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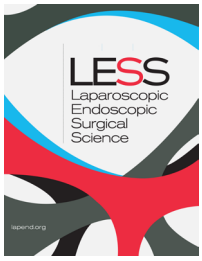

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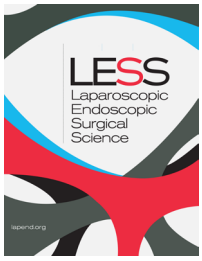

Information to Authors

Laparoscopic Endoscopic Surgical Science (LESS) is a peer-reviewed, independent, international periodical that considers for publication clinical and experimental studies, reviews, case reports, technical contributions, and letters to the editor. Scope of the journal covers the minimally invasive surgical and endoscopic interventions. It is an open access journal and published four times (March, June, September, and December) a year in English. Authors are responsible for the accuracy of data and the journal is in compliance with the uniform requirements for manuscripts submitted to biomedical journals published by the ICMJ (updated in August 2013).

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RESEARCH ARTICLES

LETTER TO THE EDITOR

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Original Article

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The influence of laparoscopic and conventional surgical approaches on the development of surgical site infections in colon cancer

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ABSTRACT

Introduction: Minimal invasive surgery techniques are getting more popular by surgeons relying their advantages such as pain control, feasibility and increased affinity. Both techniques have similar prognostic influence regarding survival in colon cancer but increased versatility of laparoscopy in years shows more tendency of laparoscopy among surgeons. This study aims to evaluate of surgical site infection (SSI) rates between conventional and laparoscopic colon cancer procedures.

Materials and Methods: Patients operated due to colon adenocarcinoma between 2018 and 2023 evaluated. Emergency, palliative or incomplete resections excluded. Demographic, pathologic, peroperative and postoperative records of patients evaluated. Patients seperated into groups by SSI occurance and surgical method choice.

Results: SSI development was found higher in conventional surgery group (30.0% vs 11.6%; p=0.013). In comparison of patients by SSI development; only intraoperative Red Blood Concentrate (RBC) replacement founded to be higher in SSI (+) group (0±1 vs 0±1; p=0.002). All variables associated with SSI development were subjected to univariate regression analysis. It's shown that only conventional surgery choice was a indipendant risk factor for SSI development (OR: 3.489 (1.289 – 9.415); p=0.017).

Conclusion: Laparoscopic colon surgery has better SSI rates than conventional colon surgery procedures. Our findings are similar with the general view on SSI ratio's between two surgical practices.

Keywords: Colon Cancer, Laparoscopy, Surgical site infection

Introduction

The selection of minimally invasive techniques is becoming increasingly popular among surgeons today. The growing preference for these procedures is driven by the cumulative experience gained over time and the early exposure of new surgeons to these techniques at the start of their practice. As a result, minimally invasive surgical procedures are being chosen more frequently for a vari-

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ety of cases.[1] In general surgical practice, laparoscopy is gaining ground and popularity daily, extending its use from benign conditions, such as cholecystectomy, to oncological procedures for gastric, colon, and pancreatic cancers, and even to more confined areas.[1-4]

There are several reasons that explain the increased adoption of these procedures, despite their higher cost compared to conventional surgical methods. Firstly, minimal incision techniques result in smaller wounds, leading to less postoperative pain and enabling patients to return to their daily activities more quickly. These fundamental advantages make laparoscopy a more favorable option and warrant its consideration over open surgical methods.[5]

In addition to these advantages, although it has been noted that there is an initial learning curve and longer operative times associated with the first use of these techniques, recent studies have shown that these concerns have been mitigated. Furthermore, it has been demonstrated that minimally invasive techniques offer additional benefits, such as reduced complication rates and improved resection quality.[5,6]

Surgical site infections (SSIs) are one of the most frequently attributed advantages of laparoscopy in recent literature reviews. Numerous studies have indicated that the use of laparoscopy significantly reduces the incidence of SSIs.[7,8] This study aims to evaluate the impact of the chosen surgical method on the development of SSIs in patients who underwent surgery for colon adenocarcinoma at our center.

Materials and Methods

Approval was obtained from the Ethics Committee of Koşuyolu Yüksek İhtisas Training and Research Hospital on 03/09/2024, with reference number 2024/15/900. The records of patients who underwent laparoscopic or conventional colon cancer procedures in the Department of Gastrointestinal Surgery at the same center between 01/01/2018 and 12/31/2023 were reviewed.

Patients who underwent palliative, emergency, or inadequate oncological surgery were excluded. Additionally, any patient lacking complete data on laboratory, pathology, or demographic information, or with follow-up shorter than 30 days, was excluded. The patients' demographic data, comorbidities, pathology results, intraoperative fluid measurements and types (if recorded), intraoperative records, and postoperative ward round records for SSI definitions were evaluated.

Intravenous cefazolin prophylaxis at a dose of 2 or 3 grams, depending on the patient's weight, was administered 60 minutes before surgery, along with 500 mg of metronidazole prophylaxis at 7-hour intervals for all patients.[9] A single anesthesia team was responsible for the preoperative and intraoperative management of the patients. No mechanical bowel preparation was administered since rectal cancer patients were excluded. At least one drain was placed at the operation site in all procedures. Skin sterilization was performed using chlorhexidine. SSIs were defined according to the Centers for Disease Control and Prevention (CDC) 1988 classifications, with 2017 modifications. SSIs were classified as Superficial Surgical Site Infection (SSSI), Deep Surgical Site Infection (DSSI), and Organ/Space Infection (OSI).[10,11] Patients who developed at least one of these subtypes were confirmed as having developed an SSI.

Two analyses were performed on groups formed based on the choice of operation method and the development of SSI. The first analysis compared patients who underwent conventional surgery with those who had laparoscopic surgery. In the second analysis, patients who developed SSI were compared with those without infection. Demographic and clinical data, diagnoses, intraoperative measurements, perioperative and postoperative lactate measurements, and postoperative length of stay (LOS) were compared between these groups.

Statistical analyses were conducted using the SPSS 27.0 (SPSS Inc., Chicago, IL) software package. The normality of quantitative variables was assessed using the Kolmogorov-Smirnov test. Independent samples t-tests were used for comparison of normally distributed variables between independent groups, while the Mann-Whitney U test was used for non-normally distributed variables. The relationship between qualitative variables was explored using chi-square analysis. Descriptive statistics for normally distributed quantitative variables were presented as mean±standard deviation, while non-normally distributed quantitative variables were presented as median (25^{th}-75^{th} percentile). Descriptive statistics for qualitative variables were expressed as frequencies (%). p-values less than 0.05 were considered statistically significant.

Results

A total of 162 patients were included in the study. Regarding the origin of the lesions, 30 were in the cecum, 44 in the ascending colon, 8 in the transverse colon, 22 in the descending colon, and 58 in the sigmoid colon. A total of 42 patients developed an SSI. Among these 42 patients, 39 had a Superficial Surgical Site Infection (SSSI), 14 had a Deep Surgical Site Infection (DSSI), and 10 had an Organ/Space Infection (OSI). When comparing patients based on the surgical method, the proportion of diabetic patients was higher in the laparoscopic group (68.9% vs. 86%; p=0.029). Additionally, the prevalence of coronary artery disease (CAD) was higher in the laparoscopic group (64.7% vs. 83.7%; p=0.020). Age was higher in the conventional surgery group (65±12 vs. 58±14 years; p=0.002), as was Body Mass Index (BMI) (27.99±4.97 vs. 26.49±3.72; p=0.003). Other demographic and pathological variables were similar between the groups.

In the comparison of intraoperative findings, operation time was significantly longer in the laparoscopy group (188±58 vs. 244±50 minutes; p<0.001). Intraoperative fluid replacement was also more restricted in the laparoscopy group (2300±1900 vs. 2380±840 mL; p=0.008). Finally, SSI development was higher in the conventional surgery group (30.0% vs. 11.6%; p=0.013). Other demographic, pathological, and intraoperative variables are presented in Table 1.

In the comparison of patients based on SSI development, only intraoperative red blood cell (RBC) transfusion was higher in the SSI (+) group (0±1 vs. 0±1; p=0.002). All other demographic, pathological, and intraoperative variables were similarly distributed between the groups (Table 2).

All variables associated with SSI development in Tables 1 and 2 were subjected to univariate regression analysis. It was shown that only the choice of conventional surgery was an independent risk factor for SSI development (OR: 3.489 [1.289–9.415]; p=0.017). None of the other variables were found to be independent risk factors for SSI development (p>0.05). Since all parameters, except the choice of conventional surgery, were found to be insignificant, these variables were not included in a further multivariate Cox regression analysis to evaluate their prognostic relationship with SSI development (Table 3).

Discussion

In our study, it was demonstrated that patients undergoing conventional surgery are at a higher risk of developing SSI compared to those undergoing laparoscopic surgery. The incidence of SSI in patients who underwent laparotomy was approximately 3.5 times higher than in those who underwent laparoscopy. Today, one of the most significant factors in the preference for minimally invasive surgical procedures is the improvement in patients' postoperative quality of life. Hospital stay duration, which is closely related to SSIs, is one of the many factors affecting the early return to daily life. A lower rate of SSI development is one of the most crucial factors that enable patients to resume their daily activities as soon as possible.[12] Although there are publications showing that SSI development can even affect prognosis determination, there is no clear consensus on this matter.[13-15]

The incidence of SSIs following colorectal cancer surgery can reach up to 20%, according to the literature. The development of SSIs also prolongs hospital stays and increases cost estimates, maintaining its relevance among surgical specialties.[12] Studies conducted under the US surgical education improvement program have shown that not only colorectal procedures but also surgical procedures related to other organs are associated with a decreased incidence of SSIs in minimally invasive procedures.[16] The reasons cited for this include better surgical visualization, smaller incisions, and a reduced systemic inflammatory response associated with minimally invasive procedures.[17]

There are numerous recent studies on this topic, which is central to surgical practice. In a study comparing minimally invasive techniques, cases of laparoscopy and robotic surgery were evaluated, and it was found that neither method had an advantage over the other in terms of SSI development. However, the study showed that bleeding exceeding 100 ml, a history of diabetes, and incision size were independent risk factors for SSI development.[12] Although our study also demonstrated that a history of diabetes and intraoperative bleeding were significant for SSI development, they were not found to be independent risk factors in multivariate analyses. Since our study compared open surgery with laparoscopy cases, incision sizes were not evaluated. We only included colon cancer patients. Our study demonstrated that the incidence of SSI was lower with the choice of minimally invasive surgery.

Table 1. Demographic and pathologic variable analysis depending on laparoscopy choice

Variables	Conventional n=119 (73.5%)	Laparoscopy n=43 (26.5%)	p, †
Gender			
Male	63 (61.3%)	25 (58.1%)	0.713
Female	46 (38.7%)	18 (41.9%)	
Hypertension			
No	50 (42%)	24 (55.8%)	0.120
Yes	69 (58%)	19 (44.2%)	
Diabetes			
No	82 (68.9%)	37 (86%)	0.029*
Yes	37 (31.1%)	6 (14%)	
CAD			
No	77 (64.7%)	36 (83.7%)	0.020*
Yes	42 (35.3%)	7 (16.3%)	
COPD			
No	107 (89.9%)	38 (88.4%)	0.777
Yes	12 (10.1%)	5 (11.6%)	
Anemia			
No	103 (86.6%)	38 (88.4%)	0.761
Yes	16 (13.4%)	5 (11.6%)	
Tumor Site			
Caecum	23 (19.3%)	7 (16.3%)	0.221
Right Colon	32 (26.9%)	12 (27.9%)	
Transverse Colon	8 (6.7%)	0 (0.0%)	
Left Colon	18 (15.1%)	4 (9.3%)	
Sigmoid Colon	38 (31.9%)	20 (46.5%)	
T Stage			
T1	6 (5%)	3 (7%)	0.360
T2	7 (5.9%)	6 (14%)	
T3	85 (71.4%)	28 (65%)	
T4	21 (17.6%)	6 (14%)	
N Stage			
N0	74 (62.2%)	24 (55.8%)	0.763
N1	28 (23.5%)	12 (27.9%)	
N2	17 (14.3%)	7 (16.3%)	
M Stage			
M0	109 (91.6%)	43 (100%)	0.062
M1	9 (7.6%)	0 (0%)	
Neoadjuvant Chemotheraphy			
No	118 (99.2%)	1 (100%)	0.547
Yes	43 (0.8%)	0 (0%)	
LVI			
Negative	79 (66.4%)	24 (55.8%)	0.193
Positive	39 (32.8%)	19 (44.2%)	
PNI			
Negative	89 (74.8%)	31 (72.1%)	0.688
Positive	29 (25.2%)	12 (27.9%)	

Table 1. Demographic and pathologic variable analysis depending on laparoscopy choice (CONT.)

Variables	Conventional n=119 (73.5%)	Laparoscopy n=43 (26.5%)	p, †
Grade			
Good	17 (14.3%)	9 (20.9%)	0.483
Moderate	83 (71.4%)	30 (69.8%)	
Poor	17 (14.3%)	4 (9.3%)	
Stage			
I	10 (0.1%)	6 (14%)	0.199
II	60 (50%)	20 (46.5%)	
III	40 (33.6%)	17 (39.5%)	
IV	9 (16.3%)	0 (0%)	
SSI			
No	82 (70%)	38 (88.4%)	0.013*
Yes	37 (30%)	5 (11.6%)	
ASA Score			
1	5 (4.2%)	3 (7%)	0.329
2	40 (33.6%)	15 (34.9%)	
3	66 (55.5%)	25 (58.1%)	
4	8 (6.7%)	0 (0%)	
Anastomosis Leakage			
No	115 (96.6%)	42 (97.7%)	0.736
Yes	4 (3.4%)	1 (2.3%)	
	Mean±SD	**p‡**	
Age	65±12	58±14	0.002**
BMI	27.99±4.97	26.49±3.72	0.003**
Operation Time / minutes	188±58	244±50	<0.001***
Intraoperative RBC Replacement / per unite	0±1	0±1	0.055
Postoperative RBC Replacement / per unite	1±2	1±1	0.128
Peroperative Fluid Replacement / mL	2300±1900	2380±840	0.008**
Peroperative Bleeding /mL	137±114	92±112	0.357

CAD: Coronary Artery Disease; COPD: Chronic Obstructive Pulmonary Disease; LVI: Lymphıvascular Invasion; PNI: Perineural Invasion; SSI: Surgical Site Infection; BMI: Body Mass Index; ASA: American Society of Anesthesiology; RBC: Red Blood Cell Concentrate; mL: milliliter; LOS: Length of Hospital Stay; SD: Standard Deviation; * p<0,05, **p<0,01, ***p<0.001, † Chi-Square, ‡ Indipendent t Test.

In a separate study involving 670 patients who underwent laparoscopic colorectal surgery, factors affecting the development of SSI were evaluated. It was shown that the use of polydioxanone suture (PDS) for abdominal closure and a history of diabetes could influence SSI development, with multivariate analysis indicating that only the use of PDS reduced the risk of SSI.[18] The study mentioned that only intracorporeal stapled anastomosis was performed and described the areas and incisions used for specimen extraction. However, the rates of conversion to open surgery were not reported. In parallel with our study, demographic factors such as bleeding, operative time, anemia, and BMI were not found to be associated with SSI development.

In another large-scale prospective study involving over 3,000 laparoscopic cases, factors affecting SSI development were evaluated. Cases were compared based on colon and rectal surgeries. It was shown that rectal

Table 2. Demographic and pathologic variable analysis depending on SSI

Variables	SSI (-) n=120 (74.1%)	SSI (+) n=42 (25.9%)	p, †
Gender			
Male	71	27	0.559
Female	49	15	
Hypertension			
No	55	19	0.947
Yes	65	23	
Diabetes			
No	88	31	0.952
Yes	32	11	
CAD			
No	86	27	0.370
Yes	34	15	
COPD			
No	109	36	0.352
Yes	11	6	
Anemia			
No	105	36	0.767
Yes	15	6	
Tumor Site			
Caecum	22	8	0.910
Right Colon	32	12	
Transverse Colon	5	3	
Left Colon	16	6	
Sigmoid Colon	45	13	
T Stage			
T1	8	1	0.242
T2	12	1	
T3	82	31	
T4	18	9	
N Stage			
N0	73	25	0.924
N1	30	10	
N2	17	7	
M Stage			
M0	114	38	0.197
M1	5	4	
Neoadjuvant Chemotheraphy			
No	119	42	
Yes	1	0	
LVI			
Negative	71	32	0.055
Positive	48	10	
PNI			
Negative	86	34	0.267
Positive	33	8	

Table 2. Demographic and pathologic variable analysis depending on SSI (CONT.)

Variables	SSI (-) n=120 (74.1%)	SSI (+) n=42 (25.9%)	p, †
Grade			
Good	21	5	0.703
Moderate	83	30	
Poor	15	6	
Stage			
I	14	2	0.374
II	59	21	
III	42	15	
IV	5	4	
ASA Score			
1	6	2	0.859
2	40	15	
3	69	22	
4	5	3	
Anastomosis Leakage			
No	115	42	0.179
Yes	5	0	
	Mean±SD	**p‡**	
Age	63±13	63±2	0.542
BMI	27.35±4.43	28.29±5.42	0.268
Operation Time / minutes	205±61	194±60	0.585
Intraoperative RBC Replacement / per unite	0±1	0±1	0.002**
Postoperative RBC Replacement / per unite	1±2	1±1	0.587
Peroperative Fluid Replacement / mL	2328±1028	2300±1040	0.732
Peroperative Bleeding / mL	117±118	148±104	0.322

CAD: Coronary Artery Disease, COPD: Chronic Obstructive Pulmonary Disease, LVI: Lymphıvascular Invasion, PNI: Perineural Invasion, SSI: Surgical Site Infection, BMI: Body Mass Index, ASA: American Society of Anesthesiology, RBC: Red Blood Cell Concentrate, LOS: Length of Hospital Stay, mL: milliliter, sd: Standard Deviation, * p<0,05, **p<0,01, † Chi-Square, ‡ Indipendent t Test.

Table 3. Cox Regression Analysis for Dependants Effecting Surgical Site Infection

	Univariant		
Prognostic Factors	**OR**	**95% CI**	**p**
Conventional Surgery	3.489	1.249 – 9.415	0.017*
Diabetes	0.976	0.439 – 2.167	0.952
CAD	1.405	0.667 – 2.962	0.371
Age	1.000	0.972 – 1.029	0.994
Operation Time / minutes	0.997	0.991 – 1.003	0.316
Intraoperative RBC Replacement / per unite	0.634	0.347 – 1.161	0.140
Peroperative Fluid Replacement / mL	0.877	1.000 – 1.000	1.000

CAD: Coronary Artery Disease, RBC: Red Blood Cell Concentrate OR: Odds Ratio, CI: Confidence Interval, * p<0,05.

surgery led to a higher incidence of SSI compared to colon surgery.[19] In our study, however, rectal cancer patients were not included due to differences in oncological principles and the influence of neoadjuvant therapy as a significant factor. Finally, in a study evaluating readmissions, it was shown that patients who underwent laparoscopic colon surgery had lower rates of SSI development, shorter hospital stays, and reduced rates of re-laparotomy, bleeding, and 30-day mortality.[20] Similarly, in our study, the rates of SSI development and bleeding were lower in patients who underwent laparoscopic surgery.

