

# Role of reinforcement of staple line in laparoscopic sleeve gastrectomy for patients with morbid obesity

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## Background

Postoperative staple line bleeding and leakage after laparoscopic sleeve gastrectomy (LSG) still pose potential challenging complications. Some studies have indicated staple line reinforcement (SLR) to decrease the rate of bleeding and leakage, but its efficacy is still being debated. The aim in this study was to evaluate the incidence of staple line bleeding and leakage during LSG after SLR using absorbable suture material.

## Patients and methods

This was a retrospective study that included 180 consecutive patients who underwent LSG between January 2017 and October 2019 and were divided into two groups: 50 patients in group A (without SLR) and 130 patients in group B (with SLR). The study was conducted in Helwan University hospital and Dar Elshefa and El Merghany private hospitals.

## Results

Postoperative staple line bleeding was 4% in group A compared with 1.5% in group B ( $P=0.315$ ). Bleeding control by reoperation was 4 and 0% in groups A and B, respectively ( $P=0.021$ ). Just one patient had leakage in group A (2%) and was managed with endoscopic clipping and stenting ( $P=0.105$ ).

Operative time was shorter in group A than in group B, with mean of 70 and 81.41 min, respectively ( $P<0.001$ ).

## Conclusion

SLR by oversewing using absorbable suture material during LSG is safe and efficient in reducing the incidence of reoperation to control postoperative staple line bleeding despite the fact that it significantly increased the operative time.

Nonetheless, more studies are needed on a larger number of patients with various reinforcement techniques to prove its effectiveness. SLR with absorbable suture material is safe and efficient in LSG and may reduce the need for reoperation despite prolonging the operating time and not being statistically significant in reducing the incidence of complications such as bleeding or leakage.

## Keywords:

laparoscopy, oversewing, sleeve gastrectomy

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## Introduction

Bariatric surgery is now recognized as an evidence-based method for weight loss in patients with morbid obesity; however, the results vary depending on the procedure [1].

In 1993, Marceau first described sleeve gastrectomy in obese patients as a part of bilio-pancreatic diversion. Then, it became a standalone procedure done by many bariatric surgeons in the early 2000s. Nowadays, laparoscopic sleeve gastrectomy (LSG) has become the most popular bariatric procedure [2–4].

The simplicity of the LSG procedure, short medium operating time, lack of anastomosis of the intestine, low complications rate, and shorter learning curve than gastric bypass are all reasons for its success. [5,6].

Postoperative bleeding and staple line leakage also pose a potential problem. The incidence of bleeding ranges from 1.1 to 8.7%, and it may require reoperation [7].

Staple line leakage is less common than bleeding but more life-threatening, and its incidence ranges from 0.5 to 2.7% [8].

Despite the fact that there are a number of different approaches to make the staple line safer, there is no agreement on which approach is best. These methods include oversewing by absorbable or nonabsorbable suture materials, omental wrapping, fibrin glue, and

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use of porcine small intestinal submucosa strips or bovine pericardial strips. [9].

Several studies have indicated that staple line reinforcement (SLR) reduces the risk of bleeding and leakage, but its efficacy is still being debated. Our aim in this study was to evaluate the incidence of staple line bleeding and leakage during LSG after SLR by oversewing using absorbable suture material.

### Patients and methods

In this study, we collected data retrospectively from patients' medical records who underwent LSG from January 2017 till October 2019. The study was conducted in Helwan University Hospital and Dar El Shifa and Merghany private hospitals which included 180 consecutive cases.

All the operations were done by the same surgeons who followed the same protocol, and Ethical Committee approval was obtained.

Patients were categorized into two groups: group A included 50 patients who underwent LSG without SLR and group B included 130 patients who underwent LSG with SLR by oversewing using polyglactin suture (Vicryl 2/0).

