



Histopathological Findings of Gastric Specimens after Sleeve Gastrectomy

Shorsh Hama Hussein Ameen* Karzan Seerwan Abdullah Karwkh Hassan Salih*****

Abstract

Background and objectives: Sleeve gastrectomy is considered a safe and practicable bariatric procedure. Despite recommending preoperative gastroscopy to rule out considerable pathologies, resected gastric specimens should be sent for histopathological examination to reveal any severe findings without suggestive clinical symptoms. Thus, this study aimed to identify the most common abnormal histopathological finding after sleeve laparoscopic gastrectomy.

Methods: This retrospective descriptive, cross-sectional study included 250 patients underwent laparoscopic sleeve gastrectomy for obesity from January, 2020 to January, 2024 at (Gastroenterology and Hepatology) Teaching Hospital and Zhian Private Hospital in Sulaymaniyah, Iraq. The patients' sociodemographic data (age, sex, weight, and height) with their histopathological reports of gastric samples were collected from patient's records. Abnormal histopathological findings after sleeve gastrectomy were described.

Results: Most patients were aged 18 - 44 years (n= 189, 75.6%), females (n= 175, 70%), and had a body mass index of $<40 \text{ kg/m}^2$ (n= 114, 45.6%). Non-specific active chronic gastritis (n= 70, 28.0%) and Helicobacter pylori-positive active chronic follicular gastritis (n= 23, 9.2%) were more common among operated patients. A highly significant ($p < 0.001$) difference was observed between the patient's gender and histopathological findings (which gender was more affected?). In contrast, a substantial difference ($p=0.01$) was observed between patients' body mass index categories and different types of gastritis.

Conclusions: Sleeve gastrectomy results in abnormal histopathological findings among most patients, especially young females.

Keywords: Gastric specimens, Histopathological findings, Laparoscopy, Sleeve gastrectomy

*MBChB, FKHCMS in General surgery, KHCMS -subspecialty of digestive and hepatic surgery, Lecturer in Branch of Clinical Sciences, College of Medicine, University of Sulaimani, and. e-mail: shorsh.hussein@univul.edu.iq, Corresponding Author

**MBChB, FIBMS in General surgery, PDF in Hepatic and pancreatic surgery, Assistant Professor in Branch of Clinical Sciences, College of Medicine, University of Sulaimani, Iraq. e-mail: karzan.abdullah@univul.edu.iq

***MBChB, FIBMS in Pathology, Lecturer in Branch of Clinical Sciences, College of Medicine, University of Sulaimani, Sulaymaniyah, Iraq. e-mail: karwkh.salih@univul.edu.iq



Introduction

Obesity is defined by the World Health Organization (WHO) as a body mass index (BMI) of ≥ 30 kg/m² that has been doubled worldwide since early eighties. Over 33% of the world population is estimated to be overweight.¹ Obesity currently comprises the most serious, most prevalent, and most challenging health concerns worldwide.² Lifestyle changes and other non-surgical modalities (medications and cognitive behavioural therapy) are found to be ineffective in weight reduction and maintenance of average weight among persons with severe obesity and those with comorbidities.³ Bariatric surgery is the most effective and durable option for treating obesity and its morbidities.⁴ Sleeve laparoscopic gastrectomy (SLG) is the most commonly performed bariatric surgical procedure as a stand-alone procedure, especially for those with morbid obesity, after the ordinary diet regimens have failed to arrest its progression.⁵ In LSG, a large amount of the gastric body with fundus is resected along the gastric greater curvature with subsequent division of the stomach, creating a gastric remnant.⁶ Generally, SLG is an easy laparoscopic producer with the advantage of being associated with short hospital stays and quick recovery.⁷ As it is a restrictive procedure, SLG decreases calorie intake and decreases appetite as ghrelin-producing cells are removed. Also, it is effective in resolving obesity-related comorbidities like hypertension, type two diabetes mellitus and hyperlipidemia.⁸ It was supposed that histopathological examination of gastric specimens after SLG would be regular with the exception of a few unexpected incidental findings, but this was not supported by numerous published data on their histopathological examination of gastric specimens after SLG.⁹ There is no much data published on histopathological changes in gastric specimens from patients with morbid

