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Spectrum of gastric histopathologies in morbidly obese Turkish patients undergoing laparoscopic sleeve gastrectomy

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Abstract. – OBJECTIVE: In this study, we aimed to describe the findings associated with gastric pathology and to identify the prevalence of Helicobacter pylori (H. pylori) in patients undergoing laparoscopic sleeve gastrectomy (LSG).

PATIENTS AND METHODS: Gastric specimens of a total of 291 patients (225 females, 66 males; mean age: 42 years; range: 18 to 60 years) who underwent LSG for the treatment of morbid obesity were analyzed. Histopathologic diagnoses and their relation with body mass index (BMI), age and gender were evaluated.

RESULTS: In the histopathological examination of sleeve specimens, 58 patients (19.93%) had chronic gastritis, 102 patients (35.05%) had chronic active gastritis, 27 patients (9.27%) had follicular gastritis, 47 patients (16.15%) had active follicular gastritis, one patient (0.34%) had a glomus tumor, and one patient (0.34%) had a gastrointestinal stromal tumor. The gastric mucosa was normal in 55 patients (18.90%). Intestinal metaplasia was detected in eight patients (2.74%). The H. pylori test result was positive in 126 patients (43.29%). There was no statistically significant difference between the pathological diagnoses and age and sex of the patient.

CONCLUSIONS: Our study results suggest that the prevalence of chronic active gastritis and H. pylori positivity is high in morbidly obese Turkish patient population. No significant difference was found between the pathological diagnosis in obese patients with LSG operation in terms of age and sex.

Key Words:
Laparoscopy, Bariatric surgery, Morbid obesity, Gastritis.

Introduction

Obesity is a complex endocrine and metabolism disorder with increasing mortality and morbidity. This chronic disease, which affects the public health, results from an unbalanced energy intake relative to its expenditure[1]. Medical and minimally invasive surgical approaches in the obesity treatment have been popular research subjects of the modern era. Increased energy intake results in an excessive accumulation of the fat in the body, which is accompanied by numerous comorbidities such as type II diabetes, arterial hypertension, cardiovascular diseases, dyslipidemia, liver fattening, depression, and gastrointestinal tract malignancies[2,3]. Obesity, which is difficult and expensive to treat, has led to a dramatic increase in the number of bariatric surgical methods and bariatric centers, since the end of 1990s[3].

The World Health Organization (WHO) defines obesity according to the body mass index (BMI), which is calculated by dividing an individual's body weight in kilograms by the square of the individual's height in meters (kg/m^2). According to this calculation, individuals with a BMI <18.5 kg/m^2 are underweight, 18.5<BMI<24.9 kg/m^2 are normal weight, 25<BMI<29.9 kg/m^2 are overweight, 30<BMI<34.9 kg/m^2 are Class 1 obese, 35<BMI<39.9 kg/m^2 are Class 2 obese, and BMI>40 kg/m^2 are morbid obese (Class 3)[4].

In recent years, WHO global estimates have been reported. In 2014, more than 1.9 billion adults, 18 years and older, were overweight. Of these, over 600 million were obese. Overall, about 13% of the adult population worldwide (11% of men and 15% of women) was obese in 2014. In the same year, 39% of adults aged 18 years and over (38% of men and 40% of women) were overweight. The worldwide prevalence of obesity was more than doubled between 1980 and 2014[5].