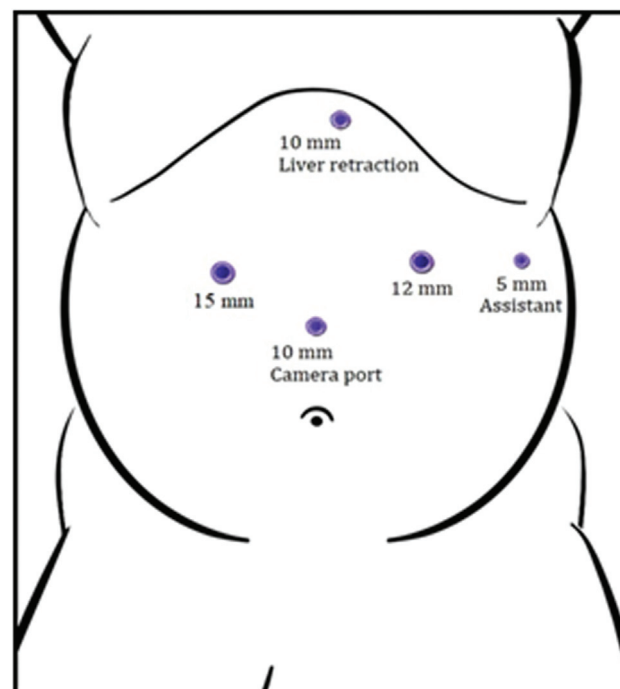
After revising patient data, we found that the change of surgical strategy from none oversewing to routine oversewing of the staple line was owing to the occurrence of postoperative staple line bleeding in two cases that needed reoperation and oversewing of the staple line.

This is a retrospective study conducted in Helwan University Hospital and Dar Elshefa and El-Marghany Private Hospitals. It included 180 consecutive cases who underwent LSG in the period from January 2017 till October 2019. Patients were divided into two groups: group A included 50 patients with LSG without SLR, and group B included 130 patients who underwent LSG with SLR by oversewing using polyglactin suture (Vicryl 2/0).

### Preoperative

Data collection from medical records revealed that all patients were offered LSG if their BMI was more than or equal to  $35 \text{ kg/m}^2$ , and all the patients had full history taking, thorough clinical examination, full laboratory blood tests (complete blood picture, liver function, viral hepatitis markers, kidney function, random blood sugar, glycosylated hemoglobin,

Figure 1



Port sites in laparoscopic sleeve gastrectomy.

thyroid profile and coagulation profile), pelviabdominal ultrasonography, chest radiography, pulmonary function tests, and ECG. Echocardiography was done to patients older than 50 years or having history of cardiac disease.

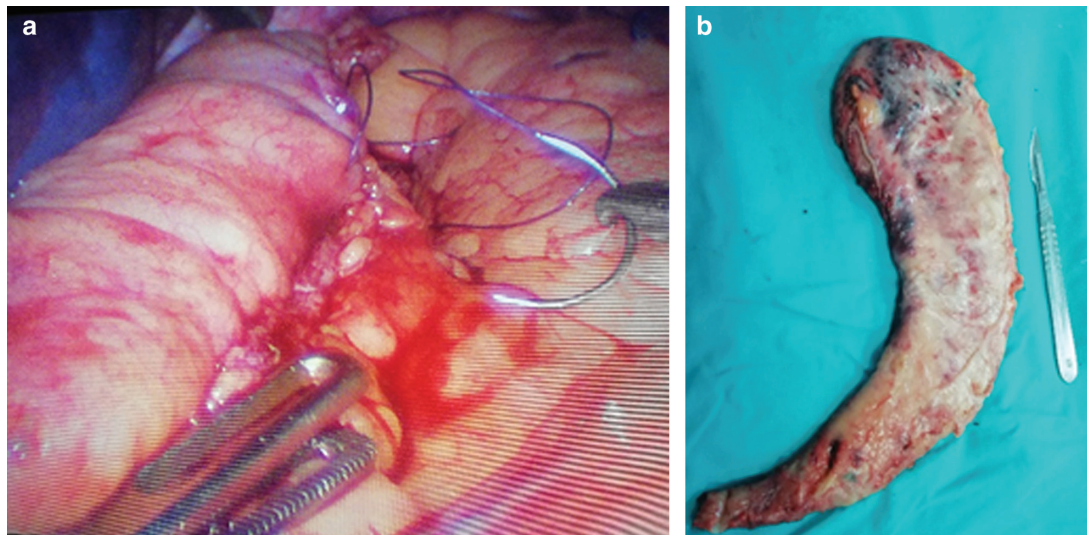
Upper gastrointestinal endoscopy was done selectively to patients with evident gastroesophageal reflux symptoms in their history (frequent heartburn, regurgitation, water brash, and choking during sleep).