obesity and few reports demonstrating pathological changes, including malignant lesions.¹⁰ At the same time, other studies show unexpected findings among histopathological specimens, including Helicobacter infection, gastrointestinal stromal tumour (GIST), intestinal metaplasia, and chronic gastritis.¹¹ The *H. pylori*-induced inflammatory response of the gastric mucosa involves several gastric cell types, which regulate ghrelin and leptin production.¹² Another study looks over the effect of chronic gastritis on secretory actives and the density of ghrelin cells and that they affect eating and weight but have controversial outcomes.¹³ Additionally, there needs to be more evidence on whether preoperative investigations, such as endoscopic examination and gastric biopsy, are essential alongside routine preoperative investigations.¹⁴ Accordingly, this study is designed to demonstrate the most common abnormal histopathological findings after SLG.

Patients and methods

This retrospective descriptive, cross-sectional study was performed on 250 patients who underwent SLG for morbid obesity, from January 2020 to January 2024 at the Teaching Hospital for Gastroenterology and Hepatology and Zhian Private Hospital, Sulaymaniyah, Iraq. The patients' sociodemographic data, including age, sex, and body mass index (BMI), were collected from hospital records. The respondents consisted of post-sleeve gastrectomy adults of any gender and age. At the same time, those with previous biopsy-proven gastric pathology, previous operation on gastric or biliary tract and those who preoperatively took proton pump inhibitors (PPI) for >6 weeks were excluded. Biopsy and surgical specimens are dealt with in the Histopathology Laboratory using histological techniques.² The Kurdistan Higher Council of Medical Specialties





(KHCMS) has accepted the study proposal. Since this is a retrospective study involving data that have already been collected and anonymized, the KHCMS grants an Institutional Review Board (IRB) waiver of the patient's consent. Data were analyzed using Statistical Package for the Social Science (Chicago, USA, Version 27). Spearman correlation coefficient was used to correlate numerical variables with histopathological features, while the chi-square test was used to compare the histopathological results to patients' data. A $p \leq 0.05$ was considered significant, while a $p \leq 0.001$ was set as a highly significant difference.

Results

The patient's age ranged from 13 to 64 years, with a mean of 36.34 ± 10.46 years and a median of 35 years. Most of them (75.6%) were aged 18 - 44 years, followed by 45 - 64 years (23.2%), and only 1.2% of patients were aged 13 - 17 years. Most patients were females (n=175, 70%), and 75 (30%) were males. The mean BMI was 41.40 ± 5.23 kg/m², and the median was 40.46 kg/m². Also, most patients had a BMI of <40 kg/m² (n=114, 45.6%), followed by 40 - 45 kg/m² (n=92, 36.8%), then >45 (n=44, 17.6%), as shown in Table (1).

Table (1): Sociodemographic data of the studied patients.

Variable	Frequency	Percentages
Age (Years)		
13 - 17	3.0	1.2
18 - 44	189	75.6
45 - 64	58	23.2
Gender		
Male	75	30
Female	175	70
Body mass index (BMI, kg/m ²)		
<40	114	45.6
40 - 45	92	36.8
>45	44	17.6
Total	250	100

Regarding the histopathological findings, 65 (26%) patients had average outcomes (56% male's vs 13.1% females), while 185 (74%) had abnormal findings (86.9% female's vs 44% males). Among them, non-specific active chronic gastritis was found in most patients (n=70, 28.0%) (34.3% female's vs 13.3% males), followed by non-specific inactive chronic gastritis (n=43, 17.2%) (19.4% female's vs 12% males). Additionally, the incidence of *H. pylori* reported highest in patients with active chronic follicular gastritis (n=23, 9.2%), followed by active chronic gastritis (n=19, 7.6%), then inactive chronic follicular gastritis (n=16, 6.4%), inactive chronic gastritis (n=14, 5.6%), and finally inactive chronic gastritis (n=14, 5.6%). A highly significant difference ($p < 0.001$) was observed between the gender and histopathological findings among patients, as shown in Table (2). The study also examined the association between BMI categories and the prevalence of different types of gastritis. The proportion of participants with normal findings decreased with increasing BMI, from 52.3% in those with a BMI <40 kg/m² to 12.30% in those with a BMI >45 kg/m². The same is true for the outcomes of *H. pylori*-positive chronic gastritis, as the highest rate was in patients with BMI <40 kg/m² (51.3%), and the lowest was in those with BMI >45 kg/m² (20%). The prevalence of non-specific active chronic gastritis was reported highest in participants with a BMI of 40 - 45 kg/m² (51.42%). A significant difference ($p = 0.01$) was observed between the patients' BMI categories and different types of gastritis, as shown in Table (3) and Figure (1).