The main limiting factor of our study is its retrospective design. Although the culture growth results of most patients were accessible in the hospital records, in some cases, the outcomes had to be determined by evaluating infection records, which means that while the presence of growth was documented, the specific pathogen could not be identified. Additionally, including all colon segments may lead to heterogeneity due to potential differences in incision types and anastomosis techniques. The strengths of our study include complete patient follow-up records and the exclusion of rectal cancer patients and those who received neoadjuvant therapy to prevent bias.

The incidence of SSI is lower in patients undergoing laparoscopic colon resection compared to those who undergo open surgery. When evaluating other factors influencing SSI development, we believe it would be appropriate to consider the choice of minimally invasive surgery in conjunction with these other factors.

Conclusion

The preference for laparoscopy in colon cancer significantly reduces the incidence of SSI. Although our study showed that factors such as diabetes and bleeding also influenced SSI development, only the choice of laparoscopy was found to be an independent risk factor. It is suggested that more specific studies could be conducted by comparing standard surgical preferences and anastomosis techniques in open and laparoscopic cases, focusing on isolated surgical procedures targeting specific anatomical regions of the colon.

Disclosures

Ethics Committee Approval: Approval was obtained from the Ethics Committee of Koşuyolu Yüksek İhtisas Training and Research Hospital on 03/09/2024, with reference number 2024/15/900. The records of patients who underwent laparoscopic or conventional colon cancer procedures in the Department of Gastrointestinal Surgery at the same center between 01/01/2018 and 12/31/2023 were reviewed.

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LESS

Original Article

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Is macroscopic evaluation sufficient in sleeve gastrectomy specimens?

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ABSTRACT

Introduction: The incidence of bariatric procedures is on the rise, primarily driven by the escalating prevalence of obesity. Among these procedures, laparoscopic sleeve gastrectomy (LSG) has gained significant popularity. However, ongoing debates persist regarding the necessity of microscopic examination of postoperative pathology specimens for certain benign conditions, including those related to bariatric surgery, due to financial concerns. In our retrospective study, we aimed to investigate the adequacy of macroscopic evaluation of pathology specimens obtained from patients who underwent bariatric surgery and to identify any unforeseen pathologies that may be detected through microscopic evaluation.

Materials and Methods: Demographic and pathological data of patients who underwent surgical intervention for morbid obesity at our clinic from May 2017 to December 2021 were retrieved from the patient database. Following the macroscopic assessment of LSG specimens, the surgeon identified suspicious lesions, prompting further microscopic evaluation by pathologists. A p-value of less than 0.05 was considered statistically significant.

Results: A total of 225 patients and corresponding specimens were included in the study. The majority of patients were female (82.2%). The median age of the patients was 36 (range: 19–61) years, and the mean preoperative body mass index (BMI) was 42.6±4.21 kg/m². Macroscopic examinations revealed pathological suspicions in 21 cases (9.3%), and subsequent microscopic evaluations confirmed pathology in 20 of these cases ($p<0.001$). Notably, microscopic evaluation of all specimens identified pathology in 175 patients (77.8%).

Conclusion: Based on our findings, we conclude that relying solely on macroscopic examination of LSG specimens is inadequate for detecting lesions. Therefore, we strongly advocate for the inclusion of microscopic evaluation, particularly due to its importance in detecting premalignant lesions. We recommend that microscopic assessment be routinely performed to ensure comprehensive pathological evaluation in LSG specimens.

Keywords: Bariatric surgery, Histopathology, Obesity

Introduction

The global prevalence of obesity is trending upwards, with a notable increase observed particularly in the United States.[1,2] Obesity contributes to the development of numerous illnesses, such as hypertension, Type 2 diabetes mellitus, coronary artery disease, dyslipidemia, and obesity-related malignancies, resulting in increased healthcare costs for countries.[3] Recently, bariatric surgeries have emerged as the most successful and cost-effective long-term treatment

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modalities for obesity.[4] Currently, laparoscopic Roux-en-Y gastric bypass (LRYGB) and laparoscopic sleeve gastrectomy (LSG) are the two most frequently performed bariatric procedures in North America.[5] When considering postoperative complications and the need for reoperations, LSG has demonstrated considerable advantages.[6]

LSG, a restrictive procedure involving the resection of approximately three-quarters of the stomach, differs from LRYGB in terms of the amount of stomach tissue sent for pathological examination. While no portion of the stomach is typically submitted to pathology in LRYGB, a significant portion of the stomach is sent for pathological evaluation in LSG. Existing literature indicates that abnormal histological findings are observed in 31% to 96% of specimens examined after LSG.[7,8] Among the benign cases, gastritis represents the majority. The incidence of premalignant lesions is around 2%, while malignant lesions occur at a rate of 0.4%.[9,10]

A retrospective study was designed to assess whether macroscopic evaluation alone would be sufficient in identifying premalignant and malignant lesions, and to determine if pathological conditions could be detected solely through macroscopic examination, given the predominantly benign nature of LSG specimens.

Materials and Methods

Patient Selection and Study Design

The data of a total of 247 patients who underwent obesity surgery at the General Surgery Clinic of Malatya Education and Research Hospital between May 2017 and December 2021 were analyzed for the study. The study protocol received ethics approval from the Malatya Turgut Özal University Rectorate Non-Interventional Clinical Research Ethics Committee on June 15th, with the reference number E-30785963-020-160996. Patient data, including demographic information such as age, sex, and body mass index (BMI), as well as postoperative pathology specimen results (specifically Helicobacter pylori [Hp] status and histopathology), were extracted from the hospital's patient database.

All patients who underwent LSG were included in the study. The pathological specimens obtained from these patients were evaluated both macroscopically and microscopically in the postoperative period. Patients who underwent LRYGB (seven patients) and those for whom perioperative macroscopic evaluation data were unavailable (fifteen patients) were excluded from the study (Fig. 1).

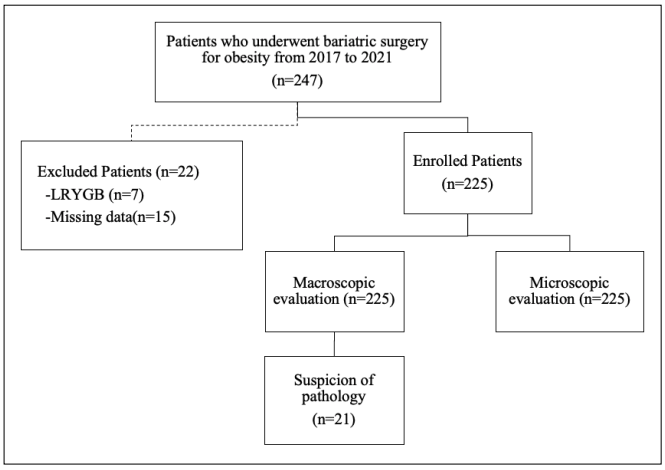

Figure 1. Flow chart of the study.

After the exclusions, a total of 225 patients were included in the study.

The macroscopic pathological evaluation of the specimens was performed by the surgeon through palpation and visual inspection. Suspicious areas were marked and evaluated microscopically by two different pathologists. Additionally, all other specimens were evaluated macroscopically and microscopically by pathologists.

Statistical Analysis

Statistical analyses were performed using SPSS Statistics for Windows, version 23 (SPSS Inc., Chicago, IL, USA). The normality of distribution was tested using the Kolmogorov-Smirnov test. All continuous variables were expressed as medians with minimum and maximum values. Categorical variables were analyzed using the chi-square test. The frequency and percentage values of these variables were presented. Statistical significance was set at $p<0.05$.

Results

Among the 225 patients included in the study, 185 (82.2%) were female and 40 (17.8%) were male, with a median age of 36 years (range: 19–61). The mean BMI was 42.6±4.21 kg/m² (Table 1). Upon macroscopic examination of the specimens, 21 cases were identified as potentially having

Table 1. Patients Characteristics

Age, years (min-max)	36 (19-61)
BMI, kg/m²	42.6±4.21
Sex, Female	185 (82.2%)

BMI: Body Mass Index.

a pathology, and of these marked areas, 20 (95.2%) exhibited pathology upon microscopic evaluation. Among all specimens, 50 (22.2%) patients were classified as normal, while pathology was detected in 175 (77.8%) patients. The majority of these cases (152; 67.7%) presented with chronic gastritis (Table 2). Premalignant lesions were observed in 11 (4.9%) patients, with intestinal metaplasia accounting for 3.1% and atrophic gastritis for 1.8% of cases. Furthermore, pathology evaluations revealed that 65 patients were positive for Hp.

As confirmed by microscopic examination, macroscopic examination demonstrated statistical significance in detecting pathology ($p<0.001$). The sensitivity of macroscopic examination was 40.0%, with a specificity of 99.4%, a positive predictive value of 95.2%, and a negative predictive value of 14.7%. Among the 21 pathologically suspicious areas identified macroscopically, eight were determined to be fundic gland polyps, seven were diagnosed as chronic gastritis, three as atrophic gastritis, two as intestinal metaplasia, and one as benign. Notably, only 45.5% of premalignant lesions exhibited macroscopic suspicion for pathological focus (Table 3).

Table 2. Pathological Evaluation

Macroscopic evaluation		p
Suspicion of pathology	21 (9.3%)	<0.001
Microscopic evaluation		
Benign	50 (22.2%)	
Gastritis	152 (67.7%)	
Fundic gland polyps	8 (3.6%)	
Lymphoid aggregates	4 (1.8%)	
Premalignant Lesion		
Intestinal metaplasia	7 (3.1%)	
Atrophic gastritis	4 (1.8%)	

p<0.05 was considered statistically significant.

Table 3. Results of suspicious foci in macroscopic evaluation

Microscopic evaluation	
Benign	1 (4.8%)
Gastritis	7 (33.3%)
Fundic gland polyps	8 (38.1%)
Premalignant Lesion	
Intestinal metaplasia	2 (9.5%)
Atrophic gastritis	3 (14.3%)

Discussion

Currently, the global prevalence of obesity is increasing, leading to a rise in the number of bariatric surgeries performed. Among these procedures, LSG has gained significant popularity worldwide. Despite being primarily performed for benign indications, LSG highlights the importance of both macroscopic and microscopic evaluation of pathological samples. In our study, we found that macroscopic examination of LSG samples yielded statistically significant results in detecting pathological conditions, as demonstrated and confirmed by microscopic examination. However, the sensitivity of macroscopic evaluation was notably low. Macroscopic evaluations identified only 20 out of 175 pathological conditions and only 45.5% of premalignant lesions.

Financial efficiency has become a major concern for healthcare providers, prompting the questioning of the necessity of histological examination for every resected tissue sample. Particularly in cases where surgery is performed for benign conditions, there is a debate regarding the need for microscopic examination if malignancy is not suspected following macroscopic examination. A related study aimed to evaluate the requirement for histological examination of resected appendix, gallbladder, or hemorrhoids that appeared macroscopically unchanged.[11]

Hansen et al.[12] highlighted in their study that the complete pathological evaluation of gastric specimens from various institutions incurred significant costs ranging from $500 to $1500 per sample. Their findings indicated that this extensive evaluation may not be necessary. Among a population of 351 patients, none of the samples revealed pathological malignancies requiring immediate treatment or urgent follow-up beyond standard post-surgical obesity monitoring. The authors argued that, particularly in an era of escalating healthcare expenses, performing a comprehensive pathological assessment of the gastric remnant following LSG is unnecessary, especially when no apparent abnormalities are observed during the surgical procedure.

AbdullGaffar et al.[13], in a study including 546 patients, reported that 54% of the gastric specimens were normal, while premalignant lesions were identified in 1.8% of cases. They suggested that macroscopic evaluation and palpation by the surgeon should initially be performed on the specimens, with subsequent microscopic analysis conducted only in the presence of positive findings.

Walędziak et al.[14], in a study analyzing a total of 1,252 cases, emphasized the importance of conducting surgical macroscopic evaluations of specimens following LSG as a standard practice. They recommended that pathological examination should be carried out if any doubts arise during the macroscopic evaluation.

Yardimci et al.[15], in their study of 755 cases, identified neoplasms in four cases, representing a prevalence rate of 0.5%. Canil et al.[16], in a study conducted over a period of five years with a total of 925 cases, detected gastrointestinal stromal tumors (GISTs) at a rate of 0.3%. In the study conducted by Almazeedi et al.[17], where the histopathological results of 656 patients were examined, GISTs were observed in 12 patients (1.8%) with atrophic gastritis, a premalignant lesion. In our study, premalignant lesions were observed in 11 cases, accounting for a prevalence rate of 4.9%.

Obesity has been established as a significant risk factor for the development of malignancies. While increased production of estrogen contributes to a higher frequency of genital malignancies in obese individuals, there is also a notable incidence of GISTs in this population.[18] Timely diagnosis of GISTs is crucial, as they can have poor outcomes if left undetected. Even after undergoing radical oncological resection, 40–50% of patients may experience relapse.[19] In our study, no cases of GISTs or other malignant lesions were detected.

Limitations

One of the significant limitations of this study is its retrospective nature and the relatively limited patient population. Additionally, despite the fact that the majority of the stomach is examined in the pathology specimens, there is a possibility of undetected premalignant or benign conditions in the remnant gastric tissue that may require treatment. Therefore, it is imperative for patients to undergo preoperative and postoperative gastroscopy to ensure comprehensive evaluation and management.

Conclusion

Microscopic evaluations of LSG specimens predominantly reveal gastritis. However, our study, along with others, has identified the presence of premalignant lesions. Although the surgeon's macroscopic evaluation can detect polypoid and ulcerated lesions, only half of the premalignant lesions are identifiable through this method. Therefore, we strongly recommend that LSG specimens undergo both macroscopic and microscopic examinations to ensure comprehensive pathological assessment.

Disclosures

Ethics Committee Approval: Malatya Turgut Özal University Rectorate Non-Interventional Clinical Research Ethics Committee on June 15th, with the reference number E-30785963-020-160996.

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Conflict of Interest: None declared.

Authorship Contributions: Concept – S.D.; Design – S.D., C.C.; Supervision – S.D., C.C.; Materials – S.D.; Data collection and/or processing – S.D., C.C., B.Ö.; Analysis and/or interpretation – S.D., C.C., B.Ö.; Literature search – S.D., C.C., B.Ö.; Writing – S.D., C.C.; Critical review – S.D., C.C., B.Ö.

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LESS

Original Article

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What to expect in the first 3 months following a sleeve gastrectomy?

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ABSTRACT

Introduction: The purpose of this descriptive study was to analyze the clinical, laboratory, anthropometric, and histological results of patients who underwent laparoscopic sleeve gastrectomy (LSG) before and three months after the operation.

Materials and Methods: A total of 110 patients who were followed and underwent LSG between January 2021 and December 2021 were included in this study. Body mass index (BMI), waist and hip circumference, soft lean mass (SLM), percent body fat (PBF), and common laboratory parameters were evaluated before and three months after the LSG. Endoscopic biopsies and LSG specimens were examined by the pathology department.

Results: The mean age of the patients was 40.8±11.3 years, and 78.4% were female. There was no significant difference in age in terms of gender (p=0.789). The mean age was significantly lower in patients without comorbid diseases and chronic drug use (p<0.001). There was a significant decrease in BMI, PBF, SLM, glucose, HOMA-IR, HbA1c, total cholesterol, and triglyceride values in the third month (all p's <0.001). A significant correlation was observed between PBF% change and SLM% change values at post-op 3rd month (r=0.332, p=0.001). BMI% and PBF% change showed a stronger correlation than BMI% and SLM% change with (r=0.447, p<0.001) and (r=0.253, p=0.016), respectively. Histopathologic findings of LSG revealed gastrointestinal stromal tumor in 2 cases, neuroendocrine hyperplasia in 2 cases, and intestinal metaplasia in 13 cases, which were detected incidentally.

Conclusion: LSG is an effective treatment for obesity and associated comorbidities, with significant improvements observed in metabolic parameters, hypertension, and laboratory values. Careful monitoring and follow-up are essential to detect and treat potential histopathologic findings.

Keywords: Bariatric Surgery, Gastrectomy, Gastrointestinal Stromal Tumors, Obesity

Introduction

More than 1.9 billion adults worldwide are overweight, and 650 million of them are obese, making obesity a severe health problem. This condition increases the risk of numerous comorbidities, including hypertension, stroke, dyslipidemia, type 2 diabetes, osteoarthritis, asthma, cer-

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tain cancers, and a shorter lifespan.[1] Bariatric surgery is frequently recommended for morbidly obese patients with a BMI >40 kg/m² or a BMI >35–40 kg/m² with at least one comorbid condition when non-surgical therapies, including lifestyle changes and drugs, fail.[2]

However, psychiatric status and patient awareness are critical selection factors, given the significant impact of surgical consequences.[3] Bariatric surgery has shown remarkable effectiveness in achieving long-term weight loss and preventing obesity-related comorbidities, with low morbidity and mortality rates.[4] Roux-en-Y gastric bypass (LRYGB) (a malabsorptive/restrictive type) and laparoscopic sleeve gastrectomy (LSG) (mainly a restrictive type) are the two most frequently used bariatric surgical techniques.[2] These surgeries alter appetite and eating behavior by changing levels of gastrointestinal or exogenic hormones like ghrelin, neuropeptide Y, and peptide YY (PYY).[5] Peptide YY (PYY) is released postprandially from the distal gastrointestinal tract to inhibit the release of neuropeptide Y. Ghrelin injections in humans stimulate food intake, while PYY infusion induces satiety.[6] Both LRYGB and LSG increase postprandial PYY levels, but only LSG significantly suppresses postprandial ghrelin levels.[7]

LSG offers other benefits, such as short recovery periods, quick weight loss, and safety, making it the preferred surgery for obesity.[8] During an LSG, the greater curvature of the stomach is detached, and a gastric remnant is constructed.[9] Despite the removal of 80% of the stomach, active gastritis remains prevalent in the remaining region. Hormonal secretion continues from the antrum, and detection of activity in the remnant can impair weight loss, which may be explained by hormonal mechanisms.[10] Despite the lack of guidelines, histopathologic examination of bariatric surgery specimens provides an opportunity for surgeons to explore various gastric pathologies that may affect obese patients.[11]

In this study, we aimed to assess the clinical, biochemical, and anthropometric data, as well as the histopathological findings, in patients who underwent LSG before and three months after surgery.

