



Histopathology Findings in Patients Undergoing Laparoscopic Sleeve Gastrectomy

Ammiel Martínez Canil^{1,2}  · Angelo Iossa¹ · Pietro Termine¹ · Daniela Caporilli¹ · Vincenzo Petrozza³ · Gianfranco Silecchia¹

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Abstract

Background Laparoscopic sleeve gastrectomy (LSG) has gained popularity in the last 10 years for its good results in weight loss and comorbidity control. However, guidelines on the pathological examination of the specimen are lacking. The aim of this retrospective study was to determine the usefulness of the routine specimen examination when presurgery endoscopy (upper gastrointestinal endoscopy, UGIE) and multiple gastric biopsies are part of the preoperative work-up.

Methods A retrospective review of records of the patients submitted to LSG between January 2012 and August 2017 was carried out. Sex, age, histopathology findings in the presurgery endoscopy biopsies and surgical specimen, and the prevalence of *Helicobacter pylori* infection were analyzed.

Results A total of 925 patients entered the study group (mean age = 44.1 years, Females = 80.3%, BMI = 44.58 kg/m²). The most common histopathology pattern in the endoscopy biopsies and in the surgical specimens was *inactive chronic gastritis* (64.4 and 55.6%, respectively). *Helicobacter pylori* infection was 24.6 and 2.48%, respectively. Ninety-nine percent (*n* 796) of patients with non-significant endoscopy biopsy findings showed the same patterns in specimen analysis. Only three patients (0.3%) who had intestinal presurgery metaplasia were positive in the specimen analysis, and two cases of gastric stromal neoplasms (gastrointestinal stromal tumor and gastric leiomyoma) were found intraoperatively.

Conclusion Most of the findings are non-significant and can be predicted if UGIE plus multiple biopsies is routinely included in the bariatric work-up with significant cost reduction. In those patients who had a significant finding prior to the surgery or intraoperatively, the pathological examination of the specimen is recommended.

Keywords Sleeve gastrectomy · Bariatric surgery · Biopsy · Histopathology · Morbid obesity · *Helicobacter pylori*

Ammiel Martínez Canil and Angelo Iossa contributed equally to this work.

✉ Ammiel Martínez Canil
ammielemartinezcanil@gmail.com

¹ Department of Medico-Surgical Sciences and Biotechnologies, Division of General Surgery, Bariatric & Metabolic Center of Excellence (IFSO European Chapter), Center of Excellence (SICOB – Italian Society of Bariatric and Metabolic Surgery), La Sapienza University of Rome, Via F. Faggiana 1668, 04100 Latina, Italy

² Medical Sciences Faculty, Postgraduate Secretary, Pablo Mirizzi Scholarship Program, National University of Córdoba, Avenue Haya de la Torre, Ciudad Universitaria, 5000 Córdoba, Argentina

³ Pathology Unit, ICOT Ospedale, La Sapienza University of Rome, Via F. Faggiana 1668, 04100 Latina, Italy

Introduction

In recent years, bariatric surgery has become the most powerful tool to fight obesity and related pathologies. Currently, the most common procedure used in this kind of surgery is laparoscopic sleeve gastrectomy (LSG) [1–3]. However, even after four consensus conferences, LSG is still not accepted as a standardized procedure worldwide [4]. Moreover, the preoperative work-up of patients who undergo bariatric surgery is not standardized and involves much controversy. While the European and Italian national guidelines recommend the use of presurgery endoscopy (upper gastrointestinal endoscopy, UGIE) plus multiple biopsies in the work-up of patients, the guidelines of the American Society for Metabolic & Bariatric Surgery (ASMBS) only recommend it in selected cases with symptomatic gastric disease [5–7].

Furthermore, information regarding the histopathology changes of the specimen after LSG is scanty, considering that LSG is the only resective bariatric procedure with specimens.

The above controversial topics should be considered as the rationale for this study. The aims of this retrospective study were (1) to identify the most frequent histopathology changes in the Italian morbid obese population and their prevalence in patients eligible for LSG, (2) to establish the prevalence of *Helicobacter pylori* (HP) infection, and (3) to determine whether routine histological examination of the specimen is useful when presurgery endoscopy (UGIE) and multiple gastric biopsies are considered as part of the presurgery work-up.