Patients were excluded from this study if they had previous bariatric procedure or their operative data showed concomitant cholecystectomy or hiatal hernia repair.

### Surgical technique

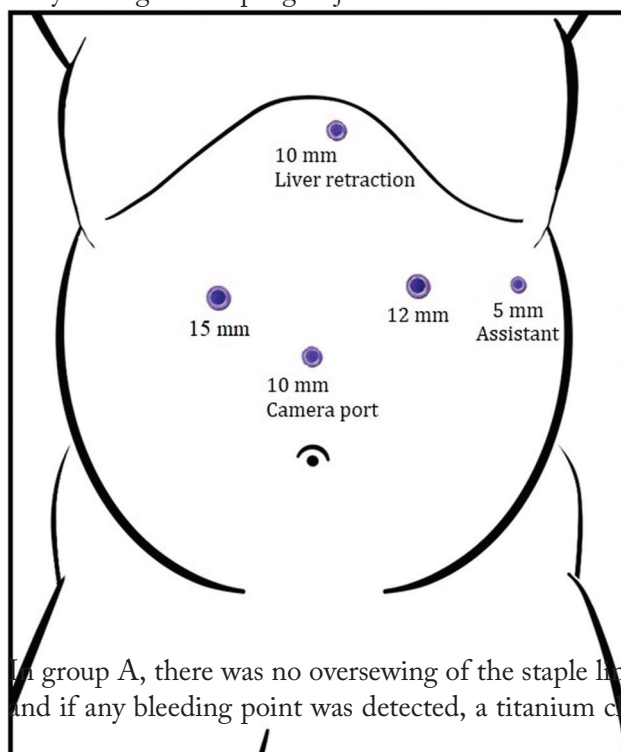
All patients underwent the procedure under general anesthesia and were given 1g third-generation cephalosporin (Ceftriaxone) at the induction of anesthesia. Patients were placed in supine position with the surgeon standing between the legs, camera operator to the right of the patient, and the assistant on the left side. Overall, 5 trocars were used as shown in Figs 1 and 2. Pneumoperitoneum was done by Hasson open technique from the midline trocar, and then all trocars were introduced under vision using  $30^\circ$  camera lens. The 15 and 12-mm ports were used as working ports.

Figure 2



(a) Staple line reinforcement using continuous Vicryl 2/0 suture. (b) Stomach specimen after resection.

After creation of pneumoperitoneum, the left lobe of the liver was retracted upward from the 10-mm port for full visualization of the stomach. Then the procedure was started by division of gastroepiploic vessels by using advanced bipolar technology (ligasure; Covidien/Medtronic Inc., Mansfield, Massachusetts, USA) started 2 cm from pylorus. Dissection continued toward gastric fundus with division of short gastric vessels until complete visualization of the left crus of diaphragm to ensure complete mobilization of gastric fundus. The gastric sleeve is then created after introduction of 36 F calibration tube, and stapling was done by linear cutting Endo GIA 60 mm (Covidien/Medtronic Inc.) started 4 cm from pylorus and ended at the angle of His 1 cm away from gastroesophageal junction.



In group A, there was no oversewing of the staple line, and if any bleeding point was detected, a titanium clip

was applied. In group B, SLR was done by oversewing using continuous Polyglactin (Vicryl) 2/0 suture material taking only the serosal layer of the gastric sleeve.

It is oversewing as a second layer over the staple line taking the serosal layer of the gastric sleeve ending by making the whole staple line invisible.

Finally, methylene blue leak test was done to detect any leakage, and a tube drain 18 F was routinely inserted intra-abdominal from the left subcostal assistant port and positioned beside the gastric sleeve. The transected stomach was removed via a 12-mm port on the left flank.

Local anesthetics were penetrated along the port sites done before and after the completion of the procedure and closed the skin using absorbable subcuticular sutures accompanied by sterile dressing.