Materials and Methods

The study was approved by the Ethics Committee of Kartal Dr. Lutfi Kırdar City Hospital (Decision number: 514/194/32, Date: 27.01.2021). One hundred and ten patients (24 females, 86 males), aged 22–66 years, with a BMI >35–67 kg/m², who were followed at the obesity outpatient clinic between October 2016 and December 2020 and underwent LSG between January 2021 and December 2021, were included.

A multidisciplinary team at the obesity center of Kartal Dr. Lutfi Kırdar City Hospital evaluated the patients. The patients' psychosomatic and endocrine profiles were reviewed to identify contraindications before surgery. Patients were followed for at least six months before surgery to track changes in their lifestyles, such as eating behaviors and physical activity. A psychiatrist evaluated patients with eating disorders, and a physiotherapist informed them about the physical exercises required after surgery. Subsequently, these patients were evaluated by a multidisciplinary committee consisting of a bariatric surgery team and endocrinologists, and those suitable for LSG were selected. The surgery was performed by the same surgical team using the classical LSG technique. Terminal malignancies, severe psychiatric disorders, bipolar disorder, psychosis, and post-traumatic stress disorder were contraindications for surgery. Anthropometric measurements (weight, BMI, waist circumference, hip circumference, soft lean mass (SLM), and percent body fat (PBF)) were analyzed using a Tanita MC-580 body composition analyzer (TANITA MC-580, Japan) preoperatively, as well as within the first and third months after the LSG. BMI (body weight/height² (kg/m²)) was calculated, and patients were classified as overweight (BMI = 25.0–29.9 kg/m²), obese (BMI = 30–40 kg/m²), and morbidly obese (BMI > 40 kg/m²).[9]

Upper gastrointestinal endoscopy (UGIE) was performed preoperatively on all patients, and biopsies were taken from the corpus and antrum, even without significant macroscopic lesions. Endoscopic and sleeve gastrectomy biopsy specimens were assessed with routine immunohistochemical and histopathologic methods. The endoscopic biopsies and the LSG specimens were examined microscopically with hematoxylin and eosin (H&E) staining, enhanced with Giemsa stain for Helicobacter pylori (HP) infection, and Periodic Acid-Schiff Alcian Blue (PAS-AB) stain for intestinal metaplasia.[12]

Statistical Analysis

Statistical analysis was carried out using the SPSS program (Statistical Package for Social Science, version 11.7; Chicago, IL). The Kolmogorov-Smirnov test was performed to determine the distribution of the parameters. Descriptive statistics were expressed as mean±standard

deviation (SD) and median (2.5–97.5%) as required. The comparison of the variables was done with the Wilcoxon test. Correlations were determined by Spearman correlation analysis, and p <0.05 was accepted as statistically significant.

Results

The study included 110 patients, and patient characteristics are shown in Table 1. The mean±SD age of the patients was 40.8±11.3 years, with a range of 22–66 years, and 78.4% were female. Age differences between males and females were not statistically significant (p=0.789). Patients without comorbid diseases and chronic drug use had a significantly lower mean age (p<0.001). The median duration of diabetes was five years, and 33 patients were receiving oral anti-diabetic (OAD) therapy, whereas 36.2% of the cases were diabetic, and 26.1% were taking insulin. After the procedure, 11.9% of diabetics continued their OAD medication. Table 2 shows the median (2.5–97.5 percentile) values for the anthropometric and clinical laboratory parameters before and three months after LSG. There was a significant decrease in BMI, PBF, SLM, glucose, HOMA-IR, HbA1c, total cholesterol, and triglyceride values at the 3rd month. Pre-op and post-op 3rd-month BMI levels are given in Figure 1. Pearson analysis showed a significant correlation between PBF% change and SLM% change values (r=0.332, p=0.001). BMI% and PBF% change showed a better correlation than BMI% and SLM% change, with (r=0.447, p<0.001) and (r=0.253, p=0.016), respectively. Gastrointestinal stromal tumors were observed in 2 cases, neuroendocrine hyperplasia in 2 cases, and intestinal metaplasia in 13 cases, all detected incidentally during the histopathologic examination. The diameters of the gastrointestinal stromal tumors were 3 mm, and micronodular linear-type neuroendocrine hyperplasia was detected.

A standard HP eradication protocol, consisting of clarithromycin, amoxicillin + clavulanic acid, and a proton pump inhibitor, was administered for one week to the 50 patients with confirmed HP infection based on biopsy results. Histopathological findings of the patients are given in Table 3.

Table 1. Patient demographics

Patients	n	%
Age (mean±SD) (years)	40.8±11.3	
Gender (Female/Male)	91/25	78.4/21.6
Diabetes Mellitus	42	36.2
Hypertension	31	26.7
Hyperlipidemia	10	8.6
Hypothyroidism	9	7.8
Depression	3	2.6
Gastritis	2	1.7

Table 2. Median (2.5-97.5) percentile values for the anthropometric and laboratory parameters before and 3rd month after the LSG

	Before LSG	After LSG	p
	Median (2.5-97.5 Percentile)		
BMI (kg/m^2)	46.7 (37.4-60.3)	38.9 (28.5-50.1)	*<0.001
PBF (%)	44.0 (29.8-49.3)	41.1 (23.2-49.3)	*<0.001
SLM (%)	62.9 (50.9-93.5)	55.5 (44.8-79.3)	*<0.001
Glucose (mg/dL)	109 (79-337)	95 (72-153)	*<0.001
HOMA-IR	5.2 (2.4-25)	2.2 (1.0-4.68)	*<0.001
HbA1c (%)	5.8 (5.6-6.4)	5.4 (5.2-5.8)	*< 0.001
Total Cholesterol (mg/dL)	208 (135-285)	197 (119-266)	*0.044
LDL Cholesterol (mg/dL)	124 (75-206)	127 (67-194)	0.631
Triglyceride (mg/dL)	136 (55-353)	108 (53-242)	*0.001
HDL Cholesterol (mg/dL)	43 (30-48)	43 (32-71)	0.982
Hemoglobin (g/L)	12.7 (9.0-16.0)	12.8 (10.2-16.5)	0.618

*p<0.05 statistically significant.

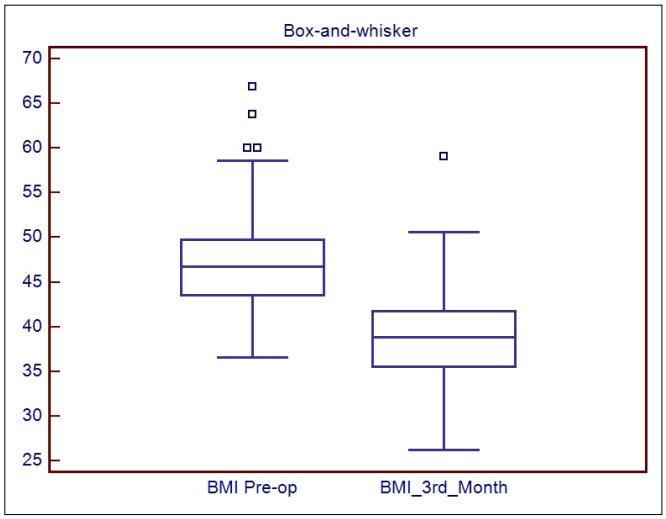

Figure 1. Pre-op and post-op 3rd-month BMI levels.

Table 3. Histopathological findings of the patients

Histopathological findings	n (%)
Chronic gasritis	99 (90)
Helicobacter Pylori	50 (45.4)
Intestinal metaplasia	13 (11.8)
Lymphoid aggregate	30 (27.2)
Gastrointestinal stromal tumor	2 (1.8)
Neuroendocrine cell hyperplasia	2 (1.8)
No specific pathology	10 (9)

Discussion

Diabetes and hypertension were the most prevalent comorbid diseases in our patients, while individuals without comorbid disorders and drug use were younger. In the third month following surgery, we observed a significant decrease in BMI, PBF, SLM, glucose, HOMA-IR, HbA1c, total cholesterol, and triglyceride levels.

Upper body and visceral fat are strongly associated with comorbid diseases such as insulin resistance and metabolic syndrome.[13] According to Piché et al.,[14] individuals who are overweight and have excess visceral adipose tissue are at a higher risk. Additionally, overweight patients are more likely to suffer from type II diabetes, chronic back pain, malignancies, and cardiovascular and gallbladder diseases.[15] Waist circumference (WC), hip circumference (HC), and waist-to-hip ratio (WHR) are predictors of central or visceral obesity and are considered independent risk factors for cardiovascular diseases.[13] In the current study, the patients' WC and HC dropped by 13.3% and 12.1%, respectively. After the operation, the incidence of comorbidities and chronic drug use significantly decreased. Our findings are consistent with previous studies that have reported the benefits of bariatric surgery in improving metabolic parameters and comorbidities such as hypertension and diabetes.[4] Bariatric surgery has been found to significantly improve hypertension and diabetes, with recovery rates of 61.7% and 78%, respectively.[4] Sjöström et al.[16] reported a more than three-fold decrease in the risk of developing diabetes in the surgery group compared to those treated with nonsurgical procedures.

Our study observed a decrease of 6.6% in SLM and 13.4% in PBF in the third month after LSG, with a significant correlation between the percentage changes in SLM and PBF. Studies have shown that optimal weight loss after bariatric surgery should come from PBF without a decrease in lean mass and bone mineral content, referring to SLM.[17] Schneider et al.[18] reported a greater decrease in SLM following LSG compared to LRYGB. Belfiore et al.[19] highlighted the importance of preserving SLM and maintaining it at least at a physiological level, with the final goal of achieving SLM and PBF levels similar to those of individuals with normal weight.[20] Additionally, Vaurs et al.[21] reported that metabolic parameters improved significantly three months after surgery, with patients experiencing the least muscle loss showing better glycemic improvement. Schauer et al.[22] compared intensive medical treatment with LSG in 150 diabetic obese adults and found that LSG achieved a greater improvement in HbA1c (<6%) than the medical treatment group.

Dyslipidemia is a significant risk factor for atherosclerosis and coronary artery disease, and it is a leading cause of excessive mortality in obese patients.[23] Salman et al.[24] reported significant improvement in carotid intima-media thickness and dyslipidemia after surgery in their study, while Buchwald et al.[4]'s meta-analysis showed that surgical procedures significantly improved hypercholesterolemia and hypertriglyceridemia at the 2-year follow-up. Also, Sirbu et al.[25] reported a significant improvement in both HOMA-IR and dyslipidemia six months after LSG. In our study, metabolic parameters, including HOMA-IR, HbA1c, total cholesterol, and triglyceride values, decreased significantly in the third month after surgery.

Our institution performs routine histopathologic evaluations before and after LSG, and our study found that chronic gastritis was the most common finding, observed in 99% of patients. The higher prevalence of chronic gastritis might be due to dietary habits and the more frequent

presence of HP in the population (50%). Chronic gastritis could lead to premalignant lesions such as atrophic gastritis and intestinal metaplasia, which could eventually result in gastric adenocarcinoma.[26] Our study also reported 2 gastrointestinal stromal tumors, 2 neuroendocrine cell hyperplasias, and 13 cases of intestinal metaplasia, all of which require careful follow-up and treatment.

One limitation of our study is that the majority of our study group was women, limiting the evaluation of gender effects. Future studies with larger patient populations, including different comorbidities and longer follow-up periods, are necessary to evaluate the long-term effects of LSG.

Conclusion

In conclusion, our study shows that LSG is an effective treatment for obesity and associated comorbidities, with significant improvements observed in metabolic parameters, hypertension, and laboratory values. Careful monitoring and follow-up are essential to detect and treat potential histopathologic findings.

Disclosures

Ethics Committee Approval: The study was approved by the Ethics Committee of Kartal Dr. Lutfi Kırdar City Hospital (Decision number: 514/194/32, Date: 27.01.2021).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – M.K.T.; Design – M.K.T.; Supervision – Ö.Ç.M.; Materials – Ö.Ç.M.; Data collection and/or processing – M.K.T.; Analysis and/ or interpretation – Ö.Ç.M.; Literature search – M.K.T.; Writing – M.K.T.; Critical review – Ö.Ç.M., D.Y.

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Laparoscopic versus open right hemicolectomy for colon cancer: Long-term outcomes from a Tertiary Care Teaching Hospital

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ABSTRACT

Introduction: The aim of this study was to compare the short- and long-term outcomes of laparoscopic surgery and open surgery in right colon cancer.

Materials and Methods: Demographic, clinicopathological, postoperative complications, mortality and long-term oncological outcomes of 162 patients who underwent laparoscopic (n=61) or open (n=101) surgery for colon cancer between January 2014 and December 2019 were compared in two groups.

Results: The operation time was significantly longer in the laparoscopic group (p<0.001). Length of hospital stay, tumor stage, T stage, N stage, tumor diameter and number of excised lymph nodes were significantly higher in the OS group. Postoperative morbidity and mortality rates were similar in both groups. The surgery was converted to open surgery in five patients (8.1%) in the LS group. There was no significant difference between the groups in terms of overall survival (p=0.086) and disease-free survival (p=0.089).

Conclusion: Laparoscopic and open right hemicolectomy operations had similar results in terms of short-term complications, mortality and long-term oncological findings.

Keywords: Colon cancer, Right hemicolectomy, Laparoscopy

Introduction

Colorectal cancer continues to be one of the major health-threatening diseases today. It is the third most common cancer worldwide.[1] In addition, there has been an increase in the incidence of right colon cancers in recent years. They account for approximately 40% of colon tumors.[2] Today, the laparoscopic approach has become popular, especially in the surgery of left colon and rectal cancers. The advantages of laparoscopic colectomy include less wound infection, less postoperative pain, rapid recovery, and shorter hospitalization.[3,4] Moreover, this approach is associated with similar oncological outcomes and better postoperative recovery compared to open surgery.[5] However, the situation is somewhat different for the right colon. Data are more limited in oncological right hemicolectomies. Concerns include the high learning curve due to the proximity of laparoscopic right hemicolectomy to important anatomical structures, vascular variations, the length of the operation, and the inability to remove enough lymph nodes. For these reasons, laparoscopy is less preferred, and controversy on this issue continues.[6,7]

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The aim of the present study was to review the postoperative complications and long-term oncological outcomes of patients who underwent laparoscopic right hemicolectomy for right colon cancer and to compare them with open surgery.

Materials and Methods

Between January 2014 and December 2019, right hemicolectomy surgeries performed for colon cancer in the oncological surgery clinic of Tokat Gaziosmanpasa University Training and Research Center were retrospectively analyzed from the prospective database. Due to the retrospective design of the study, ethical approval and informed consent were not required. However, the study was conducted in accordance with the Ethical Principles of the Helsinki Declaration. Patients with distant metastases, immunosuppressive conditions, patients who underwent emergency surgery due to obstruction and/or perforation, and patients under 18 years of age were excluded from the study.

Patients diagnosed with colon cancer, whose diagnosis was preoperatively confirmed histopathologically as adenocarcinoma, were included. The patients were staged preoperatively with multi-slice abdominal and thoracic CT. PET/CT was used in necessary cases. The decision to perform the operation was made by the multidisciplinary tumor council, which convenes weekly in our clinic. The surgeries were performed by senior colorectal surgeons. The surgical procedure included both open and laparoscopic D2 lymphadenectomy and the standard right hemicolectomy procedure.

Demographic data (age, gender), American Society of Anesthesiologists (ASA) status, preoperative body mass index (BMI), tumor localization, tumor staging, number of excised reactive and metastatic lymph nodes, duration of surgery, intraoperative and postoperative complications, time to start oral feeding, duration of postoperative hospital and intensive care unit stays, relapse status, survival, and oncological follow-up data were analyzed. Postoperative complications were defined as surgical and non-surgical complications occurring from the postoperative period until discharge. Mortality was defined as death within 30 days from the date of surgery.

Recurrence was defined as the appearance of new lesions in the anastomosis and/or surrounding colon wall and/or in the lymphatic drainage zone of the previously resected tumor, confirmed by clinical findings, scanning tomography, positron emission tomography-CT (PET-CT), or pathological examination. Recurrence of the disease in the peritoneum or other organs was considered distant metastasis.

Statistical Analyses

Statistical analyses of the data obtained in this study were performed using SPSS software (Version 22, SPSS Inc., Chicago, IL, USA). Continuous variables were analyzed using the Student's t-test or the Mann-Whitney U test. The Chi-square test was used in the analysis of categorical variables. The survival rate was analyzed using the Kaplan-Meier method, and the groups were compared with the log-rank test. A p-value of <0.05 was considered statistically significant.

Results

The study cohort consisted of a total of 162 patients. There were 61 patients in the laparoscopic surgery (LS) group and 101 patients in the open surgery (OS) group. Demographic and clinicopathological data are presented in Table 1. The mean age was 68.28±12.3 years across all groups. The mean age in the LS group (32 females and 29 males) was 69.3±11.4 years, while the mean age in the OS group (50 females and 51 males) was 67±12.8 years. There was no significant difference between the groups in terms of age or gender ($p>0.05$). According to the ASA classification, comorbidities were similar in the two groups. There was no difference between the groups in terms of cancer localization, BMI, or the number of metastatic lymph nodes ($p>0.01$).

Tumor diameter and lymph node count were significantly higher in the OS group ($p<0.001$ and $p=0.035$, respectively). Average tumor stage was significantly more advanced in the OS group's T and N stages ($p=0.03$, $p=0.01$, and $p=0.003$, respectively).

A total of five patients (8.1%) in the LS group underwent open surgery. Two patients had extensive adhesions due to previous open cholecystectomy and prostate operations. Conversion took place due to ureteral injury in one patient, bleeding in one patient, and duodenum invasion of the tumor in another patient.

Preoperative, intraoperative, and postoperative data are presented in Table 2. There was no significant difference between the LS and OS groups in terms of time to liquid

Table 1. Demographic and clinicopathological data

	LS (n=61)	OS (n=101)	p
Age (years) (mean±SD)	69.3±11.4	67±12.8	0.39
Gender (n,%)			
Female	32 (52.4)	50 (49.5)	0.71
Male	29 (47.5)	51 (50.4)	
BMI(mean±SD)	27±5.6	28.5±6.3	0.09
ASA(n)			0.26
1	2	0	
2	14	10	
3	34	62	
4	11	29	
Location of cancer, (n,%)			
Caecum	32 (52.4)	52 (51.4)	0.18
Ascending colon	16 (26.2)	38 (37.6)	
Transverse colon	13 (21.3)	11 (10.8)	
Stage(n)			
1	15	10	0.032*
2	21	35	
3	25	56	
T Stage(n)			0.019*
1	4	5	
2	23	34	
3	23	73	
N Stage(n)			0.003*
0	37	42	
1	16	21	
2	8	38	
Tumor diameter (mean±SD)	3.8±1.8	5.6±2.9	<0.001*
Number of lymph nodes (mean±SD)	16.8±6.4	20.7±9.4	0.035*
Number of metastatic lymph nodes (mean±SD)	2.9±3.2	3.4±3.9	0.353
Conversion (n, %)	5 (8.1)	-	

*Significant.

diet initiation (3.0 and 3.4 days, respectively, p=0.18). The mean operative time for LS was significantly longer than for OS (156 minutes vs. 113 minutes, respectively, p<0.001). The length of hospital stay was longer in the OS group (9.2 vs. 6.5 days, respectively, p<0.001).