Methods

We performed a retrospective search of all patients who underwent LSG between January 2012 and August 2017 in the Department of Medico-Surgical Sciences and Biotechnologies, Division of General Surgery and Bariatric Center of Excellence, La Sapienza University of Rome. We included not only patients who underwent primary LSG but also those who underwent revisional LSG with different indications. As per the standard protocol, all patients underwent a routine UGIE including multiple biopsies of the fundus, body, and antrum of the stomach. Patients with histologically proven HP infection (HPI) underwent eradication treatment with clarithromycin or amoxicillin for 2 weeks, followed by treatment with proton-pump inhibitor for 1 month. All patients underwent C-Urea Breath Test to verify the eradication of HP after 4 weeks of therapy. In case of the C-Urea Breath Test is positive, a second-line treatment is established. An average of three endoscopic biopsies was collected in different parts of the fundus, body, and antrum, even when no evident lesions were present. All patients' specimens and biopsies were sent to a pathologist experienced in gastrointestinal pathology. The endoscopic biopsies were processed for standard histopathology by hematoxylin & eosin (H&E) staining improved with modified Giemsa stain for HPI.

The variable items analyzed were sex, age, type of procedure, prevalence of different histopathology patterns, and the presence of HPI in endoscopic and specimen's biopsies. To compare the latter, we created the following groups, considering the most frequent endoscopic biopsy findings:

- Group 1: Patients with inactive chronic gastritis
- Group 2: Patients with active chronic gastritis
- Group 3: Patients with atrophic chronic gastritis
- Group 4: Patients with intestinal metaplasia, dysplasia, or other borderline conditions

These patients were assigned to the following groups according to the guidelines of the Italian Society of Pathology/International Academy of Pathology (SIAP/ IAP) [8]:

1. Non-significant findings
 - a. Normal
 - b. Inactive chronic gastritis: presence of plasma cells and lymphoid cells in the lamina propria
 - c. Active chronic gastritis: presence of plasma cells, lymphoid cells, and polymorphonuclear leukocytes in lamina propria
2. Significant findings
 - a. Atrophic gastritis
 - b. Intestinal metaplasia
 - c. Gastrointestinal stromal tumor (GIST)
 - d. Gastric leiomyoma

Results

A total of 925 LSG procedures were reviewed. Of them, 97.1% (n 897) cases were primary sleeves while the remaining 26 patients (2.9%) were revision from failed laparoscopic adjustable band (LAGB). The subjects included 743 women (80.3%) and 182 men (19.7%) with an average age of 44.1 ± 11.2 years (age range 18–72 years) and an average BMI of 44.58 kg/mts^2 .

Histopathology Findings in Endoscopy Biopsies

The most common endoscopic histopathology pattern was inactive chronic gastritis (596 patients; 64.4%), followed by active chronic gastritis (249 patients; 26.9%), normal pattern (78 patients; 8.4%), and atrophic gastritis (2 patients; 0.2%). Furthermore, intestinal metaplasia was observed in 47 patients (5.1%). Most of them (52.3%) belonged to the group of active chronic gastritis, 42.8% belonged to the inactive chronic gastritis group, and two patients with atrophic gastritis had intestinal metaplasia. Two patients presented dysplasia at the UGIE biopsies (Table 1).

Regarding HPI in UGIE biopsies, 228 patients were positive (24.7%), and among these, 151 patients (66.3%) had concomitant active chronic gastritis.

Histopathology Findings in Sleeve Gastrectomy Specimens

Concerning the results of the specimens, 515 patients presented inactive chronic gastritis (55.6%), 377 patients had normal

Table 1 Histopathology patterns in biopsies taken by upper GI endoscopy in the preoperative period

Histopathology	Patients, <i>n</i> (%)	Intestinal metaplasia, <i>n</i> (%)	Dysplasia, <i>n</i> (%)	<i>Helicobacter pylori</i> infection, <i>n</i> (%)
Total	925 (100)	47 (5.14)	2 (0.2)	228 (24.7)
Patterns				
Inactive chronic gastritis	596 (64.4)	20 (42.8)	a	74 (32.6)
Active chronic gastritis	249 (26.9)	25 (52.3)	2 (100)	151 (66.3)
Normal	78 (8.4)	a	a	a
Atrophic chronic gastritis	2 (0.2)	2 (4.7)	a	3 (0.9)

n number of patients, *a* unreported diagnosis

histology (40.7%), and 30 patients had active chronic gastritis (3.2%). The remaining percentage corresponded to three patients (0.3%) with atrophic chronic gastritis (active components) and one patient with GIST (0.1%), and one had leiomyoma of the gastric wall (0.1%) (Fig. 1).