According to the 2014 Health Survey conducted by the Turkish Statistical Institute, obese

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individuals constitute 19.9% of the population[6]. Based on the results of the biannual survey, considering the BMI values, 33.7% of the individuals older than 15 years were overweight, 24.5% of women were obese, and 29.3% were overweight. Of males, 15.3% were obese and 38.2% were overweight. Gastric pathologies in obese patients can differ from the overall population. Many studies have shown that obesity leads to reflux esophagitis, Barrett's esophagus, reflux gastritis, and hiatal hernia[7,8]. Excess abdominal fat also mechanically increases the gastric pressure, thereby, reducing the frequency of esophageal sphincter relaxation with acid reflux[9]. Another hypothesis suggests that visceral adipose tissue can lead to the development of gastrointestinal diseases. Visceral adipose tissue is known to be metabolically active and has been strongly related with elevated serum levels of pro-inflammatory adipokines, which may contribute to the development of reflux gastritis[10]. In addition, excess weight increases inflammation in the intestines and stomach. In obese individuals, the intestinal flora is different from the individuals with normal weight. High-tissue permeability in the gastrointestinal lumen for toxic and irritant materials and some bacteria may cause gastrointestinal pathologies, primarily ulcers[11].

Increased disease awareness in obese patients may modify the treatment plan. Detection of gastric pathologies, endoscopic biopsy prior to bariatric surgery, and a detailed examination of sleeve specimens after surgery can both increase the success of the surgical operation and reduce comorbidities. In this study, we aimed to describe the findings associated with gastric pathology and to identify the prevalence of *Helicobacter pylori (H. pylori)* in patients undergoing laparoscopic sleeve gastrectomy (LSG).

Patients and Methods

Patients

The study protocol was approved by the local Ethics Committee of Antalya Training and Research Hospital. The study was conducted in accordance with the principles of the Declaration of Helsinki. A written informed consent was obtained from each patient.

Gastric specimens of a total of 291 patients who underwent LSG for the treatment of morbid obesity at Antalya Training and Research Hospital were analyzed. Histopathologic diagnoses and their relation with BMI, age and gender, were evaluated.

Inclusion criteria were as follows: age ≥18 years, primary diagnosis of morbid obesity, and primary treatment of LSG for morbid obesity. Exclusion criteria were as follows: previous surgery, previous history of gastrointestinal disease, drug or alcohol addiction, recent major vascular event, or malignancy.

Methods

All patients underwent standard pre-surgical upper gastrointestinal system endoscopy. Endoscopic evaluation of the esophagus, stomach, and duodenum was performed. Following LSG, all gastric specimens were routinely evaluated macroscopically for the presence of a lesion or mass. Four macroscopic samples were taken from all stomach cases. Each sample was stained with hematoxylin-eosin (HE) and evaluated microscopically. All samples were also stained with Giemsa and PAS/Alcian blue histochemical stains to determine the presence of *H. pylori* and intestinal metaplasia, respectively. An additional diagnostic CD117 immunohistochemical staining for gastrointestinal stromal tumor (GIST) was performed. In addition, SMA, Desmin, S-100 immunohistochemical staining was performed to exclude other mesenchymal tumors present in the tumor. In this case, CD117 was positive and the other markers were negative.

The BMI was calculated preoperatively and at six months postoperatively. Preoperative and postoperative BMI values of patients with the same pathological diagnosis were statistically compared. The different pathological groups were also compared preoperatively and postoperatively in terms of the 6thmonth BMI differences. Pathological diagnoses were evaluated in terms of age and sex.

Statistical Analysis

Statistical analysis was performed using the SPSS software version 23 (SPSS Armonk, NY, USA). The variables were investigated using Shapiro-Wilks test to determine whether or not they were normally distributed. Descriptive analyses were presented using frequencies, percentages, mean and standard deviation values. The difference between the measurements of the four groups was assessed by ANOVA with the normal distribution of the data, and the Bonferroni Test was used as a post-hoc test for signifi-

cant outcomes. The difference between the measurements of the four groups was assessed by the Kruskal Wallis Test when the data did not fit the normal distribution, and the Bonferroni-Dunn procedure was used for the binary comparison in significant cases. For the difference between the two dependent measurements, the Paired *t*-Test was used if the data was distributed normally, whereas if it was not distributed normally, the Wilcoxon Test was used. Relations between categorical data were assessed by Pearson x^2 test. *p*-values less than 0.05 were considered statistically significant.

