STAPLE-LINE SUTURE REINFORCEMENT: COULD IT HELP CONTAIN THE LEAK?

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ABSTRACT

BACKGROUND: Laparoscopic sleeve gastrectomy (LSG) is currently the most commonly performed bariatric procedure. The most fearsome complications are leaks and bleeding from the suture line. Staple line reinforcement (SLR) has been suggested as a mean of reducing the risk of sleeve leakage or bleeding. The aim of this study is to analyze if the suture reinforcement can be employed to reduce the leakage rate after sleeve gastrectomy.

MATERIALS AND METHODS: A total of 100 patients undergoing LSG between January and December 2022 at the University Hospital of Foggia, all performed and treated by the same experienced surgeon, were retrospectively assessed; the reinforcement technique was applied in 98 patients at the upper third of the staple line with barbed sutures (Suture Group). We compared these data with a group of 71 patients (Control Group) undergoing LSG between January and December 2021 without the employment of reinforcement technique.

RESULTS: The study gathered 171 patients, 98 for the Suture Group and 73 for the Control Group. The study includes 61 males (35,7 %) and 110 (64,3 %) females, with a mean age of 36,8 ± 12,2 years (range: 18-65 years) and a mean body mass index of 47,5 ± 9,3 kg/m^2. The mean operative time for the Suture Group was 53,9 ± 6,3 minutes and 46,5 ± 8,2 minutes for the Control Group (p-value > 0,05). The upper third of the staple line was reinforced with barbed suture and postoperative leakage occurred in 1 patient (1 %) belonging to the Suture Group; in the Control Group we observed 3 cases of leak (4,1 %).

CONCLUSIONS: The literature does not provide sufficient evidence to support the routinary use of suture-reinforcement techniques in laparoscopic sleeve gastrectomy, but our study highlighted a lower leakage rate in the group featured by the suture reinforcement. The collected data are still small, therefore it is necessary to continue the study to obtain more significant results.

Keywords: suture reinforcement; sleeve gastrectomy, leak; gastric fistula; bleeding; bariatric surgery.

INTRODUCTION

Obesity is a complex and highly prevalent chronic disease representing a major public health concern [1].

Laparoscopic sleeve gastrectomy (LSG) is a surgical weight loss procedure in which about three-quarters of the stomach is removed, leaving behind a narrow gastric tube or sleeve. In recent years, LSG has become one of the preferred surgical modalities for the treatment of obesity [2, 4]. Not only is this surgery safe in terms of mortality, but it also offers long-term weight loss with the added benefit of resolving or improving obesity-related comorbidities [3].

The major early postoperative complications of leakage and bleeding are low probability events, but have devastating outcomes and a frustrating impact on patient recovery, hospital stay and medical costs [5,6] . Bleeding after LSG is reported at an average rate of 2% and might occur when dividing the greater curvature vessels or when suturing the stomach [7].

Gastric leakage is the most feared complication of GS due to its complex management and its clinical evolution, which can be particularly long. Lasting up to 90% of LSG leaks occur at the esophagogastric junction (EGJ) rarely involving the distal part of the suture line [8]. The leak rate is reported as 2.2%–2.4% according to two large systematic reviews in literature [9].

Despite the similar basic principles of LSG, technical variations exist among surgeons. Debates concerning the need for staple line reinforcement (SLR) after LSG and its methodologic features continue.

Intraoperative manipulation of the suture line is greatly important in order to prevent or reduce these serious and feared complications [10]. Approximately 80% of surgeons prefer the SLR, but their methods have shown a variety, including buttress, overstitch, inversion of the suture and omental tape [11].
The aim of this study is to analyze if the suture reinforcement can be used to reduce the leakage rate after sleeve gastrectomy.

MATERIALS AND METHODS

A total of 100 patients undergoing LSG between January and December 2022 at the University Hospital of Foggia, all performed and treated by the same experienced surgeon, were retrospectively assessed; the reinforcement technique was applied in 98 patients at the upper third of the staple line with barbed sutures (Suture Group). We compared these data with a group of 71 patients (Control Group) undergoing LSG between January and December 2021 without the employment of reinforcement techniques.

