## **Original Research Article**

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# Role of staple line fixation during laparoscopic sleeve gastrectomy

Mohammed A. Elbalshy\*, Asem M. Fayed, Moharm A. Abdelshahid, Yahia M. Alkhateep

Department of Surgery, Faculty of Medicine, Shepin Alkom, Menofia, Egypt

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## \*Correspondence:

Dr. Mohammed A. Elbalshy,

E-mail: mohammed.balshy@yahoo.com

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## **ABSTRACT**

**Background:** Although sleeve gastrectomy provides a technically simple procedure with minimal effect on digestive tract it deprives the stomach of its ligaments of fixation which results in impairment of gastric functions, vomiting, axial gastric rotation in addition to bleeding or leakage from the stable line. Objective of present study is the effect of stable line fixation during sleeve gastrectomy.

**Methods:** This is a prospective randomized study using closed envelop method carried on 100 patients with morbid obesity who underwent laparoscopic sleeve gastrectomy (LSG) they were divided into two groups each is 50 patient group A underwent classic (LSG) with no fixation and group (B) with staple line fixation.

**Results:** Patients were 68 females and 32 males with a mean age of 32.2±5.7 years, mean (BMI) 48.9±8.6kg/m<sup>2</sup>. postoperative vomiting, gastric axial rotation, impaired gastric emptying all were significantly higher in group A. Although both staple line bleeding and leakage were higher in the group A, but it was not statistically significant. Also, the operative time was shorter in the group A, but it was not significant.

**Conclusions:** staple line fixation should be a step during sleeve gastrectomy as it regains the stomach its ligaments of fixation anatomically and so functions better less vomiting, less gastric axial rotation, better gastric emptying in addition to decreasing staple line bleeding and leakage with minimal effect on operative time.

Keywords: Axial rotation, Fixation, Gastric emptying, Sleeve gastrectomy, Vomiting

## **INTRODUCTION**

Laparoscopic sleeve gastrectomy has been accepted as a standalone effective bariatric procedure. It has become the first option for many surgeons worldwide in treating obesity and its associated diseases. 1-3 Benefits of sleeve gastrectomy include lower complications, maintenance of normal gastrointestinal continuity, the absence of malabsorption and the ability to convert to multiple other operations. Excising the ghrelin producing stomach mass plays a significant role compared to other gastric restrictive procedures. 4

Although it is associated with excellent results and postoperative quality of life, a number of complications related to improper position and/or gastric tube

deformities resulting from loss of natural fixation may be associated with symptoms of persistent food intolerance and/or gastroesophageal reflux, and despite the relative technical simplicity and minimal impact on digestive physiology, fewer risks of nutritional complications, a number of early potentially serious postoperative problems, such as bleeding, difficult to resolve fistulae and irreversibility of gastrectomy. Also, Patients may develop significant postoperative nausea following LSG that may lead to additional clinic telephone encounters, clinic visits, or even readmissions.<sup>5-8</sup>

A twisted or spiral sleeve caused by the progressive rotation of the staple line in an anterior to omit the posterior plane can lead to a functional narrowing despite a fairly normal luminal diameter and is another cause of symptomatic stenosis. This functional stenosis makes it

difficult for gastric contents to pass through, in spite of the easy passage of the endoscope or balloon dilator through the narrowed area. Recently It has been reported that loss of abdominal ligament fixations along the greater curvature of the stomach may be implicated, so regaining normal anatomical fixation of the greater curvature to the gastrocolic ligament and gastrosplenic ligament may solve this problem and this will be the cornerstone of our study.

Objective of the present study is the role of routine fixation of the greater curvature of the stomach after laparoscopic sleeve gastrectomy (LSG).

## **METHODS**

This is a prospective randomized study performed upon a 100 case of morbidly obese patients at our Institute. Institutional Review Board approval was obtained to perform the study ,review the data and report the analysis (36-12-2015), our study has been reported in line with the STROCSS criteria. <sup>10</sup> All patients underwent LSG after meeting the indications of bariatric surgery devised by the International Federation for the Surgery of Obesity (IFSO) and the National Institute of Health (NIH). <sup>11,12</sup> The exclusion criteria included major psychiatric disorders, severe gastro-esophageal reflux disease, previous gastric surgery (including bariatric surgery), liver cirrhosis with portal hypertension, and malignancies. Patients were divided into two groups:

- *Group A:* Comprising 50 patients and underwent classic LSG.
- Group B: Comprising 50 patients and underwent LSG with fixation of the greater curvature to the gastrocolic lig gasrtrospelnic lig even the distal part is fixed to the mesocolon of transverse colon below pancreas, or even the peritoneal covering of pancreas. This study is performed from July 2015 to January 2017. Patient selection was performed using closed envelope method both doctor and patient didn't know the procedure to be performed till the patient chose an envelope containing the technique to be used. and the following data were recorded:
  - Demographic data, baseline body mass index (BMI), and associated comorbidities.
  - Steps of operative technique including the operative time.
  - Postoperative course: oral feeding and early ambulation.
  - Length of hospital stay, 30-day morbidity and mortality with special emphasis on staple line bleeding and leak, postoperative nausea, vomiting, and gastric axial rotation, food intolerance as an indicator of impaired gastric emptying.
  - Follow up of whole patients was done till 6 months postoperatively regarding vomiting, and

gastric axial rotation, food intolerance as an indicator of impaired gastric emptying.