Overall, there was no significant difference between the two groups for intraoperative and postoperative complications. Anastomotic leakage was observed in three patients (2.9%) in the OS group and in two patients (3.2%) in the LS group. Wound site infection was more common in the OS group (six patients vs. one patient). The distribution of complications is given in Table 2.

In terms of 30-day mortality, one patient in the LS group and three patients in the OS group died after surgery. All deaths in the OS group were due to underlying medical comorbidities. The patient in the LS group, on the other hand, was re-operated on twice for postoperative anastomotic leakage but died due to sepsis.

Survival

The Kaplan-Meier curves comparing the overall and disease-free survival rates in the two groups are presented in Figures 1 and 2. There was no significant difference between the two groups in terms of overall survival

Table 2. Preoperative, intraoperative and postoperative data of the patients

	LS (n=61)	OS (n=101)	p
Mean operating time (min)	156±45	113±50.7	<0.001*
Duration of hospitalization (day) (mean±SD)	6.5+3.7	9.2+4.8	<0.001*
ICU length of stay (day) (mean±SD)	4.2±8.7	2.7±4.5	0.16
liquid diet (day) (mean±SD)	3±1.6	3.4±1.9	0.185
Intraoperative complication (n)			
Bleeding	2	3	-
Organ wounding	1	1	
Other	1	2	
Postoperative Complication(n,%)	6 (9.8%)	14 (13.8%)	0.252
Anastomotic leakage	2	3	
Anastomotic bleeding	1	0	
Intra-abdominal sepsis	1	2	
Ileus	3	5	
Wound complications	1	6	
Chylous ascites	1	1	
Incisional hernia	-	1	
Pulmonary	3	1	
Cardiac	1	-	
Other	-	-	
Reoperation (30-day) (n,%)	2 (3.2)	3 (2.9)	-
Mortality (n,%)	1 (1.6)	3 (2.9)	0.26

*Significant; ICU:Intensive care unit.

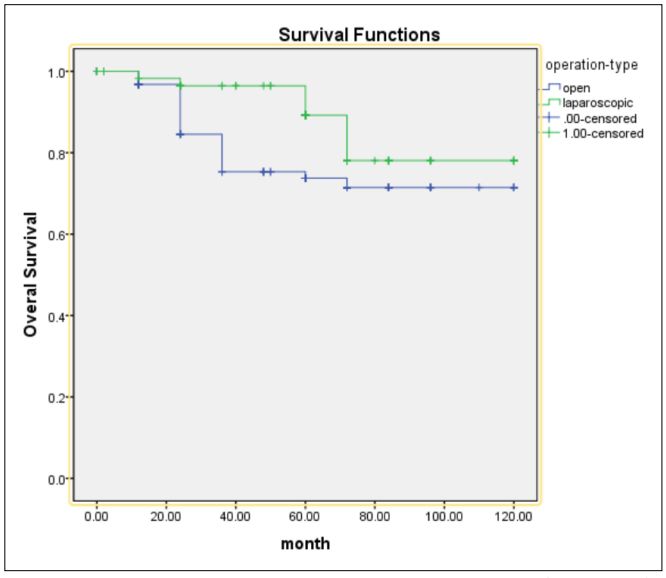

Figure 1. Overall survival in the study groups (p=0.086).

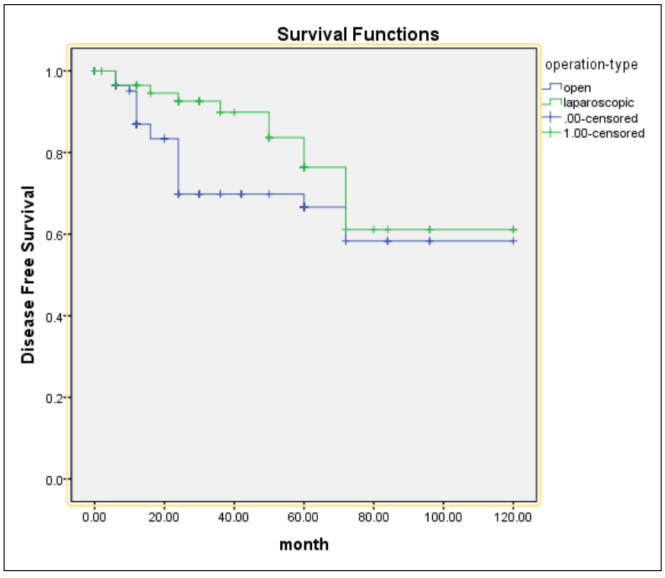

Figure 2. Disease-free survival in the study groups (p=0.089).

(p=0.086) and disease-free survival (p=0.089). The five-year overall survival in the OS and LS groups was 71.5% and 73%, respectively, while the five-year disease-free survival was 66.6% and 65.5%, respectively. There were two loco-regional cases in the LS group, and no systemic recurrence was detected. In the OS group, there were three loco-regional and three systemic recurrences.

Discussion

In 1991, Jacobs et al.[8] described laparoscopic colectomy, and since then, there has been rapid progress in laparoscopic colon surgery. Many colorectal procedures can now be performed with laparoscopy. The safety of the laparoscopic approach for short- and long-term oncological outcomes, especially in left colon and rectal cancer surgery, has been demonstrated in many studies.[9,10] However, there is still debate about whether laparoscopic colectomy has advantages over open surgery in terms of short- and long-term outcomes for right-sided colon cancers.[11,12]

In the present study, there was no significant difference between patients who underwent laparoscopy or open surgery for demographic data and comorbidities. The results were consistent with previous studies.[13] However, unlike previous studies [13,14], open surgery was used more frequently as tumor size increased in the present study. T stage and N stage were significantly higher in the open group. In larger tumors, open surgery may be preferred due to oncological safety concerns and lack of experience, especially in early cases.

Additionally, the total number of lymph nodes excised in our study was significantly higher in the open group (mean: 16 in the LS group, 20 in the OS group, p = 0.035). Some patients in the laparoscopic group had fewer than 12 lymph nodes removed, which was inconsistent with previous studies.[14,15] However, debate on this issue continues in the literature. A meta-analysis of 27 studies involving 3,049 patients reported no difference in the number of lymph nodes removed by laparoscopy and laparotomy.[12] On the other hand, Jurowich et al.[16] conducted a study using propensity score analysis of data from nearly 5,000 patients in the DGAV StuDoQ|Colon Cancer registry and found that significantly fewer lymph nodes were removed in the laparoscopic group. In their study, the probability of excising ≥20 lymph nodes was significantly higher in the open surgery group (OR: 3.45, CI 95%: 2.22–5.26; p<0.0001).

The mean operation time was significantly longer in laparoscopic surgeries, while the length of hospital stay was longer in the open surgery group. This was comparable to previous studies.[17,18] We attributed this to the long learning curve and the anatomical variations in the laparoscopic group. In the present study, we noted that the first laparoscopic surgeries took longer, but the duration of the operation decreased as experience increased. Stergios et al.[19] reported that the operation time was significantly reduced in the laparoscopic group compared to the open surgery group as the surgical team gained more experience in laparoscopic techniques.

Our conversion rate of 8.1% was comparable to the 0-16% conversion rates reported in previous studies.[13,17,20–22] Although the overall complication rate was slightly higher in the open group than in the laparoscopic group, the difference was not significant. Different results have been presented in the literature on this subject. In the Arezzo et al.[12] study, the incidence of overall complications was significantly lower in the laparoscopic group (16.8%) compared to the open group (24.2%). Rausa et al.[23] reported a higher overall complication rate in patients who underwent open right hemicolectomy. On the other hand, Jurowich et al.[16] found no difference between the two approaches for postoperative complications. Likewise, Li et al.[24] reported that there was no significant difference in postoperative complication frequency between the laparoscopy and open right hemicolectomy groups.

In our study, although the 30-day mortality rates were lower in the laparoscopic group (1 patient vs. 3 patients), there was no significant difference between the groups. This finding contradicts a recent large case series from the Netherlands[25], which reported that 30-day mortality rates were significantly lower in the laparoscopic group (2.2% vs 3.6%, p<0.001). In contrast, Arezzo et al.[12] reported in their meta-analysis that there was no significant difference between the laparoscopy and open surgery groups (RR=0.53, 95% CI=0.13–2.11, p=0.37). Mortality rates in the study by Ding et al.[26] were also similar to the results of the present study.

Considering long-term oncological outcomes, there was no significant difference between the two groups for five-year OS and DFS. Undoubtedly, the number of patients included in this study was low for comparing oncological outcomes. Furthermore, the retrospective nature of the study may have affected the results. To make a more reliable comparison between the two groups, larger sample sizes and randomized prospective studies are needed. However, based on our findings, it can be stated that the laparoscopic technique does not impair oncological outcomes in patients undergoing resection for colon cancer. These results are similar to the findings of previous studies.[27-29]

The retrospective design of our study has inherent limitations. Some patients may have been missed due to coding

errors. In addition, the study utilized single-center data, which should be confirmed with multicentric prospective randomized controlled trials.

Conclusion

Laparoscopic and open right hemicolectomy surgery approaches had similar outcomes in terms of postoperative complications, mortality, and long-term oncological findings. The present study indicated that the laparoscopic approach did not offer significant advantages except for shorter hospital stays. On the contrary, the number of excised lymph nodes was lower. However, this did not affect long-term oncological outcomes. With increased laparoscopic experience and the routine practice of D3 dissection, the laparoscopic procedure can be performed safely with advantages such as smaller incisions, earlier recovery after surgery, shorter hospital stays, and faster return to normal life compared to open surgery.

Disclosures

Ethics Committee Approval: Ethics committee approval was not obtained for the retrospective study. However, the study was conducted in accordance with the principles of the Declaration of Helsinki.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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Original Article

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Comparison of postoperative outcomes between laparoscopic and mini-incision open appendectomy for acute appendicitis

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ABSTRACT

Introduction: Acute appendicitis is one of the most common causes of emergency abdominal surgery. Laparoscopic and open (mini-incision) appendectomy are the two primary surgical techniques used for treatment, each offering unique advantages.

This study aims to compare postoperative outcomes, including wound infection rates and pain levels, between laparoscopic and mini-incision open appendectomy.

Materials and Methods: A prospective study was conducted from July 2021 to July 2022 in Van, Türkiye, with 239 patients. After excluding 13 patients, 226 were analyzed. Surgeries were performed by a single surgeon. Data on age, gender, wound infection rates, postoperative pain (measured by the Visual Analog Scale), and length of hospital stay were collected. Statistical analysis was conducted using Mann-Whitney U and Chi-square tests.

Results: No significant differences were found between the laparoscopic and mini-incision open groups in terms of age, gender, wound infection rates, or postoperative pain at 12 and 24 hours ($p>0.05$). The wound infection rate was slightly lower in the laparoscopic group, but the difference was not statistically significant.

Conclusion: Both laparoscopic and mini-incision open appendectomy are safe and effective methods for treating acute appendicitis. No significant differences were observed in terms of wound infection rates, postoperative pain, or patient demographics. Larger studies with longer follow-up periods are recommended to further evaluate long-term outcomes.

Keywords: Acute appendicitis, Laparoscopic appendectomy, Open appendectomy, Postoperative pain, Wound infection

Introduction

Acute appendicitis is one of the most common causes of emergency abdominal surgeries worldwide, with laparoscopic and open appendectomy being the two primary surgical techniques employed.[1] Laparoscopic surgery, introduced in the late 20th century, offers several advantages such as reduced postoperative pain, faster recovery, and smaller incisions.[2] However, open appendectomy, particularly mini-incision techniques, remains a preferred method in many settings due to its simplicity and

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cost-effectiveness.[3] The choice between laparoscopic and open appendectomy often depends on the surgeon's experience, patient factors, and hospital resources.[4] Despite numerous studies comparing these techniques, there remains debate regarding their relative efficacy in terms of wound infection rates, postoperative pain, and recovery times.[5] Recent studies have suggested that both methods are comparable in terms of safety and outcomes, though laparoscopic surgery may offer slight advantages in specific patient populations.[6] This study aims to evaluate the differences in postoperative outcomes, including wound infection and pain, between laparoscopic and mini-incision open appendectomy.

Materials and Methods

This prospective study was conducted between July 2021 and July 2022 in the Başkale district of Van, Türkiye, and included a total of 239 patients. All surgeries were performed by a single surgeon to ensure consistency in surgical technique. Patients received a single preoperative dose of cefazolin for prophylaxis. Postoperatively, all patients were administered a single intravenous dose of paracetamol at the 6th hour for pain management.

Exclusion criteria included patients under 18 years of age, patients over 80 years of age, and those in whom another pathology besides acute appendicitis was identified during surgery. Based on these criteria, 13 patients were excluded from the study. Data were collected on patient demographics, surgical details, and postoperative outcomes for the remaining 226 patients.

The criteria evaluated in this study included patient age, gender, type of surgery (laparoscopic or open), postoperative pain levels measured using the Visual Analog Scale (VAS) at 12 and 24 hours, wound infection rates, and length of hospital stay. In addition, any postoperative complications such as wound infection and the need for reintervention were recorded. Statistical analysis was performed to compare outcomes between the laparoscopic and open appendectomy groups.

This study was conducted in accordance with the principles outlined in the Helsinki Declaration. As it was a retrospective study, ethical committee approval was not required.

What is original about this article?

This study provides a direct comparison of postoperative outcomes between laparoscopic and mini-incision open appendectomy in a specific population from a rural region in Türkiye. It offers valuable insights by using a prospective design, ensuring consistency through a single surgeon performing all procedures, and focusing on short-term postoperative metrics such as pain, wound infection rates, and hospital stay. Additionally, it addresses a gap in the literature by analyzing outcomes in a setting with limited resources, contributing to the global understanding of how these two surgical techniques perform in diverse healthcare environments.

Statistical Analysis

In the descriptive statistics of the data, mean, standard deviation, median, minimum, maximum, frequency, and percentage values were used. The distribution of the variables was assessed using the Kolmogorov-Smirnov and Shapiro-Wilk tests. For the analysis of quantitative independent data that did not follow a normal distribution, the Mann-Whitney U test was employed. The Chi-square test was used for the analysis of qualitative independent data. SPSS 28.0 software was used for the analyses.

Results

There was no statistically significant difference ($p>0.05$) in the average age and gender distribution of patients who underwent laparoscopic and mini-incision open acute appendectomy. The average age in the laparoscopic group was 32.8±12.8 years, while in the open surgery group it was 30.3±11.3 years. The gender distribution was similar in both groups, with 61.4% female and 38.6% male in the laparoscopic group, and 59.8% female and 40.2% male in the mini-incision open group (Table 1).

Among patients who underwent laparoscopic surgery, 92.8% did not experience wound infection, while 7.2% developed a wound infection. In the mini-incision open surgery group, 88.8% did not develop wound infections, while 11.2% experienced wound infections. However, the difference in wound infection rates between the two groups was not statistically significant ($p>0.05$) (Table 2).

According to the Visual Analog Scale (VAS) scores measured for postoperative pain levels, there was no significant difference in the VAS scores between the laparoscopic and mini-incision open surgery groups at both 12 hours and 24 hours postoperatively ($p>0.05$). The average 12-hour VAS score in the laparoscopic group was

Table 1. Demographic characteristics, surgical method, wound infection rates, and postoperative pain (VAS Scores) of patients undergoing acute appendectomy

	Min-Maks.	Median	Mid.±SD/n-%	
Age	13.0-66.0	27.0	31.1±11.8	
Sex				
Famale			152	60.3%
Male			100	39.7%
Acute App. Operation Type				
Laparoscopic			83	32.9%
Minimal Insision Open			169	67.1%
Wound Infection				
(-)			227	90.1%
(+)			25	9.9%
VAS Scores				
12.Hour	1.0-8.0	5.0	4.6±2.1	
24.Hour	0.0-5.0	2.0	1.9±1.0	

Table 2. Comparison of demographic data, wound infection rates, and postoperative pain (VAS Scores) between laparoscopic and mini-incision open appendectomy groups

	Acute Appendectomy Operation Type				p
	Laparoscopic (n=83)		Minimal Insision Open (n=169)		
	Mid.±SD/n-%	Median	Mid.±SD/n-%	Median	
Age	32.8±12.8	29.0	30.3±11.3	27.0	0.162[m]
Sex					
Famele	51/61.4%		101/59.8%		0.798[X²]
Erkek	32/38.6%		68/40.2%		
Wound Infection					
(-)	77/92.8%		150/88.8%		0.316[X²]
(+)	6/7.2%		19/11.2%		
VAS Scores					
12.Hour	4.6±2.0	5.0	4.7±2.1	5.0	0.866[m]
24.Hour	1.8±0.9	2.0	2.0±1.1	2.0	0.292[m]

[m]Mann-whitney u test / [X²]Ki-kare test.

4.6±2.0, while the 24-hour VAS score was 1.8±0.9. In the mini-incision open group, the average 12-hour VAS score was 4.7±2.1, and the 24-hour VAS score was 2.0±1.1. These findings suggest that there is no significant difference between the two surgical methods in terms of wound infection rates, pain levels (VAS scores), and patient demographics (Fig. 1).