Intestinal metaplasia was observed in nine patients. The most common pattern in them was active chronic gastritis in 44.4% patients (*n* 4), followed by atrophic gastritis in 33.3% (*n* 3) and inactive chronic gastritis (22.3%) in two patients.

On analyzing the presence of HPI in the specimens, we found that 23 patients were HP positive (2.48%). Among them, only eight were newly diagnosed at this stage. Furthermore, it is important to clarify that all patients who were HP positive at UGIE received the same standard treatment. In this group of 23 patients, the most common histopathology was active chronic gastritis (56.5%), inactive chronic gastritis (45.4%), and atrophic chronic gastritis with active components (4.6%). Six of the patients with intestinal metaplasia and two patients with atrophic gastritis were HP positive.

If we consider atrophic chronic gastritis and intestinal metaplasia as risk factors for the development of intestinal-type gastric adenocarcinoma, 12 patients had some of these risk factors (1.29%) (Table 2). Finally, concerning the two neoplasms (GIST and gastric leiomyoma), both showed intrasurgery findings with completely normal presurgery UGIE. The GIST was < 5 cm at the laparoscopy test; therefore, we did not change the surgical strategy, and the complete resection was confirmed by the pathologist.

Matching Both Groups of Analyses

On comparing both groups of patients with respect to the histopathology results obtained by UGIE vs. specimen, we observed that most patients with a non-significant pattern in the UGIE biopsies (group 1 and group 2) maintained the same pattern in the specimen analysis. Regarding group 1 (*n* 576), 66.9% of patients maintained the same pattern, 29.6% of patients normalized their findings, 1.9% switched to active chronic gastritis, and one patient had gastric leiomyoma. In group 2 (*n* 222), 63.2% of patients switched to inactive