Results

Data of 291 patients who underwent LSG were analyzed. Of the patients who underwent LSG, 77.31% (n=225) were females and 22.68% (n=66) were males. The mean age was 42 (range: 18 to 60) years. The mean number of histological sections was 4 (range: 2 to 7) in each case. In histopathological examination of the sleeve specimens, 58 patients (19.93%) had chronic gastritis, 102 patients (35.05%) had chronic active gastritis, 27 patients (9.27%) had follicular gastritis, 47 patients (16.15%) had active follicular gastritis, one patient (0.34%) had a glomus tumor, and one patient (0.34%) had a GIST. The gastric mucosa was normal in 55 patients (18.90%). In addition, intestinal metaplasia was detected in 8 patients (2.74%). The *H. pylori* test result was positive in 126 patients (43.29%). Figure 1 shows the concomitant types of gastritis. Figure 2a-d shows gastric histopathology findings.

Postoperative 6th month BMI values of the patients who underwent LSG were statistically significant lower than preoperative BMI values ($p<0.001$). Preoperative BMI values of the patients with active follicular gastritis were higher than the patients with chronic gastritis ($p=0.038$). Postoperative 6th month BMI values of the patients with chronic active gastritis were higher than the patients with chronic gastritis ($p=0.048$). The difference in the BMI values within the first 6 months of surgery in patients with follicular gastritis was found to be higher than patients with chronic active gastritis ($p=0.039$). There was no statistically significant difference between the pathological diagnoses and age and sex of the patient ($p=0.417$). There was no statistically significant difference between patients younger and older than 40 years of age in terms of pathological diagnoses ($p=0.118$). Age and gender distribution of histopathologic diagnoses and changes in BMI are shown in Tables I and II.

Discussion

In recent years, many researchers have been addressing to comorbidities and their treatments in obese patients, and how different surgical methods affect obesity and metabolic syndromes. Diet, exercise, and medical treatments are

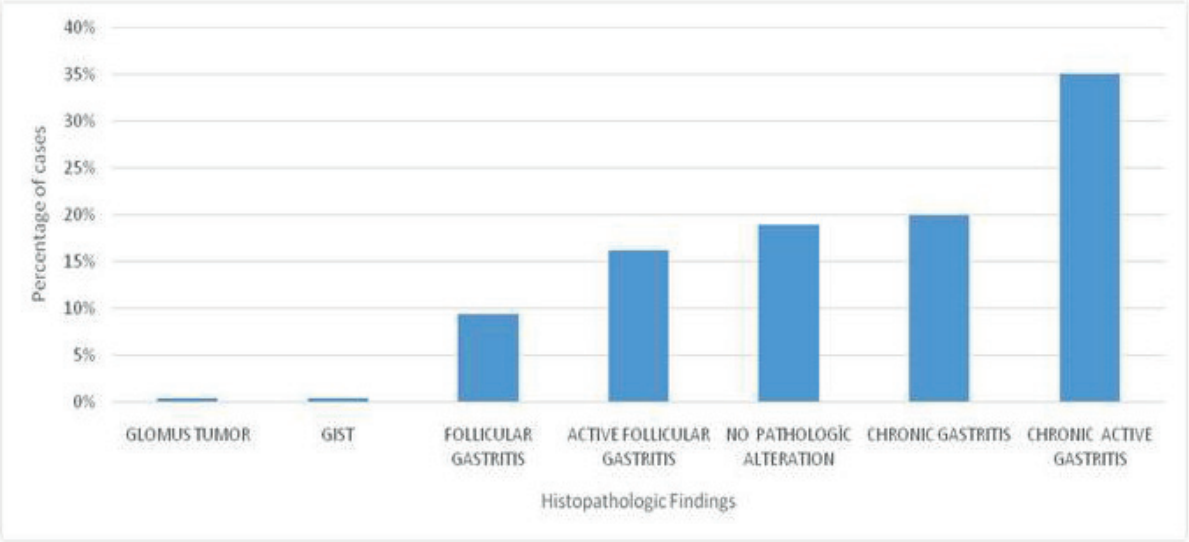

Figure 1. Gastric histopathology findings in patients undergoing laparoscopic sleeve gastrectomy.