All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written informed consents about nature of the procedure and possible complications were obtained from participating patients.

## Statistical analysis

Data were analysed using SPSS version 22 program. Data were expressed in the form of mean±standard deviation (SD), median, and range. Quantitative data were analysed using student's t-test, whereas qualitative data were managed by chi-square test or Fisher's exact test. A P-value less than 0.05 was considered significant.

## Operative technique

All procedures were conducted under general anesthesia. The prophylactic antibiotic was taken with the induction of anesthesia. 4 trocars were used in addition to self-retaining liver retractor. After the insertion of a 38-Fr bougie, the stomach was divided along the greater curvature.

We started the first stapler firings 2cm proximal to the pylorus using green reloads. In group B, on completion of the firings till reaching 1cm lateral to the angle of hiss before the last firing we created a window cautiously in the gastrosplenic lig. When the window has created the tip of the reload can be seen easily before firing, now the specimen is completely free (Figure 1).



Figure 1: Staple line after complete separation with pancreas below.

from the stomach and we will start fixation of the staple line using interrupted 2/0 vicryl suture. One case of intraoperative gastric twist has faced us (Figure 2). It was in the group B and it was fixed.



Figure 2: Gastric remnant forming a coil shape upon itself before fixation.

We affixed the anterior and posterior walls of the antrum to the mesocolic fat below the pancreas, then we proceeded upwards till crossing in front of the body of the pancreas fixing the greater curvature to the gastrocolic lig. Continuing upwards towards the angle of Hiss with fixation of staple line to the gastrosplenic lig. Taking care of short gastric vessels (Figure 3).

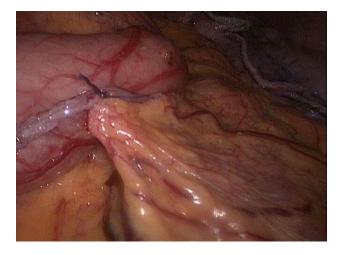


Figure 3: Fixation of staple line to gastrocolic lig.

During follow-up study of gastric emptying was done after one month, we established the step of one-month post-surgery to assure that suture line was well sealed and also that stenosis was not caused by "physio pathologic" edema and inflammation. For that, it is highly recommended to observe stricture in the first weeks after surgery.<sup>2</sup>

Using a simple technique, a light meal (e.g. yoghurt) mixed with a contrast medium e.g. urographin then x-ray was taken after the meal and 4 hours later normally the stomach should be completely free after 4 hours. if there is still radio-opaque material it is considered delayed gastric emptying (Figure 4). Unfortunately, the more precise technique was not available to us. In which gamma camera and specific indicator to stomach is used

to scan the area of the stomach and measure the radioactivity of its contents.

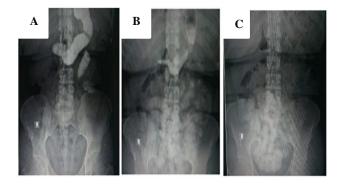


Figure 4: Gastric emptying study, (A) 5 minutes After the meal; (B) After 4 hours in group A; (C) After 4 hours in group B.

When patients complained of persistent vomiting, dysphagia, or refractory gastroesophageal reflux despite proton pump inhibitor treatment after the initial LSG, we arranged an upper gastrointestinal series and gastro endoscopy to evaluate the possibility of gastric torsion (gastric axial rotation).

#### **RESULTS**

This study included 100 patients with the mean age of 32.2±5.7 (range, 22-58) years. Patients were 68(68%) female and 32 (32%) male. The mean preoperative body weight was 140.1±27.6 (range, 120-250kg). The mean preoperative BMI was 48.9±8.6 (range, 35.4-68.8kg/m²). The mean operating time for group A was 90.6±15.7 (range, 50-159 minutes). Group B was 98.3±20.1 (range,60-190 minutes). The median hospital stays was1 day (range,1-2 days) (Table1).

Table 1: Patients characteristics in the two groups.