Discussion

In this study, no statistically significant differences were found between laparoscopic and mini-incision open appendectomy in terms of wound infection rates, postoperative pain levels, and patient demographics. These findings support existing literature that highlights the comparable safety and efficacy of both surgical methods

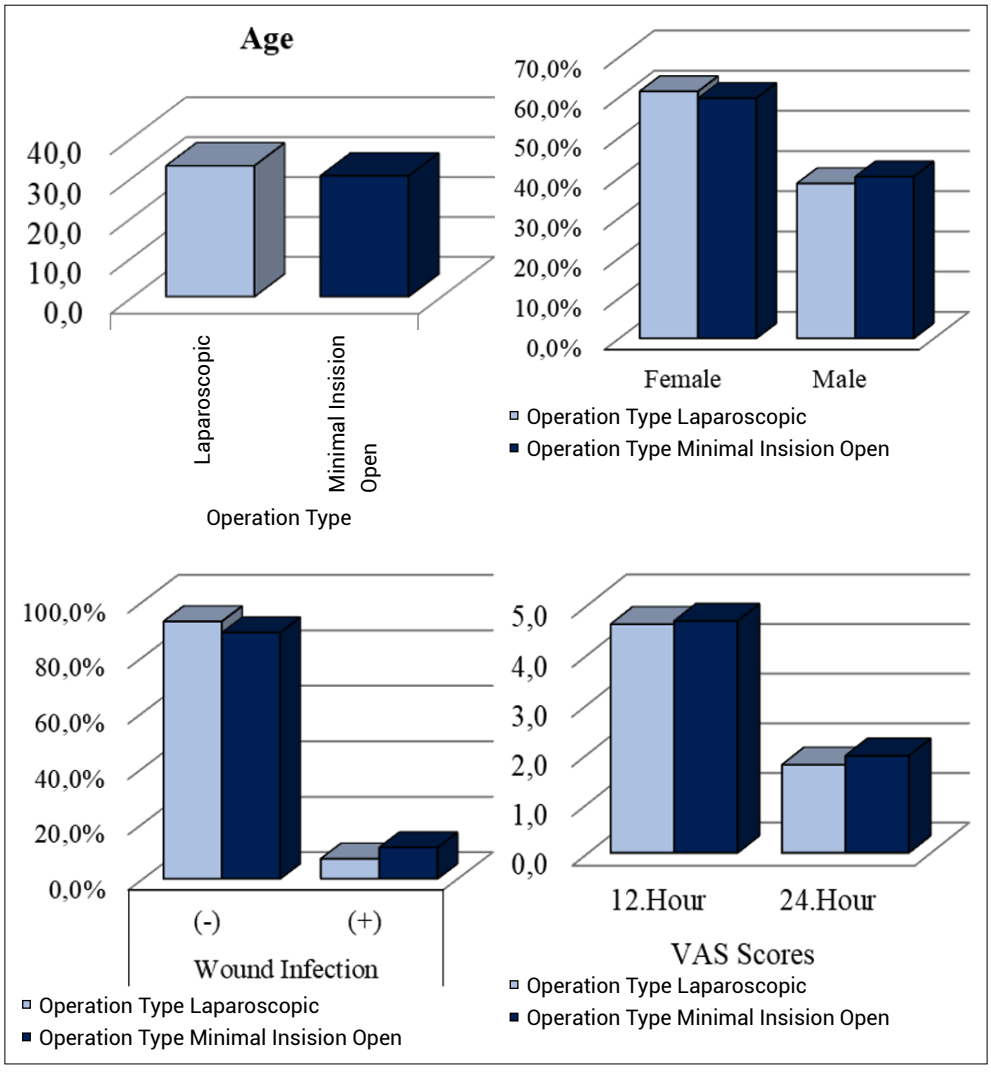

Figure 1. Comperasion MIA vs laparoscopic appendectomy.

for treating acute appendicitis.[7,8] While laparoscopic surgery is often favored due to its minimally invasive nature, which is typically associated with faster recovery times, smaller incisions, and reduced postoperative pain, our study did not observe significant differences in pain outcomes between the two groups at 12 and 24 hours postoperatively. This aligns with findings from other recent studies, suggesting that pain levels may not always be a decisive factor in determining the optimal surgical approach for appendicitis.[9]

Wound infection rates were slightly lower in the laparoscopic group (7.2%) compared to the mini-incision open group (11.2%), but the difference was not statistically significant. This finding indicates that both techniques are safe and that proper surgical technique and postoperative care can effectively mitigate the risk of wound infection regardless of the method used.[10] Additionally, the overall wound infection rates in both groups are consistent with infection rates reported in other studies on appendectomy, further emphasizing the safety of both approaches.[11]

In terms of demographic factors, no significant differences were found between the groups in age or gender distribution. This suggests that patient characteristics such as age and gender do not play a major role in determining the choice of surgical method. Rather, the decision may be more influenced by surgeon preference, hospital resources, and the availability of laparoscopic equipment.[12] Furthermore, the lack of significant differences in pain scores between the two groups, both at 12 and 24 hours postoperatively, suggests that both methods provide comparable pain relief in the immediate postoperative period.[13]

One of the strengths of this study is that it contributes to

the growing body of evidence indicating that both laparoscopic and mini-incision open appendectomy are viable treatment options for acute appendicitis. Both techniques demonstrated similar outcomes in terms of safety and patient comfort. This supports the idea that surgeon expertise and hospital protocols may have more influence over the selection of the surgical method than the patient's condition alone.[14] However, while our study did not find significant differences in short-term outcomes, some studies suggest that laparoscopic appendectomy may offer long-term benefits, such as reduced adhesion formation and fewer complications related to wound healing.[15]

One limitation of this study is its relatively small sample size, which may have reduced the statistical power to detect subtle differences between the two surgical groups. A larger cohort would allow for a more robust comparison and might reveal more nuanced differences in outcomes, such as long-term complications or recovery times.[16] Another limitation is the short follow-up period, which focused on immediate postoperative outcomes like pain and wound infection, rather than longer-term complications such as chronic pain or recurrence of symptoms.[17] Future research should aim to address these limitations by including larger patient populations and following up over longer periods to assess outcomes like recurrence rates, chronic pain, and overall quality of life.[18]

Moreover, patient-specific factors such as obesity, comorbidities, and the severity of appendicitis at presentation may also influence surgical outcomes and should be taken into account in future studies. Previous research has indicated that laparoscopic surgery may be particularly beneficial in patients with obesity, as the smaller incisions reduce the risk of wound complications in this population.[19] Understanding which patient groups benefit most from each surgical approach could help to further individualize treatment and improve overall outcomes.[20]

In conclusion, this study supports the growing consensus that both laparoscopic and mini-incision open appendectomy are safe and effective treatment options for acute appendicitis. Although no significant differences were found in terms of wound infection rates, pain scores, or patient demographics, both surgical techniques provide good clinical outcomes when performed by experienced surgeons. Moving forward, larger-scale studies with longer follow-up periods and a focus on specific patient populations may help to better define the advantages of each method and guide clinical decision-making.

Disclosures

Ethics Committee Approval: This study was conducted in accordance with the principles outlined in the Helsinki Declaration. As it was a retrospective study, ethical committee approval was not required.

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Conflict of Interest: None declared.

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LESS

Original Article

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Evaluation of the clinical impact of preoperative gastroscopy in patients undergoing cholecystectomy: A retrospective study

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ABSTRACT

Introduction: The role of esophagogastroduodenoscopy (EGD) in the preoperative period for patients scheduled for cholecystectomy due to cholelithiasis is controversial. Some studies recommend routine application, while others suggest selective application. Our study aimed to evaluate EGD findings in patients who underwent EGD before cholecystectomy.

Materials and Methods: In our single-center retrospective study, patients who underwent cholecystectomy between 2020 and 2023 and had an EGD in the preoperative period were included. Patients who did not have a preoperative EGD, those who underwent cholecystectomy as part of another surgical procedure, and those with missing data were excluded from the study. Patients were evaluated based on demographic, clinical, endoscopic, and pathological findings.

Results: A total of 336 patients were analyzed. The median age was 53 years (range 24–87), and 216 (64.3%) of the patients were women. Endoscopic pathology was detected in 180 (53.6%) of the patients. Histopathological abnormalities were detected in 199 (87.3%) of 228 patients. Helicobacter pylori (HP) positivity was detected in 90 patients (39.5%), atrophic gastritis in 45 patients (19.7%), and intestinal metaplasia in 41 patients (18%). Statistically, significantly more active and severe gastritis findings were observed in mucosal areas that appeared endoscopically pathological ($p<0.001$ and $p<0.001$, respectively).

Conclusion: It can be concluded that the routine application of EGD before cholecystectomy may impact the clinical approach.

Keywords: Cholelithiasis, Esophagogastroduodenoscopy, Gastritis

Introduction

Epigastric abdominal pain is a common condition in the population and can result from various diseases, with cholelithiasis and gastritis being particularly prominent in its differential diagnosis. The distinct treatment approaches for these two etiological factors make accurate diagnosis crucial. Cholelithiasis can be detected via abdominal ultrasonography (US), while gastritis is typically diagnosed through clinical findings and esophagogastroduodenoscopy (EGD). The preferred treatment for symptomatic cholelithiasis is laparoscopic cholecystectomy, whereas medical treatments for gastritis are based on the

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presence of *H. pylori* and pathological findings. Some patients with symptomatic cholelithiasis may also have concomitant gastritis, and it is important to consider that in some cases, the symptoms may be attributable solely to gastritis, with cholelithiasis being asymptomatic.[1] This may be the underlying condition in patients with persistent abdominal pain after laparoscopic cholecystectomy, initially considered due to symptomatic cholelithiasis.[2]

EGD is the gold standard for diagnosing and evaluating gastritis, but it is more invasive and costly than abdominal US. The necessity of performing EGD before cholecystectomy is debated in the literature; however, some studies suggest that it aids in identifying asymptomatic cholelithiasis cases accompanied by gastritis and helps reduce unnecessary cholecystectomies.[3–6] In our study, we aimed to examine the preoperative gastroscopy findings in patients scheduled for cholecystectomy and evaluate the rates of pathological findings.

Materials and Methods

In our single-center retrospective study, we evaluated 336 patients who underwent cholecystectomy and preoperative EGD between 2020 and 2023. Patients participating in our study were informed, and written consent was obtained. The study was conducted in accordance with the Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of Şişli Etfal Training and Research Hospital (30.01.2024, No: 2565).

Patients over the age of 18 who underwent cholecystectomy for gallbladder diseases between 2020 and 2023 were included. Patients who underwent cholecystectomy as part of a larger surgical procedure (e.g., pancreaticoduodenectomy), did not undergo preoperative gastroscopy, or had missing archival data were excluded. The patients were evaluated based on demographic, clinical, endoscopic, and pathological data.

Statistical Analysis

Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 25.0 (IBM Corp., Armonk, NY, USA). Categorical data were expressed as numbers and percentages, while continuous data were expressed as median and range. Chi-square tests (Pearson's chi-square, Fisher's exact test, etc.) were used to compare categorical data. All p-values were two-sided, and results were evaluated at a significance level of $p<0.05$ with a 95% confidence interval.

Results

A total of 336 patients were included in the study. The median age was 53 years (range 24–87), and 216 (64.3%) of the patients were women. It was observed that 136 (40.5%) of the patients had an American Society of Anesthesiology (ASA) score of I, 156 (46.4%) had ASA II, and 44 (13.1%) had ASA III. Among the EGDs performed, 156 (46.4%) were macroscopically normal, while endoscopic pathology was detected in 180 (53.6%) of the patients. Gastroscopic biopsies were taken from 228 (67.9%) patients (Table 1).

Histopathological abnormalities were detected in 199 (87.3%) of the 228 patients for whom biopsies were taken. Helicobacter pylori (HP) was found to be positive in 90 patients (39.5%). Atrophic gastritis was detected in 45 patients (19.7%), and intestinal metaplasia was detected in 41 patients (18%) (Table 2).

Table 1. Demographic and clinicopathologic features of the participants

Variables	N	%
All Patients	336	100
Age (Median 53, Range 24-87)		
18-49	128	38.1
50-69	164	48.8
≥70	44	13.1
Gender		
Female	216	64.3
Male	120	35.7
ASA Score		
ASA I	136	40.5
ASA II	156	46.4
ASA III	44	13.1
Endoscopic Findings		
Normal EGD	156	46.4
Antral gastritis	76	22.6
Pangastritis	48	14.3
Bile reflux gastritis	36	10.7
Peptic ulcer	20	6
Biopsy Sampling		
No	108	32.1
Yes	228	67.9

ASA: American Society of Anesthesiology.

Table 2. Pathological findings

Variables	N	%
All Biopsied Patients	228	100
Histopathological Findings		
Normal	29	12.7
Abnormal	199	87.3
HP Detection		
No	138	60.5
Yes	90	39.5
Atrophic gastritis		
No	183	80.3
Yes	45	19.7
Intestinal Metaplasia		
No	187	82
Yes	41	18

HP: Helicobacter pylori.

When the 199 patients with histopathological abnormalities were examined, mild gastritis findings were observed in 74 (37.2%) patients, moderate gastritis in 98 (49.2%), and severe gastritis in 27 (13.6%). Of the 199 patients, 44 (22.1%) had inactive gastritis, 45 (22.6%) had mild activity, 82 (41.2%) had moderate activity, and 28 (14.1%) had severe activity. Statistically, significantly more active and severe gastritis findings were observed in mucosal areas that appeared endoscopically pathological ($p<0.001$ and $p<0.001$, respectively) (Table 3).

Discussion

Cholelithiasis is prevalent in society and can be incidentally detected during examinations performed for unrelated reasons.[7–9] When gallbladder stones are detected in these patient groups, there is often a tendency to focus solely on this issue and overlook other differential diagnoses. Abdominal ultrasonography (USG) is typically one of the initial examinations requested for patients presenting with upper quadrant and epigastric abdominal pain. Patients diagnosed with gallbladder stones on abdominal USG are often directly referred for surgery.

Articles advocating the routine necessity of EGD evaluation before cholecystectomy emphasize the likelihood of detecting pathological findings during EGD in patients with gallstones. They also suggest that in some cases, appropriate treatment can lead to symptom resolution without the need for cholecystectomy.[4,10] In contrast, articles that do not advocate routine EGD before cholecystectomy note that the detection rate of endoscopic pathology is low in patients presenting with "typical" gallbladder pain during detailed anamnesis. It is suggested that EGD may be considered if pain persists after cholecystectomy.[6,11] In our study, we found that 53.6% of EGDs performed before cholecystectomy revealed endoscopic pathology, and histopathological abnormalities were detected in 199 (87.3%) of 228 patients who underwent biopsies.

Based on these findings, while it may be argued that routine EGD before cholecystectomy could be beneficial, it is important to consider the retrospective nature of our study. There is also the possibility that some patients un-

Table 3. Abnormal histopathologic fingings according to endoscopic findings

Variables (N=199, %)	All Patients	Normal EGD	Antral Gastritis	Pangastritis	Bile Reflux Gastritis	Peptic Ulcer	p
Severity of Chronic Gastritis							
Mild	74 (37.2)	4 (2)	34 (17.1)	18 (9)	18 (9)	0 (0)	<0.001[a]
Moderate	98 (49.2)	14 (7)	39 (19.6)	23 (11.6)	12 (6)	10 (5)	
Severe	27 (13.6)	1 (0.5)	3 (1.5)	7 (3.5)	6 (3)	10 (5)	
Activity of Chronic Gastritis							
Inactive	44 (22.1)	1 (0.5)	25 (12.6)	9 (4.5)	9 (4.5)	0 (0)	<0.001[a]
Mild	45 (22.6)	5 (2.5)	16 (8)	12 (6)	11 (5.5)	1 (0.5)	
Moderate	82 (41.2)	11 (5.5)	30 (15.1)	21 (10.6)	12 (6)	8 (4)	
Severe	28 (14.1)	2 (1)	5 (2.5)	6 (3)	4 (2)	11 (5.5)	

[a]Fisher's Exact Test; EGD: Esophagogastroduodenoscopy.

dergoing EGD before cholecystectomy may present with dyspeptic complaints. Prospective studies focusing on patients with typical symptoms of gallstones would provide further clarity on this matter.

The prevalence of HP infection is reported to be approximately 35% globally, with a decreasing trend in recent years. However, there is variability in HP prevalence, with lower rates observed in developed Western societies and higher rates in Asia.[12,13] In our study, Helicobacter pylori (HP) positivity was detected in 90 (39.5%) of 228 patients from whom biopsies were taken, consistent with the literature.

In a study investigating the incidence of atrophic gastritis, Adamu et al.[14] reported that its prevalence in the general population varies between 0% and 11%. In our study, 19.7% of biopsied patients had atrophic gastritis, and 18% exhibited intestinal metaplasia. These higher-than-normal rates of atrophic gastritis and intestinal metaplasia in our study cohort support the rationale for performing EGD before cholecystectomy.

When examining the distribution of histopathological findings based on endoscopic results, we observed more severe and active gastritis in patients with peptic ulcer and bile reflux, whereas patients with normal endoscopic findings showed milder and less active gastritis.

The primary limitations of our study include its retrospective and single-center nature. Due to missing data regarding the indications for gastroscopy in patients undergoing cholecystectomy, we cannot accurately determine the prevalence of complaints such as dyspepsia. Consequently, there is a possibility that pathological findings may be detected at a higher rate than normal. This issue requires evaluation through prospective studies, particularly focusing on EGD findings in patients presenting with typical symptoms of cholelithiasis.

Conclusion

The detection rates of pathology are high in patients who undergo EGD before cholecystectomy, suggesting that routine preoperative EGD could enhance clinical management.

Disclosures

Ethics Committee Approval: The study was conducted in accordance with the Declaration of Helsinki and was approved by the Clinical Research Ethics Committee of Şişli Etfal Training and Research Hospital (30.01.2024, No: 2565).

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Comparison of VATS and open thoracotomy in anatomical lung resections according to multifaceted parameters

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ABSTRACT

Introduction: In our research, the data of lung cancer patients operated via VATS and thoracotomy methods were investigated. In the evaluation performed by using versatile parameters, both methods were compared on the basis of objective criteria. Our study was carried out in order to assess the outcomes of both methods.

Materials and Methods: 232 patients who underwent surgery with a diagnosis of lung cancer of various stages between the dates of January 2016 and June 2021 were involved in the research, and the patients' data were retrospectively scanned. To ensure balance between both groups, cases that were operated on for benign causes, performed pneumonectomy, received neoadjuvant, underwent chest wall resection, and cases converted to open from VATS were excluded from the research. The patients' hospitalization, amount of drainage, count of dissected lymph nodes, stages, complications and early mortality were reviewed.

Results: There were 81 patients underwent VATS lobectomy and 151 patients underwent thoracotomy, in our study. The mean age was 63.5 in the thoracotomy group, and, 61.8 in VATS group. In the thoracotomy group, there were 31 female and 120 male patients; and in VATS group, 28 female and 53 male patients. The hospitalization times were shorter in VATS group; however, it was not statistically significant. In thoracotomy group, drainage amount and the count of lymph node dissections were significantly higher. The stage was determined significantly earlier in VATS group. Despite the rate of complication was lower in VATS group, there was no statistical difference between the both groups. Early mortality rates were comparable.

Conclusion: Even though our research has limitations, we believe that we will gain better outcomes as our learning curve enhances in VATS.