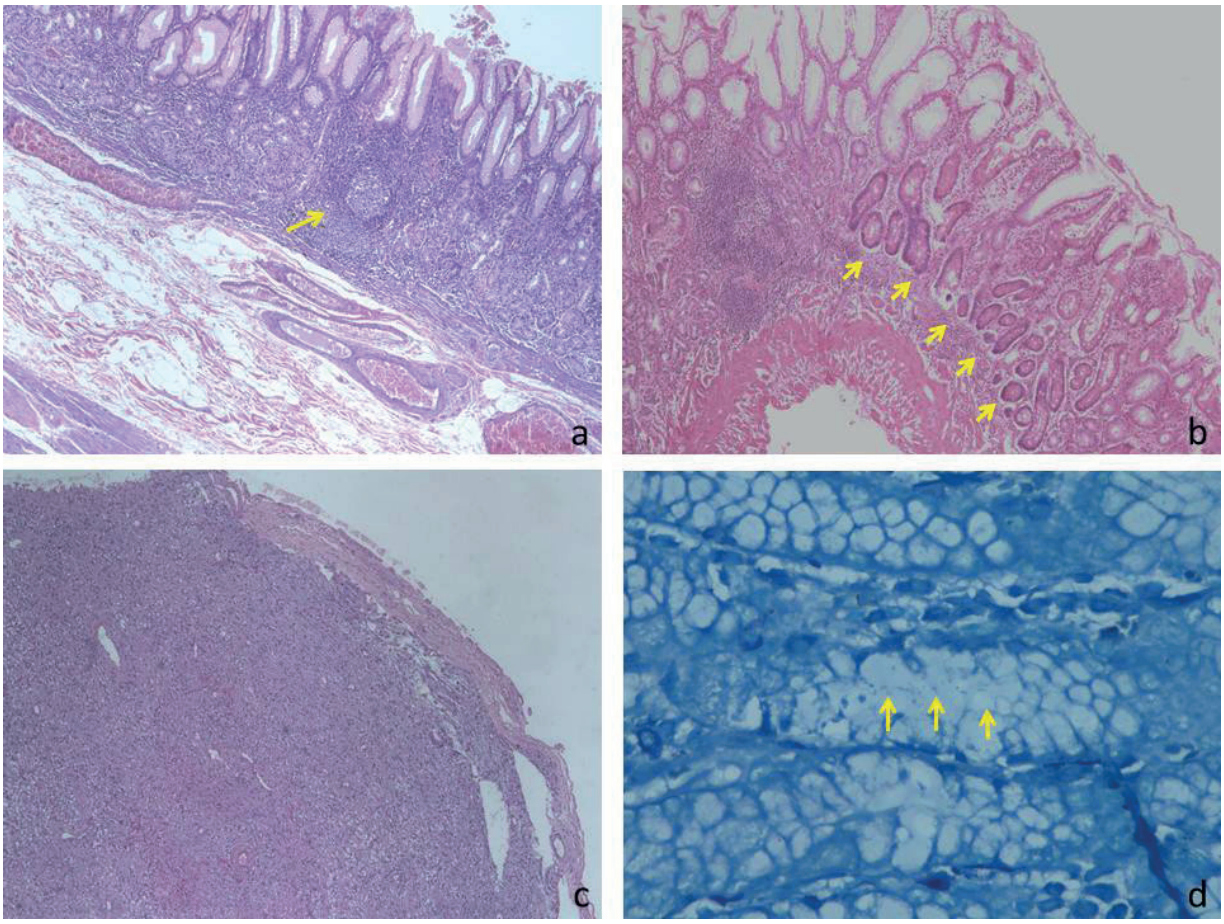

Figure 2. ***A,*** Lymphoid follicular indicated by the yellow arrows in chronic gastritis (HE x 40); ***B,*** Intestinal metaplasia indicated by the yellow arrows in chronic gastritis (HE x 40); ***C,*** Gastrointestinal stromal tumor (GIST) (HE x 40); d *H. pylori* indicated by the yellow arrows in chronic active gastritis (Giemsa x 400).

mostly not sufficient during the process of losing weight.