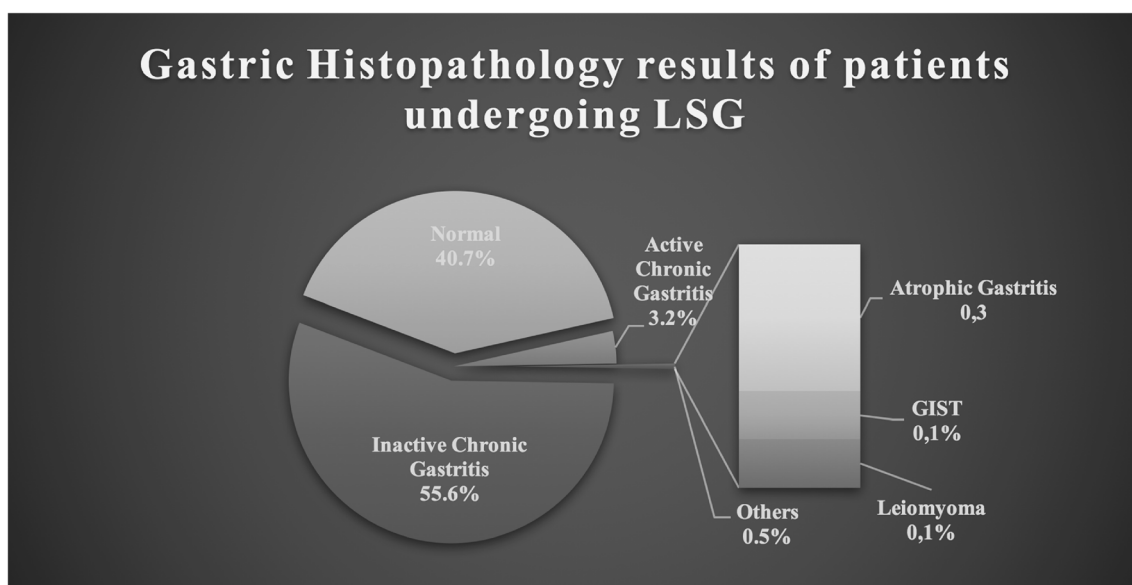


Fig. 1 Histopathology results in patient's specimens undergoing to LSG

Table 2 Variable comparison of the four most important groups

	Inactive chronic gastritis (<i>n</i> = 515)	Active chronic gastritis (<i>n</i> = 30)	Atrophic gastritis (<i>n</i> = 3)	Normal (<i>n</i> = 376)
Age (m, SD)	43.8 ± 2.82	51.4 ± 12	60.3 ± 5.5	43.8 ± 2.12
Sex (<i>n</i> , %)				
Male	109 (21.1)	8 (25.3)	1 (33.3)	69 (18.4)
Female	409 (78.9)	25 (75.7)	2 (66.6)	307 (81.6)
HP infection (<i>n</i> , %)				
Positive	10 (1.95)	11 (36.6)	2 (66.6)	0
Negative	505 (98.5)	19 (63.3)	1 (33.3)	376 (100)
Intestinal metaplasia (<i>n</i> , %)	2 (0.3)	4 (13.3)	3 (100)	0

m mean, *SD* standard deviation

chronic gastritis, 28.5% normalized their biopsies, and 8.1% maintained the same pattern.

Two patients in group 3 had inactive chronic gastritis in the specimen evaluation.

Concerning group 4 (*n* 49), three patients who had intestinal metaplasia in the presurgery period maintained the same diagnosis in specimen analysis, and the patient with dysplasia evolved to a non-significant pattern.

On the other hand, it is important to note that the patient diagnosed with GIST came from the group of patients with normal findings in UGIE biopsies.

Discussion

Most patients were women with a mean age of 44 years, which coincides with the majority of the published studies [9–15], observing a predominance of middle-aged women.

According to the histopathology results of the examination of UGIE biopsies and surgical specimens, the predominant pattern is similar in both groups. These findings suggest that UGIE could be a good predictor of the results obtained in the specimen, on top of that being a reliable method for the screening of mucosal lesions and HPI [16]. UGIE is very helpful in properly informing the patients and discussing the type of surgery and the need for concomitant surgical procedures (i.e., hiatal hernia repair) and presurgery medical treatment (HP eradication, peptic mucosal lesions). As previously reported, symptoms are not a reliable driver for UGIE; 50% of the patients with upper GI mucosal lesion or diseases are asymptomatic preoperatively [17].

Nonetheless, this topic is still controversial. While the European Association for Endoscopic Surgery and the Italian Society of Bariatric Surgery & Metabolic Diseases recommend UGIE before any bariatric procedures, the ASMBS recommends endoscopy only in symptomatic patients with suspicion of upper GI diseases [5–7]. In our series, 798 patients had non-significant findings in UGIE biopsies (86.2%); among them, 99.7% maintained a pattern without relevance

for its follow-up. Some patients who had intestinal metaplasia reversed its histopathology, maybe following HP eradication treatment, as previously reported by other authors [18, 19]. Nevertheless, three patients (0.3%) who were diagnosed of intestinal metaplasia in UGIE biopsies continued showing the same pattern in specimen examination, but only one of them presented antrum metaplasia at UGIE. So, only one patient will need endoscopic follow-up. The patient with antrum dysplasia at 2-year endoscopic follow-up showed tubular adenoma (< 2 cm) at that level and was successfully treated by endoscopy. Regarding gastric specimen analysis, our findings coincide with those observed by Almazeedi et al. (2013), who reported 74.4% patients with chronic gastritis [9]. However, the majority of authors report normal histology in most of their patients, but the most frequent pathological finding is chronic gastritis [9–14]. Only Raes et al. (2015) described a different pattern, with 31.2% cases of follicular gastritis [15]. This point is important because, in the last years, chronic gastritis has been proposed as an obesity-related disease [20]. Almazeedi et al. found a few premalignant conditions in patients with no prior history. Our 0.6% intestinal metaplasia in specimen analysis was similar to that reported by Abdull Gaffar et al. (2016) (0.7%) [10]. Likewise, our atrophic chronic gastritis prevalence (0.2%) was similar to that reported by Sajaan et al. (2017) (0.19%) [14]. These conditions are clearly known as risk factors for intestinal gastric adenocarcinoma in *Lauren* classification [21–24]. In fact, we believe that this is another important point because they are also histopathology changes related to HPI, thus, highlighting the importance of treatment before the surgery [25]. Six patients with intestinal metaplasia in the post-surgery period had concomitant HPI. All of them are in an endoscopic follow-up program.