Eligibility criteria

Adult patients of both sexes aged between 18 and 65 years with morbid obesity defined as BMI>40 kg/m^2or BMI>35 kg/$m^2$with at least one associated major comorbidity were included and were subjected to laparoscopic Sleeve Gastrectomy. We excluded patients with secondary obesity due to endocrine and psychological disorders, patients under antiaggregant and anticoagulant therapies and re-do surgery.

Statistical analysis

Continuous data were expressed as mean and standard deviation (SD) and they were analyzed with **Chi-square test** with a p value less than 0,05 ($p<0,05$) for statistical significance.

Surgical Technique

The technique involves the use of 4 12 mm trocars. Pneumoperitoneum is induced by a 0° optical trocar and maintained at 15 mmHg. The first trocar is usually inserted along the left mid-clavicular line approximately 3 fingers from the costal arch, another trocar along the left axillary line, a third trocar 1 cm to the right of the midline, and the fourth trocar along the right mid-clavicular line. A 10 mm, 30 ° laparoscope is used.

The left lobe of the liver is retracted to expose the lesser gastric curvature and the gastroesophageal junction. The procedure begins by dissecting the small branches of the gastroepiploic arch 6 cm from the pylorus. The dissection continues along the great curvature of the stomach, remaining very close to the gastric wall, up to the short gastric vessels which are also dissected. The stomach is then raised to expose its posterior wall and the adhesions are lysed. His angle is fully mobilized and the left diaphragmatic pillar are exposed. The gastric tubule is created according to the guide provided by 40 F Bougie using mechanical suturing machines with cartridges of different thickness depending on the thickness of the gastric wall. At this point the bougie is removed and the resected stomach is extracted from the abdomen through the mesogastric access.

In Suture Group, we applied running seromuscular stitches at the proximal third of the stapled line using unidirectional 2/0 barbed sutures to invaginate the staple line completely.

The pneumoperitoneal pressure of CO2 is reduced to 8 mmHg and the haemostasis is assessed. In case of bleeding we proceeded cauterizating with monopolar forceps or employing laparoscopic hemostatic agents. Abdominal drainage is placed.

RESULTS

The study gathered 171 patients, 98 for the Suture Group and 73 for Control Group.

The study includes 61 males (35,7 %) and 110 (64,3 %) females, with a mean age of 36,8 ± 12,2 years (range: 18-65 years) and a mean body mass index of 47,5 ± 9,3 kg/m^2 (Table 1). The mean operative time for the Suture Group was 53,9 ± 6,3 minutes while for the Control Group was 46,5 ± 8,2 minutes (p-value > 0,05). The upper third of the staple line was reinforced with barbed suture and this Group postoperative leakage was featured by 1 patient (1 %); the Control Group expressed 3 cases of leak (4,1 %) (Table 2).

Table 1: Preoperative characteristics and comorbidities of the study groups

	Suture Group	Control Group
Age (years) mean ± (SD)	45,1 ± 8,4	44,5 ± 9,2
Female number (%)	59 (60,2%)	51 (69,9%)
Preoperative BMI (kg/m^2) mean ± (SD)	45,6 ± 6,71	48,9 ± 7,15
Type 2 diabetes number (T2D) (%)	21 (21,4%)	15 (20,5%)
Hypertension number (HTN) (%)	72 (73,5%)	62 (84,9%)

SD: Standard Deviation

Table 2: Operative characteristics of the study groups

	Suture Group	Control Group	p-value
Operative Time (minutes) ± (SD)	53,9 ± 6,3	46,5 ± 8,2	0.3843
Rate of conversions to open surgery number (%)	0 (0%)	0 (0%)	n.s.
Leak number (%)	1 (1%)	3 (4,1%)	n.s.