Keywords: Lung Cancer, Lung Resection, Open Thoracotomy, Video-assisted Thoracic Surgery

Introduction

Lung cancer has the highest incidence and mortality rate in the world among all cancers.[1] In accordance with National Comprehensive Cancer Network (NCCN) Guidelines, the main treatment for lung cancer at Stage 1–2 is surgery; in Stage 3, however, surgical treatment is recommended in selected patient groups.[1] The video-assisted thoracoscopic surgery (VATS) method, which has been

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utilized in lung cancer surgery since the 1990s, has shown great progress recently. Sleeve resections began to be performed using VATS, and uniportal methods were developed over time. Furthermore, other advantages of VATS, such as providing a shorter discharge time, less cosmetic damage, and less pain, have been reported in numerous publications.[2-4] Nevertheless, thoracotomy is still considered the best choice, particularly in advanced-stage cancers and centrally located tumors.

In our study, we compared VATS and thoracotomy based on multifaceted effects in patients with anatomical lung disease due to lung cancer. We aimed to evaluate the advantages and limitations of both methods.

Materials and Methods

Our research was conducted retrospectively, including data from 232 patients who underwent lung cancer surgery at Kartal Dr. Lütfi Kırdar City Hospital over a 5-year period between January 2016 and June 2021. The patients' age, gender, operation side, operation name, operation method, number of dissected lymph nodes, pathological outcome, stage, postoperative complications, hospitalization time, and drainage amounts were recorded. Patients who underwent anatomical resection for benign etiologies, pneumonectomy, post-neoadjuvant cases, lung resection with chest wall resection, sleeve resections, segmentectomy cases, cases that remained in exploration, and cases that were converted to thoracotomy were excluded from the study. All patients were staged after surgery in accordance with the 8th International TNM Classification System for Lung Cancer.[5]

Mediastinal lymph node assessment was conducted using the "systematic mediastinal lymph node sampling method" based on the map proposed by the American Thoracic Society.[6]

The TM&M (Thoracic Morbidity and Mortality) classification, created by Seely et al.,[7] in 2010 by modifying the Clavien-Dindo classification,[8] was used for the classification of complications. Surgical complications were divided into Clavien-Dindo Class 1 and Class 2 (minor) and Classes 3 and 4 (major) (Table 1).

Statistical Analysis

In the descriptive statistics of the data, mean, standard deviation, median, lowest, highest, frequency, and ratio values were utilized. The distribution of variables was tested using the Kolmogorov-Smirnov test. Independent sample t-tests were utilized for the analysis of quantitative independent data. The Chi-square test was used for the analysis of qualitative independent data, and Fisher's exact test was used when Chi-square test requirements were not met. SPSS 27.0 software was used for the analyses.

Ethics Committee Approval

Our study was approved by the Ethics Committee of Kartal Dr. Lütfi Kırdar City Hospital on 20.08.2019 with decision number 2019/514/160/5.

Table 1. Classification of complications

Major Complications	Minor Complications
Pneumonia requiring intensive care	Wound infection
Chylothorax requiring ductusligation	Prolonged air leak (PAL)
Hematoma requiring revision	Subcutaneous emphysema
Myocardial Infarction	Atelectasis
Cerebro-vascular disease (CVD)	Gastrointestinal complications
Renal failure requiring hemodialysis	Urological complications
Pulmonary edema requiring mechanical ventilation	Acute renal failure
	Atrial fibrillation (AF)
Bronchopleural fistula requiring surgery	Pneumonia
Acute respiratory distress syndrome (ARDS)	Chylothorax
	Hematoma
	Pulmonary embolism
	Pulmonary edema
	Bronchopleural fistula

Results

A total of 232 patients who underwent anatomical resection (81 VATS, 151 thoracotomy) were included in the study. The mean age was 63.5 years in the thoracotomy group and 61.8 years in the VATS group. There were 31 female and 120 male patients in the thoracotomy group, and 28 female and 53 male patients in the VATS group. The operation side was principally the right side in both groups (64.6% in thoracotomy and 58.0% in VATS). The demographic characteristics of the patients are summarized in Table 2.

The most frequent operation in both groups was upper lobectomy, with 55.6% in the VATS group and 59.9% in the thoracotomy group (Table 2). After reviewing the exact pathology in both groups, we found that adenocarcinoma was the most common type. Adenocarcinoma was observed in 42.9% of the patients in the thoracotomy group, followed by squamous cell carcinoma in 42.2%. In

Table 2. Demographic data of the patients, operation types, final pathology results, pathological stages

	Thoracotomy Mean±SD/n-%		VATS Mean±SD/n-%		p
Age	63.5±8.7		61.8±8.7		0.170[t]
Gender					
Famele	30	20.4%	28	34.6%	0.019[X²]
Man	117	79.6%	53	65.4%	
Side					
Right	95	64.6%	47	58.0%	0.466[X²]
Left	56	38.1%	34	42.0%	
Anatomical Resection Type					
Lower Lobectomy	44	29.9%	34	42.0%	0.049[X²]
Upper Lobectomy	88	59.9%	45	55.6%	0.689[X²]
Middle Lobectomy	6	4.1%	0	0.0%	0.069[X²]
Bilobectomy Inferior	8	5.4%	1	1.2%	0.170[X²]
Bilobectomy Superior	5	3.4%	0	0.0%	0.166[X²]
Cancer Stage					
1A1	11	7.5%	11	13.6%	0.000[X²]
1A2	40	27.2%	21	25.9%	
1A3	15	10.2%	26	32.1%	
1B	21	14.3%	11	13.6%	
2A	19	12.9%	1	1.2%	
2B	21	14.3%	7	8.6%	
3A	19	12.9%	4	4.9%	
3B	5	3.4%	0	0.9%	
Pathology					
Adenocarcinoma	63	42.9%	55	67.9%	0.000[X²]
Squamous	62	42.2%	18	22.2%	0.006[X²]
Large Cell	11	7.5%	4	4.9%	0.679[X²]
Adenosquamous	5	3.4%	2	2.5%	0.964[X²]
Pleomorphic carcinoma	6	4.1%	1	1.2%	0.447[X²]
Typical carcinoid	2	1.4%	1	1.2%	0.614
Atypical carcinoid	1	0.7%	0	0.0%	1.000
Small cell	1	0.7%	0	0.0%	1.000

[t]: independent sample t test; [X²] Ki-kare test; n: number.

the VATS group, 67.9% had adenocarcinoma, and 22.2% had squamous cell carcinoma. The exact pathology of the patients is summarized in Table 2.

The stage of lung cancer was significantly higher ($p < 0.05$) in the thoracotomy group compared to the VATS group (Table 2). In the thoracotomy group, 57.2% of patients were at Stage 1, and 42.8% were at Stage 2 and above. In contrast, 85.2% of patients in the VATS group were at Stage 1, and 14.8% were at Stage 2 and above. The VATS method was favored more in early-stage cancers (Table 2).

Examining the number of lymph nodes dissected between both groups, the total number of lymph nodes was 5.75±1.48 in the thoracotomy group and 4.75±1.34 in the VATS group. The total number of lymph nodes in the thoracotomy group was significantly higher ($p<0.05$) compared to the VATS group. The ratio of the number of lymph nodes 2, 4, 8, and 9 was significantly higher ($p<0.05$) in the thoracotomy group compared to the VATS group. However, the ratios of lymph nodes 5, 6, 7, 10, and 11 did not significantly differ between the two groups ($p>0.05$) (Table 3).

In terms of drainage amounts, the total drainage was 747±694 ml in the thoracotomy group and 525±449 ml in the VATS group, with a statistically significant difference between both groups ($p<0.05$) (Table 4). The hospitalization time was 8.5±5.7 days in the thoracotomy group and 7.4±3.4 days in the VATS group, which was not statistically significant ($p>0.05$) (Table 4).

The TM&M system, a modified version of the Clavien-Dindo classification, was used to classify complications. These complications were grouped as major or minor (Table 4). Both minor and major complications, as well as total complications, were higher in the thoracotomy group (22.5%, 11.3%, and 33.8%, respectively). The total complication ratio was significantly higher in the thoracotomy group ($p<0.05$). The rates of prolonged air leaks (PAL), subcutaneous emphysema, pneumonia, chylothorax requiring ligation, chylothorax, atrial fibrillation (AF), pulmonary embolism, bronchopleural fistulas (BPF) requiring an operation, pulmonary edema, wound infection, and cerebrovascular disease (CVD) did not significantly differ between the two groups ($p>0.05$). However, the rates of atelectasis, urinary complications, and hematoma were significantly higher ($p<0.05$) in the thoracotomy group (Table 5).

Mortality data were collected, including patients who died due to postoperative complications during their first month of follow-up. Complications-associated mortality was noted in 4 patients (2.6%) in the thoracotomy group and 2 patients (2.4%) in the VATS group within the first postoperative month. This difference was not statistically significant ($p>0.05$). Mortality data are presented in Table 4.

Discussion

In our research, we compared the VATS and thoracotomy methods based on multifaceted parameters in patients who underwent anatomical resection due to lung cancer. To ensure balance among cases, we excluded patients whose

Table 3. Numbers and percentages of lymph nodes dissected during the operation

	Thoracotomy Mean±SD/n-%		VATS Mean±SD/n-%		p
Side					
Right	95	62.9%	47	58.0%	0.466[X²]
Left	56	37.1%	34	42.0%	
Total Number of Lymph Nodes	5.75±1.48		4.75±1.34		0.000[m]
Lymph Node					
2.4	82	54.3%	29	35.8%	0.007[X²]
5.6	50	33.1%	18	22.2%	0.082[X²]
7	143	94.7%	71	87.7%	0.056[X²]
8.9	103	68.2%	37	45.7%	0.001[X²]
10.11	137	90.7%	73	90.1%	0.881[X²]

[m]Mann-whitney u test / X^2 Ki-kare test; ave :average, ss/n : standard deviation/number.

Table 4. Analysis of major-minor complications, total drainage, length of stay, mortality data

	VATS		Thoracotomy		
	Mean±SD/n-%	Median	Mean±SD/n-%	Median	p
Postoperative Complication					
(-)	57/70.4%		103/68.2%		0.735$^{X^2}$
(+)	24/29.6%		48/31.8%		
Major Complication					
(-)	77/95.1%		142/94.0%		0.747$^{X^2}$
(+)	4/4.9%		9/6.0%		
Minor Complication					
(-)	60/74.1%		110/72.8%		0.841$^{X^2}$
(+)	21/25.9%		41/27.2%		
Total Drainage	485.6±453.6	400.0	712.0±696.7	500.0	0.002^{m}
Hospitalization Duration	7.4±3.4	7.0	8.5±5.7	7.0	0.058^{m}
Mortality					
(-)	79/97.6%		145/97.4%		0.069$^{X^2}$
(+)	2/2.4%		4/2.6%		

^{m}Mann-whitney u test / X^2 Ki-kare test (Fischer test); (-) not, (+) available, ave :average, ss/n : standard deviation/number.

Table 5.Postoperative complications

	Thoracotomy		VATS		p
	n	%	n	%	
Complication					
Atelectasis	11	7.3%	0	0.0%	0.013$^{X^2}$
Prolonged air leak (PAL)	11	7.3%	3	3.7%	0.275$^{X^2}$
Hematoma Requiring Revision	3	2.0%	1	1.2%	1.000$^{X^2}$
Hematoma	3	2.0%	8	9.9%	0.007$^{X^2}$
Urinary Complication	7	4.6%	0	0.0%	0.049$^{X^2}$
Subcutaneous Emphysema	5	3.3%	5	6.2%	0.306$^{X^2}$
Pneumonia	7	4.6%	2	2.5%	0.415$^{X^2}$
Chylothorax requiring ligation	1	0.7%	3	3.7%	0.124$^{X^2}$
Chylothorax	2	1.3%	1	1.2%	1.000$^{X^2}$
Atrial fibrillation (AF)	2	1.3%	1	1.2%	1.000$^{X^2}$
Pulmonary Embolism	1	0.7%	0	0.0%	1.000$^{X^2}$
Bronchopleural fistula requiring surgery	1	0.7%	0	0.0%	1.000$^{X^2}$
Bronchopleural fistula	0	0.0%	0	0.0%	1.000$^{X^2}$
Pulmonary Edema	0	0.0%	0	0.0%	1.000$^{X^2}$
Wound Infection	1	0.7%	0	0.0%	1.000$^{X^2}$
Cerebrovascular accident	2	1.3%	2	2.5%	0.613$^{X^2}$

X^2 Ki-kare test, n: number.

operations were converted to thoracotomy, those who underwent pneumonectomy, lung resection with chest wall resection, and patients with neoadjuvant therapy.

In numerous studies comparing thoracotomy and VATS, the number of lymph nodes dissected, drainage amount, length of hospitalization, and postoperative complications were evaluated.[9-11] We investigated demographic data, hospitalization, drainage amount, number of lymph nodes, stages, complications, and early mortality in our study.

In a study conducted in 2006,[12] McKenna reported on 1,100 patients who underwent VATS lobectomy over 12 years, 1,015 of whom were operated on for lung cancer. Of the participants, 54.1% were female, and 45.9% were male. The mean age was 71.2 years (range: 16–94). The most common histologic type was adenocarcinoma, with a rate of 63.1%. The most frequent operation type was right upper lobectomy (403 cases, 39.7%). In a multicenter randomized controlled study by Long et al.[13] in 2017, 425 patients undergoing VATS and axillary thoracotomy were included (215 VATS and 210 axillary thoracotomy). Of these patients, 49.8% were female, and 50.1% were male. The mean age was 57.1 years in the VATS group and 58.1 years in the axillary thoracotomy group. The most common histologic type was adenocarcinoma (VATS 82.7%, thoracotomy 76.6%), and the most frequent operation was right upper lobectomy (VATS 26.9%, thoracotomy 35.7%). Of the 232 patients included in our study over a 5-year period, 59 (25.4%) were female, and 173 (74.5%) were male. The mean age was 63.5 years in the thoracotomy group and 61.8 years in the VATS group. The most frequent operation side was the right side (thoracotomy 64.6%, VATS 58.0%), and the most common operation type was upper lobectomy (thoracotomy 59.9%, VATS 55.6%). The most common cancer type was adenocarcinoma (thoracotomy 42.9%, VATS 67.9%). The rate of female patients in our research was lower compared to other studies.[3,4] The mean age of patients was 7 years older than that reported in McKenna's study, while it was 5 years older than in Long H.'s study. Adenocarcinoma was the most common cancer type, as in other studies[3,4] and the most frequently performed operation was right upper lobectomy.

In studies conducted, the length of hospitalization following lung resection was noted to be shorter in the VATS group compared to the thoracotomy group.[13-15] The length of hospitalization ranged between 4.5 and 14 days in the VATS group and between 5 and 15 days in the thoracotomy group.[13-15] In our research, the hospitalization duration was 7.4±3.4 days in the VATS group and 8.5±5.7 days in the thoracotomy group. However, this difference was not statistically significant ($p>0.05$).

The amount of drainage and the timing of drain removal are crucial factors in determining patient discharge times. In various studies,[4,13] drainage amounts were noted to be higher in thoracotomy patients compared to VATS patients. In our research, the drainage amount in the thoracotomy group was significantly higher than in the VATS group (total drainage: 747±694 ml in the thoracotomy group and 525±449 ml in the VATS group, $p<0.05$). Although the specific day for drain removal was not mentioned, all patients were discharged after a control chest X-ray was taken the day after the drain was removed in our study.

Various studies have compared the number of lymph nodes dissected between VATS and thoracotomy groups.[16-19] In some of these studies, the number of lymph nodes dissected was found to be similar between the two groups.[16,18,19] However, other studies reported that the number of lymph node dissections was higher in the thoracotomy group.[17,20,21] In our study, the total number of lymph nodes in the thoracotomy group was significantly higher ($p<0.05$) compared to the VATS group.

Numerous publications on lung cancer treatment suggest that VATS lobectomy should be preferred in early-stage cancers.[9-11] Some studies, however, have demonstrated that VATS also provides successful outcomes in tumors larger than 5 cm (Stage 3).[22,23] In some studies comparing VATS and thoracotomy, VATS was less frequently preferred in advanced stages.[13,21,24] A similar trend was observed in our research, where the selection of VATS diminished in higher stages.

In McKenna's 2006 study, no postoperative complications were reported in 932 of the 1,100 patients who underwent VATS (82% of the patients).[12] Wang et al.[25] included a total of 10 studies involving 1,514 patients in their meta-analysis and found a lower incidence of postoperative complications in the VATS group. In a study involving 269 patients, Erdoğu et al.[24] reported an early postoperative complication rate of 17.9% in patients who underwent VATS and 32.2% in those who underwent thoracotomy. In a study with 516 patients, Lee et al.[17] reported a major complication rate of 4.3% in the VATS group and 9.6% in the thoracotomy group. The minor complication rate was 13.9% in the VATS group and 13% in the thoracotomy group. The complication rate for VATS lobectomy has

been noted to be lower than that for thoracotomy in many studies.[26,27] In our study, the total complication rate was 26% in the VATS lobectomy group and 34% in the thoracotomy group. The major complication rate was 8.7% in the VATS group and 11.3% in the thoracotomy group, while the minor complication rate was 17.3% in the VATS group and 22.5% in the thoracotomy group. The difference in total complications was found to be statistically significant in favor of the VATS group. Additionally, the complication rates in the thoracotomy group were similar to those in other studies. In the VATS group, the rate of hematoma was reported to be between 0.9% and 1.5% in other studies,[13,17,26,27] whereas in our research, the rate was 2.5%.

The mortality rate following VATS lobectomy due to lung cancer ranges between 0.3% and 3% and between 0.7% and 6% following thoracotomy.[12,17,25-28] In our study, early mortality rates were 2.4% in the VATS group and 2.6% in the thoracotomy group. There was no significant difference in early-term mortalities between the two groups.

The limitations of our study include its single-center design, the lack of postoperative pain scoring between the two groups, and the fact that long-term postoperative complications and survival outcomes were not examined.

Conclusion

For lung cancer in the first two stages, the ideal treatment option is surgery. VATS has become increasingly popular in lung resections due to its numerous advantages.

In our study, although the length of hospitalization was shorter in the VATS group, no statistically significant difference was observed between the two groups. However, the drainage amount was greater in the thoracotomy group, and this difference was statistically significant. The number of lymph node dissections was also higher in the thoracotomy group, and this difference was significant as well. We believe there is a direct correlation between the number of lymph node dissections and the amount of drainage, and the outcome from the data supports our opinion.

In the thoracotomy group, there were more patients in higher stages of lung cancer, and the stage was significantly higher compared to the VATS group. The major-minor complication ratio and total complications were found to be lower in the VATS group, with the total complication rate being significantly lower. No significant difference was noted in early mortality rates between the two groups.

Our study did not address pain, quality of life, cost, long-term outcomes, or the distribution of VATS over the years. However, in alignment with our results, we believe that VATS should be favored, particularly for early-stage tumors, as the length of hospitalization is shorter, the drainage amount is less, and complications are fewer. Despite the limitations of our study, we anticipate achieving better outcomes as our learning curve for VATS improves.

