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Original Article

COMPLICATIONS AFTER LAPAROSCOPIC SLEEVE GASTRECTOMY IN A SERIES OF 186 PATIENTS

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Summary

A retrospective study analyzed the complications in 186 patients who underwent laparoscopic sleeve gastrectomy (LSG). One hundred eighty-four patients were operated on at the University Hospital Centre of Albacete between May 2006 and September 2022. Two patients with early postoperative complications received surgical treatment in other centers. The overall postoperative complication rate (including GERD) was 13.9%. Ten patients (5.38%) had complications in the early postoperative period. In 4 cases (2.15%), there was stapler-line leakage. Abdominal bleeding associated with hemoperitoneum occurred in four patients (2.15%) immediately after the surgery due to bleeding from the suture line. In the long-term follow-up, two patients (1.08%) had gastric tube strictures requiring endoscopic pneumatic balloon dilation (EPBD). Fourteen patients (7.53%) presented with de novo Gastroesophageal Reflux, of whom 7 (3.76%) required revision surgery to Laparoscopic Roux-en-Y Gastric Bypass (LRYGB). Laparoscopic sleeve gastrectomy, in our experience, is a secure bariatric procedure with a low rate of morbidity and mortality, both post-surgical and long-term.

Keywords: laparoscopic sleeve gastrectomy, complications, leakage, bleeding, gastric stenosis.

Introduction

During the last two decades, bariatric surgery has been adopted to treat obesity and obesity-related diseases and has proved highly effective and durable in managing this widespread disorder [1, 2]. According to the IFSO meeting discussions (2019), laparoscopic sleeve gastrectomy (LSG) has become the world's most frequent bariatric surgical procedure, accounting for 45.9% of all bariatric procedures. LSG has been the most commonly performed bariatric technique in France since 2011 and in the USA since 2013 [3, 4]. LSG as a pure restrictive bariatric procedure has clear benefits for patients, compared to more complex bariatric techniques, such as gastric bypass and duodenal switch, because of

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lower risks of marginal ulcer, internal hernias, malabsorption adverse events, etc. Also, the quality of life is much better than that of patients with gastric bands [5].

Performing a proper gastric sleeve procedure is not easy [6], even for surgeons with long experience in bariatric surgery, and laparoscopic sleeve gastrectomy implies postoperative complications, varying from 0 to 18%. The complications involve abdominal bleeding (usually stapler line or omitted splenic lesion), gastric leakage, abdominal collections, stomach remnant spinning or kinking, sleeve stricture, portal or mesenteric thrombosis, de novo GERD, migration of the gastric tube in the thorax, poor weight loss, etc. [7-10]. The most severe complications in the early postoperative period after LSG include stapler line leak (1-2%), abdominal hemorrhage (2%), and abdominal collection (1.3%-1.5%) [9, 11-13].

The long-term prevalence of gastric stenosis (GS) after LSG ranges between 0.1–4% [14, 15].

We aimed to analyze early and long-term surgical complications in a series of 186 patients who underwent laparoscopic sleeve gastrectomy (LSG).

Patients and Methods

A retrospective study analyzed the complications in 186 patients who underwent LSG, of whom 184 were operated at the University Hospital Centre in Albacete between May 2006 and September 2022. Two patients with early postoperative complications, operated on in another hospital, were treated at the University Hospital Centre Albacete: one with staple-line leakage and the other - with an abscess in the Hiss angle.

All patients operated on at the University Hospital Centre in Albacete were given general anaesthesia. The preoperative ASA risk ranged between 1 and 4 (mean value 2). There were neither intraoperative anaesthetic nor postoperative complications. Five trocars were used routinely. The patients were placed

in the Fowler position, and the surgeon stood between the legs. Pneumoperitoneum was achieved with the trocar of direct view, placed just on the left of the mid-line, always 15-20 cm below the xiphoid process. The gastric tube size was calibrated using a 36 French tube, passed just above the pylorus. The sleeve gastrectomy was always started 3-4 cm from the pylorus and performed using a linear mechanical stapler GIA (Gastrointestinal Anastomosis, six stapler lines). The cartridge length depended on the gastric wall thickness. Initially, two green cartridges (4,1/2.0 mm) were applied, followed by two golden cartridges (3.8/1.8mm), ending up with 2 or 3 blue cartridges (3.5/1.5mm). Reinforcement of the stapler line was performed only in cases the cartridge stapling failed and stapler-line leakage. Finally, the Methylene Blue test was always performed before removing the tube to rule out the leakage. Penrose drainage was always placed beside the stapler line. The mean blood loss was between 50 and 100 cc in all cases. The interventions were always performed by the same four surgeons. All patients received perioperative antithrombotic prophylaxis with low-molecular-weight heparin (LMWH), enoxaparin, 40 mg/24h if the BMI was less than 50 kg/m². If the BMI was over 50kg/m², LWMH of 40 mg/12h or 60 mg/24h was administrated. Since 2017, intermittent pneumatic compression on the lower limbs was applied in all the patients during the surgery and was maintained for 24 hours after surgery.