Table (2): The correlation between patients' gender and their histopathological findings.

Variable	Patient's Gender		Total	p-value
	Male	Female		
	Number (%)			
Normal	42 (56)	23 (13.1)	65 (26)	<0.001**
Non-specific active chronic gastritis	10 (13.3)	60 (34.3)	70 (28)	
Non-specific inactive chronic gastritis	9.0 (12)	34 (19.4)	43 (17.2)	
<i>H. pylori</i> -positive chronic gastritis				
Active chronic gastritis	4.0 (5.3)	15 (8.6)	19 (7.6)	<0.001**
Inactive chronic gastritis	1.0 (1.3)	13 (7.4)	14 (5.6)	
Inactive chronic follicular gastritis	5.0 (6.7)	11 (6.3)	16 (6.4)	
Active chronic follicular gastritis	4.0 (5.3)	19 (10.9)	23 (9.2)	
Total	75 (100)	175 (100)	250 (100)	

**Highly significant difference

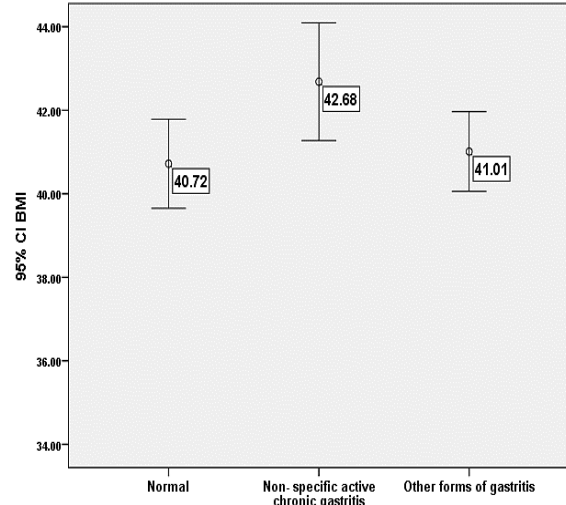


Figure (1): Demonstrates the correlation between patients' body mass index (BMI) and gastritis type.

Discussion

National Institute for Health and Care Excellence (NICE) guidelines considered bariatric surgery as an option in patients with severe obesity in whom lifestyle changes and medications have not been effective.¹⁴ Thus, nowadays, SLG is commonly implemented to reduce morbid obesity rates in patients worldwide, including Sulaymaniyah City, Iraq. In this study, the mean patient's age was 36.34 ± 10.46 years, and most of them were significantly young adults (75.6%), females (70%), and had a BMI of $<40 \text{ kg/m}^2$ (45.6%) (mean of $41.40 \pm 5.23 \text{ kg/m}^2$). These results agree with Rashdan et al, who found more female patients (77.5%) with mean patients aged 36 ± 10.7 years and a mean BMI of $46 \pm 7.5 \text{ kg/m}^2$.⁶ Also Algerian, found the mean age of the patients was 31.36 ± 0.78 years and female predominance (55.8%) among patients who underwent SLG.² These findings indicate that obesity is more common among young adult females and might be due to improper lifestyle, such as consumption of an unhealthy diet, low physical activity, and stress. Regarding the histopathological results among patients, a minority had normal outcomes (26%), while

Table (3): The correlation between patients' body mass index (BMI) and gastritis type.