SD: Standard Deviation

DISCUSSION

Laparoscopic sleeve gastrectomy (LSG) is the most commonly used bariatric surgery procedure and is preferred for reduction of comorbidities, and low complication rate. Serious complications associated with LSG include postoperative leak and suture bleeding. Most of the leaks and bleeding are related to the staple line, since 90% of the leaks occur in the proximal part of the gastric sleeve near the gastroesophageal (GE) junction. The most common site of bleeding is the staple line, and the strictures are most frequently near the incisura angularis [12-15]. This might be related to the configuration of the gastric pouch after sleeve gastrectomy, featuring a long tubular stomach remnant, linked to the development of high intraluminal pressure [16-17]. Moreover, the

compliance of the gastric pouch is notably lower than the compliance of the complete stomach, therefore amplifying the intraluminal pressure [18]. High intraluminal pressure associated with the relative difference of tissue thickness between fundus (1.7 mm), gastric body (2.4 mm), and antrum (3.1 mm) makes the staple line at the angle of His more vulnerable and consequently the most prone to the leakage [19]. Leak secondary to ischemia usually occurs after 5 post-surgery days, while leaks occurring earlier are usually related to mechanical failure of the stapling technique distal obstruction [16].

In this study, we compared the invagination of the upper third of the staple line with continuous running seromuscular stitches using barbed sutures, to the group without barbed suture.

Barbed suture allows knotless tissue approximation and requires less effort and time than conventional barbed sutures because it does not need to be repeatedly retensioned during the apposition. It is potentially safer and has a higher burst pressure in comparison with barbless monofilament.

Operative time was longer in Suture group, with a mean operative time of 53,9 ± 6,3 min, while the Control group was characterized by 46,5 ± 8,2 min. The difference in timing is not statistically significant.

Leak occurred in three cases (4,1%) in the Control group and one (1%) in Suture group.

Varban et al. [20] observed that oversewing the staple line was the only technique-specific factor associated with lower leaks.

Aggarwal et al. [21] compared staple line oversewing by invaginating sutures with no intervention techniques over a 60-patient cohort study reporting a lower leak rate in the oversewing group.

Casella et al. [22] performed staple line oversewing using 2-0 polydioxanone in 100 cases over a total of 200 patients. They reported two leaks in the suture group and four leaks in the other 100 cases. They considered that oversewing cannot eliminate leak but can diminish it.

Bülbüller et al. [23] performed a prospective study to compare different staple line reinforcement (SLR) techniques in LSG; 65 patients were included and were randomized into four groups: group 1 (15 patients) had no SLR, group 2 (16 patients) had SLR by continuous imbricating 3-0 prolene sutures, group 3 (16 patients) had SLR by imbricating 3-0 V-Loc 180 sutures and group 4 (18 patients) had SLR by fibrin glue. They reported longer operative time with the prolene group with no significant differences in leak and bleeding between the different groups.

Albanopoulos et al. [24] randomly enrolled 90 patients in a study to compare SLR by continuous imbricating sutures to SLR using absorbable polymer membrane in LSG. Group A (48 patients) had

SLR by buttressing the staple line with Seamguard and group B (42 patients) had SLR by oversewing the staple line with 2-0 PDS sutures. They reported two cases of leak and one case of bleeding in group A with no complications in group B, still not providing statistical significance.

D'Ugo et al. [25] performed a multicenter study over a total of 1162 patients undergoing LSG. The patients were enrolled into six groups: group 1 (189 patients) had no SLR done, group 2 (476 patients) had SLR oversewing using continuous absorbable sutures, group 3 (312 patients) had SLR by buttressing using bovine pericardium strips, group 4 (76 patients) had SLR by buttressing using synthetic polyester, group 5 (63 patients) had SLR by buttressing using absorbable polymer membran and group 6 (46 patients) had reinforcement by applying hemostatic thrombin matrix. The frequency of bleeding was significantly higher in group 1 with no SLR, and frequency of leak was significantly lower in group 3 (SLR using bovine pericardium strips).

Our results are in line with literature evidences, showing a reduction in leak rate in patients subjected to LSG with a staple line reinforcement with barbed suture, though this is not always statistically significant.

CONCLUSION

Current literature does not provide sufficient evidence to support the routinary use of suture-reinforcement techniques in laparoscopic sleeve gastrectomy, but our study highlighted a lower leakage rate in the group featured by suture reinforcement.

Further studies with larger sample size are needed to verify the preventive role of suture staple line reinforcement on postoperative leak rate.

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26.