Variable	Group A	Group B	p-value
Number	50	50	
Age (years)	31.2±4.32	33.4±3.21	0.24
gender (M/F)	15/35	17/33	0.6
Preoperative weight (kg)	138.3±2.64	142.8±3.24	0.22
Preoperative BMI (kg/m <sup>2</sup> )	48.1±2.3	49.9±4.9	0.3
Operative time (min.)	90.6±15.7	98.3±20.1	.07

BMI, body mass index

Patients started oral feeding usually after 4 hours of the operation, and started ambulation 1 to 2 hours. Mean number of patients suffering from postoperative vomiting during the period of follow-up was 24 patients (24%). 18 patients in group A 6 patients in group (B). 2 patients developed postoperative bleeding (2%) both were in group A. One case of stable line leak in group A.

Postoperative gastric axial rotation was detected in 6 patients all were in group A. Those were diagnosed when suspected clinically by persistent vomiting, dysphagia, or refractory gastroesophageal reflux despite proton pump inhibitor treatment after the initial LSG, then it was confirmed by both upper gastrointestinal series and gastro endoscopy all were treated endoscopically, all were functional stenosis no organic stricture was found. 4 cases responded well to repeated dilatation using achalasia balloon dilator at an increasing pressure starting from 15-psi, and the other 2 cases required stent deployment with a self-expandable metal stent for 3 weeks then stent was removed. No further intervention was needed in any of the patients. The case that was detected intraoperatively was in group B and, so it was fixed with uneventful postoperative course.

No case of leak or bleeding in group B. Mean number of patients with impairment of gastric emptying was 18 patients in group A and 4 patients in group B during the period of follow-up. No mortality was recorded in the study. Operative time was shorter in group A than in group B, but the difference was not significant. There was significant difference between both groups regarding post-operative vomiting, gastric sleeve axial rotation and impaired gastric emptying (p <0.05). But there was no significant difference between both groups regarding operative time, stable line bleeding or leakage (Table 2).

Table 2: Postoperative outcome in the two groups.

Variable	Group A (N =50)	Group B (N =50)	p-value
Vomiting	18	6	0.01*
Bleeding	2	0	0.45
Leak	1	0	1.00
Postoperative axial gastric rotation	6	0	0.04*
Impaired gastric emptying	18	4	0.002*

<sup>\*</sup>p values less than 0.05 is statistically significant

## **DISCUSSION**

Staple line bleeding and leak after sleeve gastrectomy are the most important and serious two complications in this regard. Incidence of staple line bleeding ranges from 1 to 6%. Bleeding can be intraluminal causing hematemesis and/or melena, or can be extraluminal causing hemoperitoneum. In our study bleeding has occurred in two cases (2%) both were in group A, and they were managed conservatively by blood and plasma transfusion and follow up by abdominal Ultrasound and haemoglobin level and the patients had passed without intervention. Also, a case of stable line leak (1%) has faced us during our study and it has been managed by a mega stent insertion for one month then it was removed, and the leak has stopped. Moon han s, et al at 2005 stated that Staple

line leak is a serious, dreaded complication of LSG, with an incidence reaching up to 5%. <sup>14</sup>

Abou Rached A et al, had recommended technical tips to reduce gastric leak such as the careful application of ultrasonic devices and staplers, use of larger bougie size, avoiding distal stenosis, and performing intraoperative methylene blue test for immediate detection of leaks. <sup>15</sup>

Twist of the gastric remnant after sleeve gastrectomy is a condition similar to the organo-axial gastric volvulus. A twisted or spiral sleeve caused by the progressive rotation of the staple line in an anterior to posterior plane can lead to a functional narrowing despite a fairly normal luminal diameter, and is another cause of symptomatic stenosis. This functional stenosis makes it difficult for gastric contents to pass through, in spite of easy passage of the endoscope or balloon dilator through the narrowed area. This can be equated to twisting a straight balloon where there is a twist at the incisura. Baumann T et al recommended to do a proper posterior dissection of the stomach in sleeve gastrectomy in order to achieve a symmetric stapling of the posterior and anterior wall to avoid twisting of the remnant stomach tube.

Pexy of omentum to the gastric remnant may also help to avoid such a twist in the remnant stomach after sleeve gastrectomy. There is always possibility of asymmetrical staples leading to initiation of the twist but completion of twist to an extent of obstruction as in a volvulus is attributed to a long tubular remnant with no supports. <sup>16</sup> Some degree of a twist is seen in every stomach post laparoscopic sleeve gastrectomy but none of these cause functional stricture. <sup>17</sup> These twists can be managed nonoperatively with placement of covered stent It has recently been reported that loss of abdominal ligament fixations along the greater curvature of the stomach may result in improper gastric pouch positioning, causing food intolerance and persistent reflux. <sup>16</sup>