Variable	Patients Body Mass Index (kg/m ²)			Total	p-value
	<40	40 - 45	>45		
	Number (%)				
Normal	34 (52.3)	23 (35.38)	8.0 (12.3)	65 (26)	0.01*
Non-specific active chronic gastritis	21 (30)	36 (51.42)	13 (18.5)	70 (28)	
<i>H. pylori</i> -positive chronic gastritis	59 (51.3)	33 (28.7)	23 (20)	115 (46)	
Total	114 (100)	92 (100)	44 (100)	250 (100)	

*Significant difference





the majority had pathological findings (74%), especially in females. These outcomes agree with those of Demirbas et al, who observed normal histopathologic findings in 25.7% of patients; however, they do not agree with those of Nowak et al, who found that most specimens had no pathological abnormalities identified by non-specific gastritis.^{15,16} Among abnormal findings, non-specific active chronic gastritis was more common (28.0%), especially in females. Meanwhile, *H. pylori* reported the highest (72% in total), especially in those with active chronic follicular gastritis (9.2%). Similarly, Algerian, 2018² indicated that most patients had chronic gastritis (83.4%), *H. pylori* (22.3%) and active gastritis (22.3%). Also, Rashdan et al, detected that most patients had chronic gastritis (88.3%) and *H. pylori*-related gastritis (50.3%).⁶ This study outcome contraindicates a study by Miller et al, who revealed that the most prevalent histopathology result in sleeve gastrectomy is no pathological changes (80.2%).¹⁷ The high prevalence of *H. pylori* in this study reveals that histopathological examinations of specimens are warranted. This differs from that of Taha-Mehlitz et al, who found *Helicobacter*-associated gastritis in only 5.38% of patients. Accordingly, gender was highly significantly ($p < 0.001$) correlated with histopathological findings of the patients, as normal histopathology was significantly reported among males, while most females had significantly abnormal histopathological lesions.¹⁸ These disparities might be related to the predominance of females in this study. Interestingly, the results of this study indicate the null occurrence of malignancy in resected gastric specimens. A significant association ($p = 0.01$) was also seen between BMI categories and different types of gastritis, as chronic gastritis caused by *H. pylori* was found predominantly in patients with BMI $< 40 \text{ kg/m}^2$ (51.3%) and least commonly in

those with BMI $> 45 \text{ kg/m}^2$ (20%). At the same time, the non-specific active chronic gastritis reported highest in patients with a BMI of 40 – 45 kg/m^2 (51.42%). These outcomes are not in line with other studies that found no significant association between preoperative BMI and histopathological findings in gastric specimens, including Tomasicchio et al, Saafan et al and Adali et al.^{12,19, 20} These disparities might be related to geographical location, sample size, surgical technique, and clinical factors of patients. Collectively, these findings showed clinically significant pathologies in patients who underwent SGL that necessitate alterations in postoperative management that might be life-threatening if not resolved correctly.

Conclusions

Sleeve gastrectomy was more common among young female adults, resulting in abnormal histopathological findings, especially those caused by *H. pylori*. These findings support the need for routine histopathological examination of all LSG specimens to identify any pathology that might impact future patient management. Thus, more studies are needed to generate a panel of characteristics for patients undergoing sleeve gastrectomy to identify high-risk groups mandating preoperative endoscopic biopsy and postoperative histopathological examination.

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Conflict of interest

The authors declared no conflict of interest in this study.