Disclosures

Ethics Committee Approval: Our study was approved by the Ethics Committee of Kartal Dr. Lütfi Kırdar City Hospital on 20.08.2019 with decision number 2019/514/160/5.

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Authorship Contributions: Concept – S.K., M.B.; Desing – S.E., S.K.; Supervision – R.D., S.E.; Materials – S.K., T.D.; Data collections and/or processing – B.Ç., S.K.; Analysis and/or interpretation – B.Ç., A.Ö.; Literature search – A.Ö., S.K.; Writing – S.K., S.E.; Critical review – R.D., S.E.

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LESS

Original Article

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The effect of laparoscopic sleeve gastrectomy on serum levels of vitamin A, D and B12 and iron profile in patients with morbid obesity: Short term outcomes

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ABSTRACT

Introduction: Laparoscopic sleeve gastrectomy (LSG) has emerged as a prominent surgical intervention for morbid obesity. In the present study, we aimed to evaluate the effect of LSG on serum levels of vitamins A, D, B12, and the iron profile in patients with morbid obesity.

Materials and Methods: This single-center, retrospective cohort study was conducted at Department of General Surgery between February 2021 and March 2023. Inclusion criteria were established in accordance with the American Society for Metabolic and Bariatric Surgery (ASMBS) guidelines. Exclusion criteria were as follows: pregnant or lactating women; those receiving medications known to affect vitamin or iron levels (e.g., anticonvulsants, long-term proton pump inhibitors); having prior gastrointestinal surgeries affecting nutrient absorption. A total of 116 patients who met the inclusion criteria were enrolled.

Results: The mean age of the participants was 38.7±7.5 years, and 80 of them (68.9%) were females and 36 of them (31.03%) were males. The mean preoperative BMI was 42.1±4.1 kg/m^2 A comparison of parameters before and after surgery showed that serum changes in vitamins A, B12, ferritin, and TIBC were not significantly different from before surgery, indicating that long-term LSG did not alter serum levels of these micronutrients. However, serum vitamin D showed a significant difference before and after surgery ($p<0.001$).

Conclusion: Nutritional deficiencies are a significant concern both before and after bariatric surgery. The results of the present study showed that laparoscopic sleeve gastrectomy is one of the most effective surgical methods that does not cause a lack of nutrients and vitamins in the long term.

Keywords: Bariatric Surgery, Laparsopic sleeve gastrectomy, Serum vitamins

Introduction

Laparoscopic sleeve gastrectomy (LSG) has emerged as a prominent surgical intervention for morbid obesity, offering significant advantages in terms of weight reduction and improvement in obesity-related comorbidities. This procedure involves the resection of nearly 75 to 80% of the stomach, creating a sleeve-shaped stomach that restricts food intake and alters hormonal signals related to appetite and metabolism.[1] It is associated with substantial weight loss and metabolic improvements, but it may lead

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to nutritional deficiencies due to reduced stomach volume and altered digestive processes.[2]

One of the primary concerns following LSG is the potential effect on micronutrient levels, particularly vitamins and iron, which are crucial for various physiological functions. Vitamins A, D, and B12, along with iron, play key roles in maintaining metabolic health, immune function, and red blood cell production.[3] Deficiencies in these nutrients may lead to several health issues, including anemia, bone disorders, and neurological complications.[4] According to Rashoo et al.,[5] LSG is one of the most effective surgical methods for obesity treatment and does not cause long-term nutrient and vitamin deficiencies or require supplementation. Mulita et al.[6] reported that one year after bariatric surgery, there was an increase in ferritin, magnesium, and vitamin B12 deficiencies. However, there was no significant difference between pre- and postoperative iron, folic acid, and phosphorus deficiencies. Decreased vitamin D levels are more common in individuals with obesity than in healthy individuals without obesity. Many patients undergoing bariatric surgery have decreased 25-hydroxyvitamin D [25(OH)D] levels. Vitamin D3 levels show an inverse relationship with body mass index (BMI) >30 kg/m^2.[7]

In light of these data, it is essential to monitor and manage the nutritional status of patients undergoing LSG to prevent and address potential deficiencies. In the present study, we aimed to evaluate the effect of LSG on serum levels of vitamins A, D, B12, and the iron profile in patients with morbid obesity. Understanding these effects would help tailor effective postoperative nutritional strategies and supplementation protocols to ensure optimal health outcomes and prevent complications associated with nutrient deficiencies.

Materials and Methods

Study Design and Study Population

This single-center, retrospective cohort study was conducted at the Department of General Surgery of Avrupa Şafak Hospital between February 2021 and March 2023. The study protocol was approved by the Institutional Review Board (IRB), and written informed consent was obtained from each participant. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Inclusion criteria were established in accordance with the American Society for Metabolic and Bariatric Surgery (ASMBS) guidelines as follows:[8] age between 18 and 65 years; BMI ≥40 kg/m^2 or BMI ≥35 kg/m^2 with obesity-related comorbidities; no history of gastrointestinal diseases affecting absorption; and no history of chronic diseases affecting vitamin or iron metabolism (e.g., liver disease, chronic renal failure). Exclusion criteria were as follows: pregnant or lactating women; individuals receiving medications known to affect vitamin or iron levels (e.g., anticonvulsants, long-term proton pump inhibitors); and those with prior gastrointestinal surgeries affecting nutrient absorption. A total of 116 patients who met the inclusion criteria were enrolled.

Preoperative Assessment

Prior to surgery, participants underwent a comprehensive preoperative evaluation, including a detailed medical history and physical examination, abdominal ultrasound, upper gastrointestinal endoscopy, functional respiratory tests, nutritional assessment, and dietary history taking. Baseline laboratory tests included serum levels of vitamin A, vitamin D, vitamin B12, iron, ferritin, and total iron-binding capacity (TIBC).

Surgical Procedure

All participants underwent LSG performed by two bariatric surgeons. The surgical technique involved:

- Creation of a small vertical sleeve along the stomach's greater curvature, resecting approximately 80% of the stomach.
- Use of standard laparoscopic equipment and techniques to minimize surgical complications.

Postoperative Follow-Up

All patients underwent standard LSG and received a multivitamin supplement for six months (Supradyn®, Bayer Pharmaceuticals, Germany, one capsule daily, and calcium citrate). The patients' postoperative diet was prescribed by a nutritionist in accordance with the protocol for sleeve gastrectomy patients. At six months, the patients were asked to discontinue multivitamin supplementation. One year after the operation, BMI values were recorded, and blood samples were analyzed to check serum levels of vitamins A, D, B12, ferritin, and TIBC. The results were recorded.

Statistical Analysis

Statistical analysis was performed using SPSS version 24.0 software (IBM Corp., Armonk, NY, USA). Continuous data were expressed as mean±standard deviation (SD) or median (min–max), while categorical data were expressed as number and frequency. Independent t-tests and chi-square tests were used to analyze the data. A p-value of <0.05 was considered statistically significant.

Results

A total of 116 patients with morbid obesity were included in this study. All patients completed the follow-up period. The demographic characteristics of the patients are shown in Table 1.

Table 1. Baseline and demographic characteristics of patients

Variables	Values
Male n (%)	36 (31.03)
Female n (%)	80 (68.9)
Age (year)	38.7±7.5
Height (cm)	165±8.9
Weight (kg)	
Preoperative	127.1±13.2
Postoperative	88.2±12.1
BMI (kg/m^2)	
Preoperative	42.1±4.1
Postoperative	31.2±4.2
Weight loss (kg)	37.7±7.8

BMI: body mass index.

At baseline, the mean age of the participants was 38.7±7.5 years, with 80 participants (68.9%) being female and 36 (31.03%) male. The mean preoperative BMI was 42.1±4.1 kg/m^2 (Table 1). The mean preoperative serum parameters were vitamin A: 18.6±8.2 g/dL, vitamin D: 26.3±7.1 ng/mL, vitamin B12: 409.7±239.1 pg/mL, ferritin: 66.2±59.8 ng/mL, and TIBC: 332.4±61 g/dL. One year after surgery, the mean BMI was 31.2±4.2 kg/m^2 (Table 1). The mean postoperative serum indices of vitamins A, D, B12, ferritin, and TIBC are given in Table 2. A comparison of pre- and postoperative parameters showed no significant changes in serum levels of vitamins A, B12, ferritin, and TIBC, indicating that long-term LSG did not alter serum levels of these micronutrients. However, serum vitamin D showed a significant difference before and after surgery (p<0.001) (Table 2).

Discussion

According to the World Health Organization (WHO), the prevalence of obesity worldwide has tripled since 1975, with more than 650 million adults being obese in 2016.[9] Bariatric surgical procedures promote weight loss through three main mechanisms: restrictive, malabsorptive, and a combination of both.[10] Restrictive bariatric surgeries primarily work by reducing the stomach's volume, limiting food intake, and consequently calorie consumption. These procedures usually do not significantly alter the digestive tract's absorption capabilities. Currently, as a restrictive procedure, LSG is preferred due to its simpler technique and fewer complications.[11] Malabsorptive bariatric surgeries involve modifications to the gastrointestinal tract that reduce nutrient absorption. These procedures typically combine elements of restriction with changes to the digestive process, resulting in more pronounced nutritional deficiencies.[10,12,13] Reduced stom-

Table 2. Pre- and postoperative serum indices of patients

Variable	Baseline	At Month 12	Normal range	p (t-test)
Vitamin A (µg/dl)	18.6±8.2	17.1±9.1	32-78 (µg/dl)	0.381
25 (OH) Vitamin D (ng/ml)	26.3±7.1	31.2±10.1	30-60 (ng/ml)	<0.001
Vitamin B12 (pg/ml)	409.7±239.1	411.1±226.1	200-800 (pg/ml)	0.141
TIBC (µg/dl)	332.4±61	335.6±61.1	250-310 (µg/dl)	0.653
Serum ferritin (ng/ml)	66.2±59.8	66.7±68.1	Male: 24-336 Female: 24-307 (ng/dl)	0.980
Serum iron (µg/dl)	82.1±21.2	85.7±60.1	50-150 (µg/dl)	0.212

TIBC: total iron-binding capacity.

ach capacity can lead to insufficient intake of essential vitamins and minerals. Deficiencies in vitamin B12, iron, calcium, and vitamin D are common.[14,15]

Before undergoing bariatric surgery, many patients with morbid obesity already experience nutritional deficiencies, often resulting from poor dietary habits, malabsorption issues, and the high prevalence of comorbid conditions such as type 2 diabetes and gastrointestinal disorders.

Vitamin D deficiency, although common in the general population, has a higher prevalence in patients with obesity, reaching up to 94%.[16] Following bariatric surgery, 10 to 73% of patients develop vitamin D deficiency.[17] Postoperative vitamin D deficiency can worsen due to reduced food intake, altered absorption, and increased metabolic demand. Bariatric patients often require higher doses of vitamin D supplementation to maintain adequate levels and support bone health.[18] The risk of osteoporosis and fractures can increase if vitamin D levels are not adequately managed.[19] The study by Kull et al.[20] showed that patients with obesity had lower levels of vitamin D before surgery, consistent with our study findings. Bariatric surgery may also lead to calcium deficiency due to altered absorption and impaired gastric acid secretion. Calcium deficiency contributes to bone loss and osteoporosis.[21] Supplementation and dietary modifications are necessary to prevent these complications.[22] Our study showed a statistically significant increase in serum levels of vitamin D in patients one year after LSG.

Following bariatric surgery, vitamin B12 deficiency is common due to decreased intrinsic factor production and changes in the digestive tract.[23] Long-term supplementation and monitoring are essential to prevent anemia and neurological complications.[24] In the study by Mulita et al.,[6] one year after SG, 15% of the study population had vitamin B12 deficiency. Vitamin B12 deficiency, particularly in malabsorptive BS, may manifest after three years of inadequate intake, causing megaloblastic anemia and neuropathy.[25,26] In contrast, there was no significant difference in vitamin B12 levels before and after LSG in our study.

Iron deficiency is a significant concern following bariatric surgery due to reduced gastric acid secretion and alterations in the absorption sites within the intestines.[27] Patients often require iron supplementation and dietary modifications to manage this deficiency.[15] Several studies have shown that the prevalence of this anemia can be up to 17% after surgery.[28] Iron deficiency occurs in 33 to 49% of patients within two years post-bariatric surgery.[29] Symptoms include microcytic anemia, fatigue, and lethargy. In our study, no decrease in serum ferritin was observed at one year, which can be attributed to differences in the follow-up period of patients, as well as the administered multivitamin supplement.

Previous studies have also shown an increased risk of vitamin A deficiency following bariatric surgery.[30] Vitamin A, a fat-soluble vitamin, requires adequate dietary fat for absorption, which may be compromised due to reduced dietary intake and malabsorption post-surgery.[31] In our study, no decrease in serum vitamin A was observed at one year.

Nonetheless, there are some limitations to this study. First, the single-center, retrospective design potentially leads to analytic bias. Second, we could only evaluate short-term results. Further large-scale, long-term, prospective studies are warranted to evaluate the long-term effects of LSG on micronutrient status and the efficacy of different supplementation regimens.

Conclusion

In conclusion, nutritional deficiencies are a significant concern both before and after bariatric surgery. The results of the present study showed that laparoscopic sleeve gastrectomy is one of the most effective surgical methods that does not cause long-term nutrient and vitamin deficiencies.

Effective management of nutritional deficiencies, which imposes exorbitant costs on patients, involves a multidisciplinary approach, including preoperative screening and postoperative monitoring. Nutritional counseling, regular blood tests, and appropriate supplementation are critical to addressing and preventing deficiencies. Customized dietary plans and patient education are essential for ensuring adequate nutrient intake and addressing potential absorption issues.

Disclosures

Ethics Committee Approval: This study was approved by the Istanbul Yeniyuzyil University Ethics Committee (15.10.2024 - 2024/10-1332).

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LESS

Original Article

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Contributions and outcomes of terminal ileum intubation in a surgical endoscopy unit: Retrospective cohort study

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ABSTRACT

Introduction: The necessity of routine terminal ileum intubation during colonoscopy is controversial, with literature suggesting it has a low impact on clinical outcomes. Our study aimed to evaluate the effect of terminal ileum intubation on the clinical approach in a surgical endoscopy unit.

Materials and Methods: This retrospective study included 137 patients over the age of 18 who underwent colonoscopy with successful terminal ileum intubation in 2023. The patients were evaluated based on their demographic, clinical, endoscopic, and pathological data.

Results: The median age was 55 years (range 18–86), and 77 (56.2%) of the 137 patients included in the study were female. A total of 5 (3.5%) patients had a pathological appearance in the terminal ileum mucosa, necessitating an ileal biopsy. Of these 5 patients, 3 (2.2%) were referred for colonoscopy due to diarrhea, 1 (0.7%) due to abdominal pain, and 1 (0.7%) due to radiological findings. All biopsies resulted in a diagnosis of non-specific ileitis.

Conclusion: In surgical endoscopy units, terminal ileum intubation has minimal impact on the clinical approach and can be applied selectively based on the indication.

Keywords: Colonoscopy, Diarrhea, Terminal Ileum Intubation

Introduction

Colonoscopy is an endoscopic method that allows for the examination of the colon and rectal mucosa under direct visualization. This method enables the visual inspection of the colon, as well as obtaining tissue diagnoses through biopsies from pathological areas. Colonoscopy, regarded as the gold standard for colorectal cancer screening, allows for the detection of premalignant lesions, such as adenomatous polyps, and facilitates their treatment through endoscopic methods, such as polypectomy.[1]

For a colonoscopy to be considered complete, it is necessary to reach the cecal base and examine the entire colon, including the cecum. However, the necessity of routine terminal ileum intubation remains controversial in the literature.[2-5] Although terminal ileum intubation is considered evidence of reaching the cecum when the landmarks of the cecal floor cannot be clearly evaluated, some publications state that its diagnostic contribution is low.[2,6] However, it is also noted that evaluating and biopsying the terminal ileum can aid in diagnosing inflammatory

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bowel diseases (IBD) in patients with chronic diarrhea, radiologic findings of terminal ileum pathology, or right lower quadrant pain.[2,5]

Our study aimed to assess the outcomes of patients who underwent terminal ileum intubation during colonoscopy in the surgical endoscopy unit.

Materials and Methods

In our study, we examined 236 patients over the age of 18 who underwent colonoscopy in 2023 and included 137 patients who underwent terminal ileum intubation. The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (Approval Date: 30.04.2024, Protocol Number: 2627).

We retrospectively examined colonoscopies performed by a single endoscopist on patients over the age of 18 for any indication in 2023. Out of 236 colonoscopies, 137 patients who underwent terminal ileum intubation were included in the study. Patients who did not undergo terminal ileum intubation or had missing data were excluded. The patients were then evaluated based on their demographic, clinical, endoscopic, and pathological data.

Colonoscopy Technique

In our center, colonoscopy procedures are conducted under deep sedation with the supervision of an anesthesiologist as per standard protocol. Patients are initially positioned in the left lateral decubitus position following monitoring and intravenous line establishment, and sedation is administered using propofol. In selected cases, colonoscopy without sedation may be offered to high-risk patients with comorbidities or those who prefer it.

We utilize Fujifilm® EC-760R colonoscopes in our endoscopy unit, with routine examinations performed under white light or Linked Color Imaging (LCI)®. Additionally, for enhanced mucosal pathology and polyp detection, virtual chromoendoscopy is available using Blue Light Imaging (BLI)®.

Statistical Analysis

Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) version 25.0 (IBM Corp., Armonk, NY, USA). Categorical data were expressed as numbers and percentages, while continuous data were expressed as mean±standard deviation or median and range, depending on the normality of their distribution. The normality of continuous data was tested using the Shapiro-Wilk test. Chi-square tests (Pearson chi-square, Fisher's exact test, etc.) were used to compare categorical data. All p-values were two-sided, and results were evaluated at a significance level of $p<0.05$ with a 95% confidence interval.

Results

A total of 137 patients, out of 236 colonoscopies performed, were included in the study, yielding a terminal ileum intubation rate of 58%. The median age of all patients was 55 years (range 18–86), with 77 (56.2%) being female. Among them, 76 (55.4%) were aged between 50 and 69 years. Regarding indications for colonoscopy, 59 (43.1%) patients underwent screening, 37 (27%) presented with abdominal pain and constipation, 30 (21.9%) had diarrhea, 6 (4.4%) reported a history of gastrointestinal bleeding, and 5 (3.6%) had colonoscopy due to radiological findings (Table 1).