While bariatric surgery decreases the functional food intake, it also changes appetite, hormone levels related to appetite, and physical eating habits[12,13]. In particular, chronic gastritis is common in obese patients due to the unhealthy eating habits and choice of foods. It is referred to as obesity-related gastritis in several studies[14]. The incidence of chronic gastritis is often high in these studies. Some of the pathologists find the presence of plasma cells sufficient for the diagnosis of chronic gastritis. The others suggest that it

Table I. Alterations of BMI of patients who underwent laparoscopic sleeve gastrectomy: comparison between pre-operative and 6 months post-operative.

	pre-operative BMI mean±SD	6 months post-operative BMI mean±SD	*p*-value
Active chronic gastritis	50.76 ± 8.23	39.1 ± 8.09	<0.001*
Chronic gastritis	46.81 ± 6.18	34.7 ± 5.49	<0.001*
Active follicular gastritis	51.2 ± 6.71	38.44 ± 6.68	<0.001#
Follicular gastritis	48.59 ± 8.4	34.75 ± 7.76	<0.001*
Normal pathology	46.66 ± 3.4	34.6 ± 3.26	<0.001*

Data presented as mean±standart deviation; BMI, Body mass index (kg/m²); *Wilcoxon Signe Rank test; #Paired Samples *t*-test; $p<0.05$.

Table II. Gender and age distribution of histopathologic diagnoses.

	Female	Male	Age >40	Age =<40
	p=0.417*		*p*=0.118*	
Active chronic gastritis, (%)	73.6	26.4	63.7	36.3
Chronic gastritis, (%)	86.2	13.8	43.1	56.9
Active follicular gastritis, (%)	78	22	51.2	48.8
Follicular gastritis, (%)	81	19	52.4	47.6
Normal pathology, (%)	72	28	44	56

*Pearson x^2-test; p= 0.417; p=0.118 (not significant).

should be severely dispersed throughout the lamina propria[15]. Review of the literature shows that various pathological findings were detected in the preoperative endoscopy of obese patients. Hiatal hernia, severe erosive esophagitis, gastritis, gastric erosions and ulcers, tumors, and *H. pylori* infections, are important pathological findings[16]. Ohannesian et al[17] found different degrees of pathologies ranging primarily from chronic gastritis to GIST, fundic glans polyps, and xanthogranulomatous inflammation in the examination of gastric specimens of 310 patients who underwent LSG. Different from other studies, they reported the percentage of patients with no pathologies as 69%. They found a low level of *H. pylori* positivity with 3.2%, and reported that the reliability of the test should be questioned due to the fact that these patients were tested negative for *H. pylori* IgM antibody prior to operation. There are still no definite data on whether *H. pylori* positivity causes anastomosis problems, obesity is a co-factor for Barrett esophagus and adenocarcinomas, and postoperative routine proton pump inhibitors should be used[18]. It has been suggested that *H. pylori*-related gastric infection has a role in the pathogenesis of various benign and malignant gastric diseases. In addition, *H. pylori*-related gastritis causes approximately 50% of a low-grade gastric mucosa-associated lymphoid tissue (MALT) lymphoma. Premalignant lesions such as intestinal metaplasia and dysplasia, which can cause gastric adenocarcinoma development, iron deficiency anemia, vitamin B12 deficiency, idiopathic thrombocytopenic purpura, and peptic ulcer disease, have been associated with *H. pylori* infection[19,20]. The GIST occurrence is higher in obese patients, compared to the overall population. Beltran et al[21] were the first to describe an incidental gastric GIST case during LSG in 2009. As rarely seen in mesenchymal neoplasm and frequently seen in the stomach, one of our patients was diagnosed with this neoplasm.

