastrointestinal contrast swallow study revealed kinking of the remnant stomach [21]. There is similarity between Kafkas study and our study regarding management of patients with gastric kink postoperatively by observation, conservative management, and no endoscopic or surgical intervention. According to Elbalshy and colleagues, there was a significant difference between both groups regarding postoperative vomiting and gastric sleeve axial rotation ( $P < 0.05$ ). However, there was no significant difference between both groups regarding operative time and staple line bleeding. This is similar to our study, which showed significant difference regarding vomiting. In contrary, our study showed significant difference in operative time between both groups.

A retrospective study published in July 2016 has shown important results after fixation of the remnant stomach. Two groups were compared in this study, with a total number of 252 patients. One group was LSG without fixation ( $n=124$ ) and the other group was LSG with suturing the remnant stomach to the transverse mesocolon ( $n=128$ ).

The procedure showed significant difference in bleeding ( $P=0.02$ ), axial rotation ( $P=0.006$ ), and hospital readmission ( $P=0.005$ ).

Operative time was shorter in group without fixation ( $P=0.04$ ) [19].

After failure of conservative treatment, focus should be on surgical correction of the architecture of sleeve. Attempt gastropexy by taking intermittent stitches involves posterior fixed structures like pancreatic capsule and mesocolon.

If gastropexy attempts fail, convert into gastric bypass. Some suggest that loss of attachment of the greater curvature of the stomach by the greater omentum to the transverse colon may cause twisting of the sleeved stomach leading to food intolerance and persistent gastroesophageal reflux disease along with other potentially serious complications such as GV [14].



Therefore, by reattaching the gastric sleeve to the pancreatic fascia, we attempt to mimic the natural anatomy of the stomach, which could possibly limit some of the postoperative complaints such as vomiting and epigastric pain and decrease the onset of twist, torsion, or kink at incisura angularis.

Jossart [22] has stated that omentopexy is recommended by some authors to avoid kinking or intermittent volvulus that may be associated with vomiting problems. Murcia *et al.* [23] documented that three cases of GT were due to traction of adhesions between the liver and staple line after SG, and this may support the idea of gastropexy to prevent this complication.

Another larger study with longer period of follow-up was published by Chang *et al.* [24]. During the follow-up of  $58.1 \pm 26.5$  months, no patient experienced gastric stenosis after LSG in those they added omentopexy versus those who did not (0/489 vs. 7/338;  $P < 0.05$ ). Authors recommend fixation of the gastric remnant when rotation is noted after LSG. Suturing the remnant gastric tube to the greater omentum was proposed by Santoro to regain the normal gastric shape [12]. Baltasar [25] suggested the fixation with the gastrocolic ligament after inverting stitches at the staple line.

Godoy suggested a double attachment of the upper and lower staple line. The first one is done by suturing the free edge of the gastrocolic ligament to the proximal staple line near the gastroesophageal junction. In the second one, an attachment is formed by the gastrocolic ligament and the gastroepiploic vessels and the transverse mesocolon beneath the lower edge of the pancreas. This attachment is sutured to the distal part of the staple line in a discontinued form. When suturing both fixations, the staple line was inverted [26].

In our study, we sutured the distal staple line of greater curvature of the gastric remnant to the pancreas on three to four points by vicryl (3/0).

Biswanath Gouda [27] reported a case started to complain of nausea with nonprojectile vomiting and low-grade fever after LSG and pancreatic fixation. Blood tests showed abnormal serum lipase and amylase. Abdominal ultrasound showed mild pancreatic edema around the body, with no collection or necrosis and received conservative treatment. On the contrary, our study did not show any cases of pancreatitis regarding both groups.

There is always some degree of twist, even in doing the best to align staples, so fixation of gastric remnant may solve this problem.

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## Conclusion

The complimentary step of pancreatic reattachment to LSG posed no harm and did not increase surgical morbidity.

Pancreatic reattachment to the gastric sleeve has reduced gastric pain and vomiting postoperative compared with cases where reattachment was not done.

Pancreatic reattachment had decreased the gastric twist and axial rotation than other cases that did not have reattachment with no adding hazard of pancreatitis.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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