The low percentage of patients infected by HP in our series (2.48%) could be explained by the different prevalence of this infection in different countries and, consequently, by different socio-economic and cultural factors [26, 27]. In addition, our percentage of HPI is slightly lower than that in other prior studies [9–15]. Even so, our percentage of HPI in the post-surgery period is

Table 3 Proposed criteria for histopathology examination after LSG

- Intestinal metaplasia and atrophic gastritis at UGIE plus multiple biopsies
- Intraoperative findings of gastric lesions
- *Helicobacter pylori* + (without response after the first-line treatment)
- Preoperative endoscopic findings of submucosal lesions
- No preoperative endoscopy

unexpectedly high for us, considering that all presurgery patients with HPI received the standard treatment and underwent the breath test that confirmed its eradication. These results suggest that histology tests are not completely sensitive for the detection or that during the interval between the eradication and the surgery, the patient can be reinfected or that the combination of drugs that we use has lost some efficacy as it has been reported by other authors [28].

Other abnormal histopathology cases involved one patient with GIST (0.1%) and one with gastric leiomyoma (0.1%). Both were diagnosed intraoperatively, and the presurgery endoscopy was normal in both cases.

Recently, Safaan et al. reported a significant relationship between HPI and the presence of GIST tumors [14]. *Viscido et al.* (2017) showed an incidence of 0.5% of GIST in 915 patients who underwent LSG [29]. These results are similar to our findings. Fortunately, in our case, the tumor was completely resected in the same operation and had low mitotic count, resulting in low-grade tumor (G1).

There are few publications on this topic. *Kopach et al.* (2017) reported a low incidence of this type of tumors (0.5%) in a series of 511 patients undergoing LSG [30].

If we include diagnoses different from chronic gastritis in a group, we would obtain that 1.18% of our patients had an unexpected diagnosis in the samples submitted. The frequency of incidental pathology found during laparoscopic bariatric surgery has been estimated to be 2% [30, 31]. Twenty-six patients (2.8%) underwent LSG as revision surgery after failure of LAGB. *Ohanessian et al.* reported 14 patients who underwent revisional LSG with more histopathology findings compared to patients who underwent primary surgery [13]. In our series, all the patients of this group had non-significant finding with similar results of primary LSG.

Regarding the specimen pathological examination costs (170 USD) considering the number of patients operated in the study period, we spent 157.250 USD. However, according to the findings, we can say that about 98% of the analyzed specimens showed non-significant findings that did not require any follow-up. Moreover, if UGIE is routinely carried out before the surgery, we can accurately predict the lesions in the specimen and thus reduce the costs.

On the basis of the reported results, we describe below the proposed criteria to indicate specimen pathology after LSG (Table 3).

Conclusion

There is no added benefit of routine histopathology examination of the specimens in LSG. This is expected to have significant positive cost-effective impact taking in consideration the current workload of LSG all over the world.

There is a large variability of histopathology findings in the specimens obtained after LSG; most of them were non-significant findings, and the majority could be predicted using UGIE plus multiple biopsies. The rate of HP infection remains low in our experience compared to other series.

We suggest that specimen assessment should be cost-effective and mandatory in selected patients, when UGIE biopsies show intestinal metaplasia and patients with HPI who did not respond to the first-line therapy. In patients with incidental findings of gastric lesions during the surgery, the specimen histopathology examination is recommended.

The results of the present retrospective study carried out on a large cohort of patients add another advantage to the presurgery endoscopy: avoid unhelpful specimen examination after LSG to reduce the overall cost of the procedure.

Compliance with Ethical Standards All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of study formal consent is not required.

Conflict of Interest The authors declare that they have no conflict of interest.

Informed Consent Does not apply.

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