The mean age of the patients in the series was 47.3 years (range 19-69); 109 were women, and 77 were men. The mean BMI was 47.6 kg/m² (35.3-70.3) (Table 1).

The most frequent concomitant disorders were arterial hypertension (HA), diabetes mellitus (DM), and obstructive sleep apnea syndrome (OSAS). All patients were assessed at a joint clinical session with the Endocrinology Service and referred to the Bariatric, Metabolic & Endocrine Surgery Unit for elective surgery. The same surgical team (access with five trocars

Table 1. Age and preoperative BMI.

Variables	No pts	Mean age (years)	Range (years)
Age	186	47.3 years	19-69 years
BMI	186	47.6 kg/m ²	35.3 – 70.3 kg/m ²

and 30° optics) operated on all the patients.

Statistical analysis was made using a mixed model (p (z test) and p – ANOVA) with the SPSS 26 program; p-values<0.05 were considered statistically significant.

Results

No intraoperative complications were recorded, no blood transfusion, and no conversion to laparotomy was necessary. The overall postoperative complication rate (including GERD) was 13.9%. Ten patients (5.38%) had early postoperative complications. Four patients (2.15%) presented Stapler line leakage that occurred in 3 of them and was managed with total parenteral nutrition (TPN), and one underwent endoscopic placement of a gastric endoprosthesis. Four patients (2.15%) had abdominal bleeding associated with hemoperitoneum immediately after surgery due to hemorrhage from the suture line. All of them

underwent emergent reintervention and were converted to open surgery. Two patients (1.08%) had postoperative intra-abdominal abscesses that required CT-guided drainage (Table 2). There was no mortality in our series of patients.

In the long-term follow-up, two patients (1.08%) had gastric tube stricture requiring endoscopic pneumatic balloon dilation (EPBD). Fourteen patients (7.53%) presented with de novo gastroesophageal reflux, of whom 7 (3.76%) required revision surgery – a Laparoscopic Roux-en-Y gastric bypass (LRYGB) (Table 3).

No statistically significant difference was found in the early postoperative complication rate and gastric remnant stenosis in the group of patients divided by sex, age, and BMI (p>0.05) (Table 4).

In the first year after surgery, the mean BMI was 31.14 kg/m², and the percentage of excessive BMI loss (EBMIL) was 77.57%. In the second year, the mean BMI was 29.87, and the EBMIL – 83.32%.

Table 2. Early postoperative complications

Early postoperative complications.	N pts	Explorative laparotomy	Total, parenteral nutrition	Endoscopic stent placement	Percutaneous drainage
Stapler line leakage	4	0	4	1	0
Intraabdominal hemorrhage	4	4	2	NA	NA
Intraabdominal collection in the angle of Hiss	2	0	2	0	2

Table 3. Long-term postoperative complications

Long term postoperative complications	N pts	Endoscopic pneumatic balloon dilatation (EPBD)	Medical treatment	Gastric bypass conversion
Gastric remnant stenosis	2	2	2	0
GERD de novo	14	NA	7	7

Table 4. Statistical analysis (p-value).

Variables	Stapler line leakage	Intraabdominal hemorrhage	Intraabdominal collection in the angle of Hiss	Gastric remnant stenosis
Sex (M/F) p (z test)	0.50286	0.77182	0.80258	0.80258
BMI group (BMI<50/BMI>50kg/m ²) p (z-test)	0.63836	0.56868	0.7414	0.7414
Age group (19-45, 46-60, >60) P - ANOVA	0.8694	0.482	0.9332	0.3044

Discussion

Hemorrhage and gastric leakage, though unusual in practice, compose nearly all adverse events after LSG [16]. Leakage from the stapler line is considered the most dangerous handicap of LSG [11]. According to the literature, stomach remnant leakage is seen in 0–6.7% of patients [17].

Noel et al. reported patients who underwent LSG from October 2005 to December 2014. Twenty patients (1%) had leakage from gastric tubes. The annual leak percentage was 4.76% in 2006, 5.66% in 2007, 0% in 2008, 2.55% in 2009, 2.04% in 2010, 0.81% in 2011, 0.58% in 2012, 0.23% in 2013, and 0% in 2014. The author divided the patients into two cohorts. In cohort A (the initial 1000 cases), 18 cases of stapler line leakage were registered, whereas in cohort B (the subsequent 1000 cases), there were stapler line leakages in only 2 cases. Regarding the two patients in cohort B, in the first case, the leak was related to a lack of reinforcement of the stapler line. In the other patient, the leak appeared despite the application of resorbable Seamguard® [9]. Revision of this extensive series of patients showed that the percentage of stapler line leakage after LSG can be considerably decreased depending on good individual experience, including primary or redo bariatric surgery.

Concerning the buttressing and reinforcing of the gastric tube's stapler line, a systematic review containing 8920 patients published leak and complication percentages of 1.1 and 5.5%, respectively, with “absorbable polymer membrane”, 2.0 and 6.3% with oversewing, 2.6 and 8.9% without stapler line buttressing, and 3.3 and 7.8% with “bovine pericardial strips” [18].