In the preoperative abdominal computed tomography, GIST was detected and simultaneously treated with LSG. Almazeedi et al[14] reported only one (0.2%) of 656 patients with GIST in their study. It is still controversial whether routine preoperative upper gastro-intestinal (GI) endoscopy should be performed in patients undergoing LSG. Many researchers support endoscopy due to the weak correlation between the patients' clinical symptoms and endoscopic findings. The method is convenient, safe and easily applied[22,23]. Others advocate that endoscopy is slightly invasive and the possibility of the findings to change the scheduled surgical treatment plan is very low. However, it should be performed in symptomatic patients[24,25]. Loewen et al[26] reported that endoscopy required medical treatment in 18% of the patients prior to surgery; however, the surgical planning changed in 1% of the patients. Preoperative routine upper gastrointestinal endoscopy enables the diagnosis of rarely observed gastric pathologies. Preoperative treatment of these patients is an important factor, which affects the success of bariatric surgery. In our surgery practice, routine upper GI endoscopy is performed prior to all bariatric surgical procedures. Severe dysphagia and reflux can modify the surgical planning. Pre-surgical medical treatment can be required for patients with symptomatic *H. pylori* infection. Unless multiple gastric erosions, pyloric ulcer, and *H. pylori* are treated, they can cause gastric outlet obstruction after bariatric surgery and gastric stricture around pylorus. Another interesting issue is the surgical waiting time following endoscopy. Long waiting times can lead to reinfection in patients under preoperative treatment for *H. pylori* infection or new infections in *H. pylori*-negative patients[14]. High gastritis prevalence observed in many studies suggested a new disease phenomenon, namely, obesity-related gastritis[27]. Gastroesophageal reflux caused

by obesity can contribute to the development of hyperplastic polyp.

Sleeve gastrectomy, applied in obesity surgery, can worsen the decreased state of parietal cells, as in atrophic gastritis. This can lead to achlorhydria and vitamin B12 absorption deficiency[14]. Intestinal metaplasia is a premalignant condition rarely observed in the gastric pathology of obese patients but accepted as moderate carcinogenesis[28]. In their study, Onzi et al[29] reported that while the rate of preoperative chronic gastritis in obese patients was 33.3%, it decreased to 16.7% after sleeve gastrectomy, most of the foveolar hyperplasia cases improved, and most of the patients remained asymptomatic.

In the gastric specimens of obese patients who underwent LSG, Gundogan et al[30] detected interstitial lymphocyte infiltration (63.6%), follicular lymphoid hyperplasia in lamina propria (60.7%), and microvesiculation/dilatation of parietal cells (57.6%).

Conclusions

We observed that the prevalence of active follicular gastritis, chronic active gastritis and *H. pylori* positivity, are high in morbidly obese Turkish patient population. No significant difference was found between the pathological diagnosis in obese patients with LSG operation in terms of age and sex. Research shows that obesity is also highly likely to be seen in gastric pathologies. The treatment of gastric pathologies is important in the follow-up of patients and in the success of bariatric surgery.

Ethics Approval

The present study performed all procedures on humans according to the Ethics Principles of the Institutional and/or National Committee of Research and the Declaration of Helsinki (1964) as amended or corresponding Ethical principles.

Authors' Contribution

Ugur Dogan (ABDEF), Dinc Suren (BD), Mehmet Tahir Oruc (CD), Ahmet Arda Gokay (BDE), Burhan Mayir (BD), Tugrul Cakir (CEF), Arif Aslaner (EF), Osman Zekai Oner (CF), Nurullah Bulbuller (CD). Note: Study Design (A); Data Collection (B); Statistical Analysis (C); Data Interpretation (D); Manuscript Preparation (E); Literature Search (F).

Conflict of interest

The authors declare no conflicts of interest.

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