From anatomical and functional point of view. we agree with that consensus. In light of the above, and owing to the current inability to identify the factors responsible for the problems of improper positioning discussed, so we do pexy of the gastric remnant to return it back to its fixation ligaments. As we think that loss of these supports may be the involved cause in that large number of patients suffering from vomiting, and food intolerance after sleeve gastrectomy. In spite of using a large-sized bougie also as there is always some degree of twist even you do your best to properly align staples, so fixation of gastric remnant may solve this problem. Recent studies show significant changes in gastric emptying after vertical sleeve gastrectomy.<sup>18,19</sup>

Although emptying time for liquids is generally shorter, the peristaltic capacity of the sleeve seems to be considerably compromised. In our study, we have found that in group A sleeve with no fixation there was a significant difference in favour for group B sleeve with

fixation as regards to the post-operative vomiting, gastric axial rotation and impaired gastric emptying. Distension caused by the presence of food in the absence of one of these ligaments may lead to primary rotation.<sup>20,21</sup> It is recommended that in certain cases the surgeon may observe the tendency of the gastric tube to form a coil shape and that fixation sutures be applied to the greater omentum to correct the deformity and maintain it in the proper position.<sup>22</sup> On the contrary to our study the first randomized study comparing omentopexy to no omentopexy published by Afaneh C et al, stated that there was no difference between both groups but this may be explained by some points First, they continue medications on proton pump for 3 months and this may mask the symptoms.<sup>23</sup> In addition, the anti-nausea medication could not be standardized with a single agent as some patients responded better to specific medications as they reported, Second, they do not explain how the patients with omentopexy required a significantly higher dose of ondansetron, Third. In that study the effect of number of patients suffering from e.g. vomiting is ameliorated by change of the whole group into a score so we don't know how many persons in each group are suffering from vomiting this may be due to the small number in each group (30 patients) so the discrepancy may be unnoticed, Fourth, in that study they do not agree with the effect of omentopexy even in prevention of torsion of gastric sleeve without any recorded data as they stated.

Finally, the number of our patients or the patients in that study is limited to reach a final conclusion, it needs a larger number of patients and longer periods of follow-up. On the same way with us de Godoy and colleagues describe the technique of gastric fixation of the greater curvature of the stomach following LSG.<sup>24</sup> The authors reported that the technique potentially attenuates the incidence of GERD and food intolerance.

Also, Gregg H has stated that omentopexy is recommended by some authors to avoid kinking or intermittent volvulus that may be associated with vomiting problems.<sup>25</sup> Again in the case report published by Murcia et al documented that the 3 cases of gastric torsion were due to adhesions between the liver and staple line after SG, and this may' in our opinion' support the idea of omentopexy to prevent this complication.<sup>26</sup> another one larger study with longer period of follow-up published by Po-Chih Chang.<sup>27</sup> During the follow-up of 58.1±26.5 month, no patient has experienced GS after LSG till the time of publishing in those they added omentopexy versus those who didn't (0/489 vs. 7/338, p<0.05). Really the LSG procedure is associated with changes in gastric emptying. The incidence of delayed gastric emptying and persistent food intolerance is reported as high as 30%. 16,28,29 Although Goitein et al, published a study associated with swift gastric emptying than delay due to twisting or torsion of the gastric sleeve it was studied on contrast material only, also they did not study the effect of omentopexy at that time.<sup>30</sup> As it is

known gastric stricture is well described with a prevalence between 0.7 and 4.0% and this may increase as SG rate increases and also this may increase hospital readmission with more burden on both the doctor and the patient.31 So, it represents a problem even there is no consensus about how to solve, due to deficient information about the pathophysiology of mechanical, complication. Either or functional impairment of the gastric peristalsis, or even impairment of pyloric function, but there is consensus that to prevent the problem is better than to treat, we think that omentopexy may help to decrease or prevent the incidence of gastric torsion' as we have not any published data about cases of gastric torsion with omentopexy 'till more objective studies done on patients with SG on larger number and longer period of follow-up.

As regards to surgery time there was no significant difference between both groups. From the above we can say that the stomach fixation with this strategy, has proven to be easy to apply, has a non-significant effect on surgery time, is safe and seems to provide suitable and reliable re-fixation of the stomach after the procedure.

Limitation of the present study was to be the second randomized study to compare omentopexy, with non-omentopexy. But we tried to depend on objective methods in addition to subjective one. Even it is not the most precise. Also, the number of patients and the period of follow-up is not sufficient to permit us to give a final decision.

## **CONCLUSION**

The stomach fixation strategy is easy to use, safe and can reduce complications arising from improper positioning and gastric tube alterations in laparoscopic vertical sleeve gastrectomy. This may promote enhanced postoperative esophageal and gastric emptying, reducing the occurrence of symptoms related to impaired gastric emptying, gastric axial rotation, and postoperative vomiting. In addition to being useful in protecting the staple line, thereby providing greater resistance against fistulae and hemorrhagic complications.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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