In our experience, an overall leak after LSG was reported in 3.2% of cases. Four patients (2.15%) had low-volume gastric leak, which was treated successfully with TPN and endoscopic stent placement. Two patients (1.08%) had high-volume gastric leaks with abdominal collections and were treated by percutaneous drainage. Usually, we do not reinforce the stapler line and initially employ two green cartridges, followed by two beige cartridges, ending up with 1 or 2 blue cartridges.

Hemorrhage after LSG occurs in general in 1.1% - 2% of cases [12, 13]. This complication can be both intraabdominal and intraluminal in the gastroenteric tract. Usually, tachycardia and low blood pressure are the first alerts of bleeding. Furthermore, a significant hemoglobin drop appears in the hemogram and helps determine the diagnosis. Typically, there is no pain, or it is slight. Melena is a classic but delayed symptom of intraluminal hemorrhage. A CT scan helps to confirm or discard the bleeding, evaluate the quantity of intraperitoneal liquid, and determine consecutive management (surgery, endoscopy, or conservative treatment). Comorbidities such as arterial and/or portal hypertension and previous anticoagulant therapy are risk factors for postoperative bleeding after LSG [19, 20]. The selection of cartridge height according to the gastric wall thickness and waiting for tissue adaptation before stapling are crucial details to avoid postoperative bleeding and leakage [20]. There are different ways to reinforce the stapling: oversewing, buttressing (invaginating) suture, clipping the bleeding points, sealants, and buttress substances such as Bioabsorbable Seamguard®. Some authors assume that staple line reinforcement with buttress material decreases the possibility of bleeding while oversewing prolongs the surgery, but it does not change the complication rate [21]. Gayrel et al. confirmed that applying absorbable staple-line buttressing in precarious patients significantly lowers postoperative bleeding [19].

In our series, postoperative bleeding was marked out as a decrease of hemoglobin by more than 30g/L accompanied by tachycardia, pallor, sweating, hypotension, and large blood leak from the drainage. In our series, all patients underwent emergency CT scans before surgery. We usually do not oversee the stapler line to prevent bleeding. If there is a bleeding point in the stapler line, we use monopolar energy (hook) or clips to control the bleeding. Finally, we put a local hemostatic, usually Surgicel Powder. In our protocol, we always leave an intraabdominal Penrose drainage beside the gastric sleeve and usually remove it on the second or third postoperative days after a negative methylene blue swallow test. We use buttress running suture only in case of suspected stapler line leak, usually monofilament absorbable PDS V lock

2/0 or 3/0.

Gastric stenosis (GS) is a well-known dilemma after LSG that influences patients' nutrition and quality of life. There are rigorous discussions regarding the aspects of its management [22, 23]. The general frequency of gastric stenosis is 0.1–4%, even though the actual figure in the population is probably higher [15, 24]. The onset of gastric stenosis symptoms is essential for the management [25]. Usually, the treatment choice is endoscopic pneumatic balloon dilatation EPBD [26]. Hamed H. et al. reported 66.7% success in 28 patients treated with EPBD for GS after LSG [14]. In a series of 4304 patients who underwent LSG, Turku F. et al. reported gastric stenosis in 47 (1.1%) patients. The patients with GS managed with EPBD showed excellent outcomes in 85.7% of cases. Only patients presenting with postoperative fistulas or abscesses had a lower success rate (66.6%) [26].

In our series, only two patients (1.08%) had GS. The percentage of this complication is close to that reported in the literature. Our 100% success rate with EPBD is likely related to the short list of patients treated for GS. The success of EPBD reported in the literature is lower.

Postoperative GERD and GERD de novo are common after LSG, reaching 24.7% and 21.3%, respectively, in the operated population [27]. Antral preservation and gastropexy could be considered against the circumstances leading to postoperative GERD [27]. According to the literature, LSG was converted to Laparoscopic Rou-en-Y Gastric Bypass (LRYGB) in 15.8% of the patients with GERD [27]. On the other hand, weight loss can improve GERD signs by accelerating gastric emptying and lowering intraabdominal pressure. In our series, 14 out of 186 (7.53%) patients presented with GERD de novo. Seven patients (3.76%) required revisional surgery in LRYGB. The weight loss results in our series of patients after LSG are similar to those reported in the literature [27].

Conclusions

Laparoscopic sleeve gastrectomy, in our experience, is a secure bariatric procedure with a low morbidity and mortality rate, both post-surgical and long-term. Gastric leak from the stapler line is rare, but it should be diagnosed

and managed on time to avoid more severe complications. Selection of cartridge height according to the gastric wall thickness and attention to tissue adaptation before stapling are the two crucial details to avoid postoperative bleeding and leakage. Reinforcement of the stapler line by oversewing, buttress suture, or hemostatic sealants must be assessed in each patient to prevent gastric tube leakage and bleeding. Severe de novo GERD after LSG requires revision surgery to RYGBP.

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