#### Postoperative management

Antithrombotic low-molecular-weight heparin (Clexane) in prophylactic dose was given to all patients, and they were instructed for early mobilization. Patients were also instructed to start clear oral fluids 12 h postoperatively, and they received proton pump inhibitors (Controloc 40 mg twice daily), and it was continued up to 3 months. Postoperative pelviabdominal ultrasound and gastrografin leak test were done only in suspected cases of leakage (postoperative tachycardia, fever, or severe abdominal pain) (we used it just as a primary evaluation before doing computed tomography scan). Most of the patients were discharged on the second postoperative day, and the drain was left for observation for any leakage or bleeding

**Table 1 Demographic data and co-morbidities**

	Group A: without SLR (N=50) [n (%)]	Group B: with SLR (N=130) [n (%)]	P value
Sex			
Males	8 (16.0)	14 (10.8)	0.337
Females	42 (84.0)	116 (89.2)	
Age			
Mean±SD	38.12±8.44	34.0±8.80	0.005
Range	25–55	18–50	
BMI			
Mean±SD	44.44±5.12	45.85±6.94	0.193
Range	36–55	36–57	
Co-morbidities			
Diabetes mellitus	4 (8.0)	7 (5.0)	0.841
Hypertension	8 (16.0)	12 (9.0)	

SLR, staple line reinforcement.

and was removed on the fifth postoperative day during the first outpatient clinic (OPC) visit. All patients were evaluated regarding operative time, postoperative hospital stay, complications such as leak and bleeding, and the need for blood transfusion. Patients were instructed to return to the emergency department if they had any of the following symptoms: sudden unusual abdominal pain, tachypnea, persistent vomiting, tachycardia, or fever. They were also contacted daily by phone by one of our surgical team until their first OPC visit.

#### Follow up

Patients' first follow-up visit was on day 5 postoperatively, then once weekly until the end of the second month. Then, patients were advised to follow-up in OPC once per month for the next 6 months and then every 3 months for 2 years. Patients were examined clinically during their visit with measurement of weight, and they were asked about any systemic or gastrointestinal complains.

#### Statistical analysis

Data were analyzed using the SPSS version 15.0 (SPSS Inc., Chicago, Illinois, USA) statistical software. Quantitative variables have been expressed as mean ±SD, and qualitative variables have been expressed using absolute and relative frequency. The  $\chi^2$  test has been used to study how qualitative variables are associated.

#### Results

Table 1 indicates a total of 180 LSG patients including 158 females and 22 males, with mean BMI of 44.44 in group A and 45.85 in group B. The age in group A ranged from 25 to 55 years, and in group B from 18 to

**Table 2 Operative time and hospital stay**

	Group A: without SLR (N=50)	Group B: with SLR (N=130)	P value
Operative time by minutes (mean) ±SD	70.00±11.55	81.41±16.70	<0.001
Range	55–90	60–120	
Hospital stay by days (mean) ±SD	1.44±0.5	1.25±0.15	<0.001
Range	1–8	1–1.5	

SLR, staple line reinforcement.

**Table 3 Postoperative bleeding and leakage**

	Group A: without SLR (N=50) [n (%)]	Group B: with SLR (N=130) [n (%)]	P value
Incidence of bleeding	2 (4.0)	2 (1.5)	0.315
Management of bleeding by reoperation	2 (4.0)	0	0.021
Management of bleeding conservatively	0	2 (1.5)	0.377
Incidence of leakage	1 (2.0)	0	0.105
Management of leakage by reoperation	0	0	1.000
Management of leakage by endoscopic stenting	1 (2.0)	0	0.105
Total complications	3 (6.0)	2 (1.5)	0.102

SLR, staple line reinforcement.

50 years. In both groups, presence of co-morbid conditions was reported and compared.

The mean operating time in group A, as shown in Table 2, was 70 min, which was shorter than in group B at 81.41 min ( $P<0.001$ ). There was also statistical significance as to the duration of hospital stay between the two groups ( $P<0.001$ ). As we mentioned in patients and methods section that most of the patients, not all the patients, were discharged on the first postoperative day unless there was a reported complication. There was an increase in the hospital stay in group A owing to the presence of three patients with complications, which increased their hospital stay – one case of leak managed by endoscopic stenting and two cases of bleeding managed by reoperation. On the contrary, the two reported cases of bleeding in group B did not have significant increase in the hospital stay because one patient who developed hematoma was drained by pig tail insertion 1 week postoperatively and the patient was not admitted in the hospital, and the other patient

Figure 3



Gastrografin meal study after management of leakage by endoscopic clipping and stenting.

had drain stoppage spontaneously, with no increase in hospital stay.

In Table 3, two (4%) cases of bleeding (blood >500 ml in the drain/24 h) occurred in group A and were managed by reoperation with oversewing of staple line to control bleeding. On the contrary, two (1.5%) patients in group B had moderate bleeding (<500 ml of blood/24 h) and were managed conservatively without reoperation ( $P=0.021$ ).