References

1. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism*. 2019, 92:6-10.
2. Aljerian K. Histopathological findings in laparoscopic sleeve gastrectomy specimens from patients with obesity in Saudi Arabia. *Gastroenterol Res Pract*. 2018, 2018(1):1702705.
3. Safaan T, Bashah M, El Ansari W, Karam M. Histopathological changes in laparoscopic sleeve gastrectomy specimens: prevalence, risk factors, and value of routine histopathologic examination. *Obes Surg*. 2017, 27:1741-1749.
4. Cayci HM, Erdogdu UE, Demirci H, Ardic A, Topak NY, Taymur İ. Effect of health literacy on help-seeking behavior in morbidly obese patients agreeing to bariatric surgery. *Obes Surg*. 2018, 28:791-797.
5. Deghles A, Dana M, Obeid A, Ahmed AB, Khatib Y, Ghanem A, Maree M. Findings of the Histopathology of Resected Stomach Specimens Following a Sleeve Gastrectomy at Al-Makassed Hospital from 2017 to 2023-Can a Selective Approach Be Recommended Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4854634/
6. Rashdan M, Mansour H, Odeh G, Abu-dawood R, Otoom G, Foudeh D et al. Histopathology findings of resected gastric specimens post sleeve gastrectomy: A cross-sectional study. *Int J Surg Open*. 2022, 43:100485.
7. Chung AY, Thompson R, Overby DW, Duke MC, Farrell TM. Sleeve gastrectomy: surgical tips. *J Laparoendosc Adv Surg Tech*. 2018, 28(8):930-937.
8. Khaitan L, Shea BJ. Laparoscopic vertical sleeve gastrectomy, long and short-term impact on weight loss and associated comorbidities. *Ann Transl Med*. 2020, 8(Suppl 1): S5.
9. Alessandris R, Moroso F, Michelotto M, Fassan M, Angerilli V, Callegari L, Foletto M. Preoperative endoscopy and pathology report of the specimen to be recommended in sleeve gastrectomy *Pathologica* 2023, 115(2):90.
10. Onzi TR, d'Acampora AJ, de Araújo FM, Baratieri R, Kremer G, Lyra HF, et al. Gastric histopathology in laparoscopic sleeve gastrectomy: pre-and post-operative comparison. *Obes Surg*. 2014, 24:371-376.
11. Ge L, Moon RC, Nguyen H, de Quadros LG, Teixeira AF, Jawad MA. Pathologic findings of the removed stomach during sleeve gastrectomy. *Surg Endosc*. 2019, 33:4003-4007.
12. Tomasicchio G, Picciariello A, Dibra R, Lantone G, Trigiante G, De Fazio M, Martines G. Histopathologic findings on removed stomach after sleeve gastrectomy. Do they influence the outcome *Open Med*. 2022, 17(1):485-491.
13. Mantero P, Matus GS, Corti RE, Cabanne AM, de Palma GGZ, Olid LM et al. Helicobacter pylori and corpus gastric pathology are associated with lower serum ghrelin. *World J Gastroenterol*. 2018, 24(3):397.
14. Al Saady R, Ejeckam G. Histopathological findings in laparoscopic sleeve gastrectomy specimens. *Qatar Med J*. 2019, 2019(1):5.
15. Demirbas BT, Erdim A, Celikel C, Akbas G, Cingi A. Is it necessary to send the sleeve gastrectomy specimens to pathology *Surg Laparosc Endosc Percutan Tech*. 2019, 29(2):117-119.
16. Nowak K, DiPalma A, Serra S, Quereshy F, Jackson T, Okrainec A, Chetty R. Review of pathological findings in laparoscopic sleeve gastrectomy specimens performed for morbid obesity. *J Clin Pathol*. 2020, 73(10):618-623.
17. Miller GC, Reid AS, Brown IS. The pathological findings seen in laparoscopic sleeve gastrectomies for weight loss. *Pathology* 2016, 48(3):228-232.





18. Taha-Mehlitz S, Mongelli F, Sykora M, Scheiwiller A, Diebold J, Metzger J, Gass J-M. Routine histopathologic examination of the resected specimen after laparoscopic sleeve gastrectomy—what can be expected *Acta Chirurgica Belgica* 2021, 121(6):380-385.
19. Saafan T, El Ansari W, Bashah M. Compared to what? Is BMI associated with histopathological changes in laparoscopic sleeve gastrectomy specimens? *Obes Surg.* 2019, 29:2166-2173.
20. Adalı Y, Binnetoğlu K, Eroğlu HA, Kaya N, Güvendi GF. The relationship between histopathologic findings and body mass index in sleeve gastrectomy materials. *Obes Surg.* 2019, 29:277-280.