Moreover, there was one case of leakage (2%) in group A, whereas no patients (0%) with leakage in group B. The leakage was located 3 cm below the gastroesophageal junction and was managed by endoscopic clipping of the perforation and stenting ( $P=0.105$ ) (Fig. 3).

In both groups, there were no recorded cases of stenosis or mortality.

## Discussion

There are major advances in stapling devices technology, but the staple line complication is still of importance, with bleeding and leakage ranging from 1 to 5%, and more than 3% of patients undergo reoperation [10].

Staple line leakage is caused by many factors which may be attributed to mechanical faults or improper

instrumentation, and this type of leakage usually appears in the first 48 h, or may be caused by gastric sleeve ischemia owing to massive dissection, which appears 5–7 days after surgery [11].

So, we think that proper surgical technique with handling of tissues softly plays a major role in decreasing the incidence of leakage and bleeding after LSG, as we see that most of surgeons had higher incidence of bleeding and leakage in the start of their learning curve in the bariatric surgery field.

SLR by suturing or buttressing materials was done by many surgeons, whereas others preferred to leave the staple line without reinforcement. Many reinforcement methods are used, but suturing is the most popular method used among surgeons. Studies have shown decreased leakage rate when using buttressing materials and was attributed to distributing tension over the whole staple line [12,13].

In this study, we used inverted Lembert continuous absorbable suture in our technique in oversewing, whereas other surgeons used the through-and-through technique. Most studies in the literature compared different methods of reinforcement, but there was no comparison between suturing techniques or materials.

In our study, we reported one case of leakage (2%) in group A, with no cases of leakage in group B (0%), and it was statistically insignificant ( $P=0.105$ ). Moreover, bleeding occurred in two patients in each group, with incidence of 4% in group A (without SLR) and 1.5% in group B (with SLR) ( $P=0.315$ ). Although these results were statistically insignificant, we think that it is of clinical importance, and it was limited by the small sample size.

The severity of bleeding was more evident in group A, as two patients required reoperation to control bleeding through oversewing of the staple line, as it was the source of bleeding in the two cases ( $P=0.021$ ).

On the contrary, the bleeding which occurred in patients in group B was less severe and managed conservatively, in which one patient had operative bed hematoma discovered 1 week postoperatively and was drained through ultrasound guidance. The other patient had moderate bleeding which stopped spontaneously without significant drop in hemoglobin level or any affection of the vital signs.

In a study on 100 patients done by Kwiatkowski *et al.* [14], the incidence of bleeding and leakage in the

nonreinforced group was 4.6 and 2.3%, respectively, compared with 0% in the reinforced group, which is almost similar to our results, and the limitation of this study was the small sample size also. Another study done by Abdallah [15] showed that there was a higher incidence of bleeding (12%) and leakage (8%) in the nonreinforced group than in the reinforced group, with incidence of 4 and 0%, respectively. In one of the largest systematic review done by Knapps *et al.* [16] on 4881 patients who underwent LSG with and without SLR, the incidence of leakage was 3.2 and 3.9%, respectively, and the incidence of bleeding was 2.6 and 1.7%, respectively, indicating no statistical difference between both groups.

Although the total incidence of complications was statistically insignificant ( $P=0.102$ ), we think that it significantly affected the length of hospital stay, which was shorter in group B ( $P<0.001$ ). This was explained by reoperation of two patients and the occurrence of leakage in patient in group A, whereas the two patients of bleeding in group B were managed conservatively.

Moreover, there was a significant increase in the operative time in the oversewing group when compared with the nonoversewing group, with mean of 81.41 and 70 min, respectively. At the beginning, the duration of oversewing of the staple line took about 15 min, but at the end of this series, it reached ~5 min, because the learning curve increased. In the future, we think that the operative time may not be significantly prolonged by oversewing.

## Conclusion

SLR by oversewing using absorbable suture material during LSG is safe and efficient in reducing the incidence of reoperation to control postoperative staple line bleeding despite the fact that it significantly increased the operative time. Nonetheless, more studies are needed on a larger number of patients with various reinforcement techniques to prove its effectiveness.

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## Conflicts of interest

There are no conflicts of interest.

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