When evaluating colonoscopy-related parameters, the median Boston Bowel Preparation Score was 8 (IQR 7–9). The adenoma detection rate was 29.2% among the 137 colonoscopies reviewed. Malignancy was identified in a total of 2 (1.4%) patients. Terminal ileum mucosa was as-

Table 1. Demographic and clinical features of the participants

Variables	All patients (n=137)
Age (Years, Median, Range)	55 (18-86)
Age Groups (n, %)	
18-49	44 (32.1)
50-69	76 (55.4)
≥70	17 (12.5)
Sex (n, %)	
Female	77 (56.2)
Male	60 (43.8)
Colonoscopy Indication (n, %)	
Screening	59 (43.1)
Abdominal Pain/Constipation	37 (27)
Diarrhea	30 (21.9)
GI Bleeding History	6 (4.4)
Radiologic Findings	5 (3.6)

FOBT: Fecal occult blood test; GI: Gastrointestinal.

Table 2. Colonoscopy-related parameters

Variables	All patients (n=137)
BBPS (Median, IQR)	8 (7-9)
Appearance of Terminal Ileum (n, %)	
Normal	132 (96.5)
Mucosal Nodularity	1 (0.7)
Erosions	2 (1.4)
Ulcerations	2 (1.4)
Polyp	0 (0)
Biopsy from Terminal Ileum (n, %)	
No	132 (96.5)
Yes	5 (3.5)
Adenoma Detection (n, %)	
No	97 (70.8)
Yes	40 (29.2)
Malignancy Detection (n, %)	
No	135 (98.6)
Yes	2 (1.4)

BBPS: Boston bowel preparation score; IQR: Interquartile range.

sessed as normal in 132 (96.5%) patients, while mucosal pathology necessitating biopsy was observed in 5 (3.5%) patients. Among these, mucosal erosion was noted in 2 (1.4%) patients, ulceration in 2 (1.4%) patients, and nodularity in 1 (0.7%) patient (Table 2).

The detection rates of abnormal terminal ileum findings according to colonoscopy indications were found to be statistically significant (p=0.028). Among the patients with abnormal terminal ileum findings, 3 (2.2%) were referred for colonoscopy due to diarrhea, 1 (0.7%) due to radiological findings, and 1 (0.7%) due to abdominal pain (Table 3). In our study, none of the patients who underwent endoscopy were diagnosed with inflammatory bowel disease (IBD), and the pathology results were consistent with non-specific ileitis.

Discussion

The role and necessity of terminal ileum intubation in routine colonoscopy remain controversial, yet it is believed to offer advantages such as confirming the completion of colonoscopy and identifying potential ileal pathologies.[2-5] However, across various series in the literature, the clinical contribution of terminal ileum intubation is reported to be relatively low.[2-4] In our study, among the patients undergoing terminal ileum intubation in the surgical endoscopy unit, macroscopic abnormalities in the ileum were identified in only 5 (3.5%) out of 137 patients. This observation may be attributed to the tendency of patients seeking care at the surgical endoscopy unit to present more with surgical pathologies, whereas internal pathologies such as inflammatory bowel disease (IBD) and terminal ileitis are less prevalent among this cohort.

The literature suggests that terminal ileum intubation may offer benefits in cases of diarrhea, iron deficiency anemia, and right lower quadrant pain, with higher rates of detecting pathology in the terminal ileum among these patients.[4,7] In another study where terminal ileum intubation was conducted and biopsies were taken upon detecting pathological appearance, it was noted that biopsies, apart from those taken under suspicion of IBD, typically yielded nonspecific results. Therefore, the decision to perform a biopsy should be individualized for each patient.[8]

Table 3. Abnormal macroscopic ileal finding rates according to indications

Variables	All patients (n=137)	Normal Terminal Ileum	Abnormal Terminal Ileum	p
Colonoscopy Indication (n, %)				
Screening	59 (43.1)	59 (43.1)	0 (0)	0.028[a]
Abdominal Pain/Constipation	37 (27)	36 (26.2)	1 (0.7)	
Diarrhea	30 (21.9)	27 (19.7)	3 (2.2)	
GI Bleeding History	6 (4.4)	6 (4.4)	0 (0)	
Radiologic Findings	5 (3.6)	4 (2.9)	1 (0.7)	

[a]Fisher's exact test; GI: Gastrointestinal.

In our study, among the 5 patients who underwent biopsies due to abnormal mucosal appearance in the terminal ileum, referrals to colonoscopy were made due to symptoms such as diarrhea, abdominal pain, and radiological findings. The biopsies resulted in non-specific ileitis.

The limitations of our study include its retrospective nature, the focus on cases conducted by a single surgeon, and the relatively small sample size. However, given the scarcity of studies on terminal ileum intubation in surgical endoscopy units, we believe that our findings will provide valuable contributions to the existing literature in this area.

Conclusion

Routine terminal ileum intubation and biopsy in surgical endoscopy units are unlikely to significantly alter the clinical approach and may be selectively applied in patients presenting with symptoms such as diarrhea, radiological evidence of terminal ileum pathologies, or right lower quadrant pain. However, in situations where cecal landmarks are not clearly visualized, terminal ileum intubation may be performed to confirm completion of the colonoscopy.

Disclosures

Ethics Committee Approval: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (Approval Date: 30.04.2024, Protocol Number: 2627).

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – B.D., S.Ö.; Design – B.D., S.Ö.; Supervision – S.Ö.; Materials – B.D., S.Ö.; Data collection and/or processing – B.D.; Analysis and/ or interpretation – B.D.; Literature search – B.D., S.Ö.; Writing – B.D.; Critical review – B.D., S.Ö.

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Midterm outcomes of one anastomosis gastric bypass versus Roux-en-y gastric bypass: Single center experience

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ABSTRACT

Introduction: One anastomosis gastric bypass (OAGB) and Roux-en-Y gastric bypass (RYGB) are successful surgical treatment options for morbid obesity. In this study, we aimed to share our results by comparing these two bypass techniques in a retrospective analysis.

Materials and Methods: A retrospective study was conducted at a single center at Samsun Training and Research Hospital. The outcomes of two groups, laparoscopic OAGB and laparoscopic RYGB, were compared. Patients with a BMI over 40 kg/m² and patients with a BMI over 35 kg/m² with obesity-related comorbidities were included. Patient demographics, obesity-related comorbidities, medications, postoperative outcomes, percentage excess weight loss (%EWL), percentage total weight loss (%TWL), and postoperative BMI were recorded retrospectively.

Results: A total of 64 patients were retrospectively analyzed. Fifty-one of the patients were female, and thirteen were male. There were 21 patients in the OAGB group and 43 patients in the RYGB group. The mean follow-up period was 42.86±3.54 months in the OAGB group and 52.21±11.58 months in the RYGB group ($p<0.05$).

The mean %TWL was 35.43±5.26 in the OAGB group and 34.70±11.31 in the RYGB group ($p>0.05$). The mean %EWL was 83.02±18.95 and 76.08±22.84, respectively ($p>0.05$). The mean BMI was 29.62±5.42 kg/m² in the OAGB group and 30.14±5.05 kg/m² in the RYGB group ($p>0.05$).

There was no significant difference in the improvement of obesity-related comorbidities. However, de novo reflux was significantly higher in OAGB patients.

Conclusion: OAGB and RYGB are both effective procedures for treating morbid obesity. Both procedures provide similar improvements in obesity-related diseases, although de novo reflux appears to be more common in OAGB patients.

Keywords: Morbid obesity, one anastomosis gastric bypass, Roux-n-Y gastric bypass

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Introduction

Obesity has become one of the most serious public health challenges of our time. It is known to be a cause of certain cancers and is associated with numerous other problems, such as type 2 diabetes, hypertension, sleep apnea, and coronary heart disease.[1-6] In 2016, more than 1.9 billion adults aged 18 years and older were overweight, and more than 650 million adults were obese. The global prevalence of obesity nearly tripled between 1975 and 2016.[7] Unfortunately, the food industry, lifestyle changes, and environmental conditions negatively impact people, causing them to gain excess weight.[8-15]

Diet and physical activity are typically the starting points in treating obesity. However, the rate of permanent weight loss in morbidly obese patients using these treatment options is very low because patients struggle to adhere to diet and exercise programs for extended periods. There are currently no medical treatments with long-term success. Today, the most effective treatment for morbid obesity is surgery. One anastomosis gastric bypass (OAGB) and Roux-en-Y gastric bypass (RYGB) are successful surgical options for the treatment of morbid obesity.[16-27]

Roux-en-Y gastric bypass (RYGB) has been used safely in bariatric surgery for many years with successful long-term outcomes. One anastomosis gastric bypass (OAGB) is a restrictive and malabsorptive procedure like RYGB, first reported by Rutledge in 2001.[23] Since no enteroenterostomy is performed, the procedure is completed with a single anastomosis between the stomach and small intestine. The absence of a second anastomosis was expected to reduce morbidity by preventing surgical complications, such as internal herniation, anastomotic leakage, and bleeding. Both procedures are effective in treating obesity-related conditions. This study aimed to share our results by comparing these two bypass techniques in a retrospective analysis.

Materials and Methods

This retrospective study was conducted between January 2016 and December 2020 at a single center, Samsun Training and Research Hospital. The study was approved by the Ethics Committee at the Ethics Committee of Samsun University Hospital (no GOKAEK 2024/5/11). The outcomes of two groups, laparoscopic OAGB and laparoscopic RYGB, were compared. Patients with a body mass index (BMI) over 40 kg/m² and those with a BMI over 35 kg/m² with obesity-related comorbidities were included. Morbidly obese patients aged 18 to 65 years were eligible for the study. Patients who underwent a revision of any gastric bypass procedures, were lost to follow-up, or could not be contacted to obtain current data were excluded from the study.

All patients underwent preoperative endoscopy. RYGB was preferred by surgeons for patients with gastroesophageal reflux, hiatal hernia, or esophagitis. After surgery, patients were given a clear liquid diet. They remained on a liquid diet for two weeks, followed by pureed food for four weeks. After this period, patients were gradually reintroduced to a normal diet, provided they chewed thoroughly. Multivitamins were given postoperatively, and physical activity was planned by a sports specialist. To prevent muscle atrophy, patients began aerobic exercise two weeks after surgery and resistance exercise two months later.

Demographic characteristics, including age, sex, and BMI, were recorded. Obesity-related comorbidities and medications were recorded retrospectively. Patients were called in for clinic assessment. Type 2 diabetes remission was defined as HbA1c below 6% and normal fasting glucose without medication. Sleep apnea remission was defined as no longer needing continuous positive airway pressure (CPAP), and asthma and hypertension remission was defined as no longer requiring drug therapy. Updated information was obtained by telephone for patients unable to attend follow-up appointments.

Statistical Methods

Scaled values were described using means and standard deviations, while nominal and ordinal parameters were described using frequency analysis. The Kolmogorov-Smirnov test was used to assess the normality of the scaled parameters. The independent samples t-test was used to compare normally distributed values, while the Mann-Whitney U test was used for non-normally distributed parameters. Fisher's exact test was used to compare categorical variables. A 95% confidence interval and a significance level of 0.05 were used. SPSS 25.0 for Windows was employed to assess the research parameters.

Surgical Techniques

In RYGB, a gastric pouch was created using an endoscopic stapler with a volume of 30–40 ml. A 35 mm antecolic anastomosis was performed between the bowel loop, 50 cm from the ligament of Treitz, and the newly created gas-

tric pouch using a linear stapler. The biliopancreatic limb was transected just proximal to the gastroenterostomy and anastomosed to 150 cm of the alimentary limb. The stapler orifice was closed with polypropylene running sutures, and the mesenteric defect was closed with non-absorbable sutures.

In OAGB, dissection was performed along the lesser curvature below the crow's foot to enter the lesser sac. The gastric pouch was created using endoscopic staplers guided by a 36F gastric calibration tube. An anastomosis was created between the jejunum, 200 cm from the ligament of Treitz, and the new gastric pouch. The stapler orifices were closed with polypropylene running sutures.

Results

A total of 64 patients were analyzed retrospectively. Fifty-one of the patients were women, and thirteen were men. There were 21 patients in the OAGB group and 43 in the RYGB group. No significant differences were observed between the groups in terms of age, gender, or BMI. The groups were similar in terms of obesity-related diseases (Table 1).

The mean follow-up was 42.86±3.54 months in the OAGB group and 52.21±11.58 months in the RYGB group, showing a significant difference. The mean percentage total weight loss (%TWL) was 35.43±5.26 in the OAGB group and 34.70±11.31 in the RYGB group, with no significant difference between the groups. The mean percentage excess weight loss (%EWL) was 83.02±18.95 and 76.08±22.84, respectively, and was similar between the groups. At the end of follow-up, the mean BMI was 29.62±5.42 kg/m² in the OAGB group and 30.14±5.05 kg/m² in the RYGB group, with no significant difference. There was also no difference in the improvement of obesity-related comorbidities, such as asthma, diabetes mellitus, hypertension, and obstructive sleep apnea, between the groups. Postoperatively, B12 deficiency, vitamin D deficiency, and iron deficiency were observed at similar rates in both groups. However, de novo reflux was significantly higher in OAGB patients (Table 2).

Discussion

Although many treatment options exist for obesity, surgery remains the most effective. Currently, there is ongoing research into endoscopic procedures and medical treatments. While these options have not yet shown consistent success, they may supplement surgical treatment in the future. OAGB and RYGB are two well-established surgical options with high success rates. RYGB has been safely performed for decades and is one of the most widely accepted procedures worldwide. Although OAGB is a newer procedure, it is considered a successful and safe method with long-term results.

In our study, RYGB patients had a longer follow-up period (42.86±3.54 months in the OAGB group and 52.21±11.58 months in the RYGB group). This difference is attributed to

Table 1. Baseline characteristics of the patients

	OAGB (n=21)	RYGB (n=43)	p
Gender, n (%)			0.313[a]
Female	18 (85.7)	33 (76.7)	
Male	3 (14.3)	10 (23.3)	
Age, mean±SD	42.43±12.08	42.56±12.18	0.968[b]
BMI, mean±SD	45.95±8.09	46.57±5.84	0.587[c]
Type 2 DM preop, n (%)	13 (61.9)	17 (39.5)	0.078[a]
Oral antidiabetic drug, n (%)	13 (61.9)	17 (39.5)	0.078[a]
İnsulin, n (%)	4 (19.0)	5 (11.6)	0.329[a]
HT preop, n (%)	9 (42.9)	12 (27.9)	0.180[a]
Asthma, n (%)	3 (14.3)	5 (11.6)	0.525[a]
Sleep apnea, n (%)	3 (14.3)	3 (7.0)	0.303[a]
Dispnea, n (%)	7 (33.3)	10 (23.3)	0.286[a]

[a]Fisher's Exact Test; [b]Independent Samples t-test; [c]Mann Whitney U Test; SD: Standard Deviation; OAGB: One anastomosis gastric bypass; RYGB: Roux-en-Y gastric bypass; BMI: Body mass index; DM: Diabetes mellitus; HT: Hypertension.

Table 2. Postoperative outcomes of the groups

	OAGB (n=21)	RYGB (n=43)	p
%EWL mean±SD	83.02±18.95	76.08±22.84	0.233[a]
%TWL mean±SD	35.43±5.26	34.70±11.31	0.723[a]
BMI (kg/m^2) mean±SD	29.62±5.42	30.14±5.05	0.704[a]
Type 2 DM postop, n (%)	1 (4.8)	3 (7.0)	0.602[a]
Oral antidiabetic drug, n (%)	1 (4.8)	3 (7.0)	0.602[a]
İnsulin, n (%)	-	1 (2.3)	0.672[a]
HT postop, n (%)	3 (14.3)	4 (9.3)	0.417[a]
Denovo reflux, n (%)	4 (19.0)	-	0.009[a]
B12 deficiency, n (%)	6 (28.6)	10 (23.3)	0.432[a]
D Vit deficiency, n (%)	6 (28.6)	5 (11.6)	0.093[a]
Fe deficiency, n (%)	6 (28.6)	13 (30.2)	0.567[a]
Dumping, n (%)	1 (4.8)	4 (9.3)	0.466[a]
Follow up (month) mean±SD	42.86±3.54	52.21±11.58	0.000[b]

[a]Independent Samples t-test; [b]Mann Whitney U Test; SD: Standard Deviation; OAGB: One anastomosis gastric bypass; RYGB: Roux-en-Y gastric bypass; EWL: Excess weight loss; TWL: Total weight loss; BMI: Body mass index; DM: Diabetes mellitus; HT:Hypertension.

the fact that RYGB was adopted earlier in our clinic, while OAGB was introduced later. Initially, concerns about the single anastomosis in OAGB causing complications, such as contamination of small intestinal contents into the stomach, made RYGB the preferred surgical option. Consequently, RYGB procedures outnumber OAGB by nearly two to one. Despite initial concerns among many surgeons about the risk of gastric and esophageal cancer[28], the shorter operation time and lower complication rate have gradually increased the popularity of OAGB.[28,29]

When comparing OAGB and RYGB in terms of weight loss, no significant differences were observed between the groups. The mean BMI decreased to 29.62±5.42 kg/m² in the OAGB group and 30.14±5.05 kg/m² in the RYGB group (p=0.704). Additionally, the %EWL and %TWL were similar between groups. We presented mid-term results from a single center, and although some studies have suggested that OAGB leads to more effective weight loss in the short term, long-term outcomes indicate that both operations have similar effects on weight loss.[30] However, it should be noted that a significant portion of these studies are not randomized, and few randomized trials have a follow-up period exceeding five years.[26,27,31-34]

According to the five-year data from the YOMEGA trial published by Robert et al.[30], OAGB was not inferior to RYGB in terms of percentage excess BMI loss at five years, with similar metabolic outcomes. However, they found that the most common adverse event in the OAGB group was clinical gastroesophageal reflux disease, and 8% of patients were converted from OAGB to RYGB. Initially, concerns about bile reflux in OAGB were tied to its resemblance to Billroth II surgery. However, due to the narrow and long gastric pouch and the narrow gastroenterostomy anastomosis, the adverse effects were less than expected. Additionally, the long biliary limb and the metabolic differentiation of bile in the intestine may reduce the impact of bile reflux. In our study, postoperative reflux was the most significant comorbidity in OAGB patients, but it was managed effectively with medical treatment.

Both gastric bypass procedures cause anatomical changes in the gastrointestinal system, reducing stomach volume and gastric acid secretion, which hampers proper food digestion. The postoperative liquid and pureed diets also affect vitamin intake. We observed vitamin D, B12, and iron deficiencies in our patients, with no significant difference between groups. OAGB and RYGB are both malabsorptive procedures requiring careful attention to potential nutritional deficiencies. Overlooking these deficiencies can lead to serious problems, including protein malnutrition and negative effects on bone metabolism.[35-37] We recommend lifelong follow-up to monitor vitamin levels and provide necessary supplements.

One limitation of our study is that it was retrospective. There is a lack of literature on this topic, largely due to the small number of prospective studies and the short follow-up periods of existing studies. Additionally, the method for measuring small bowel length, which provides valuable information for standardizing groups, was not recorded in this study. Another limitation is the absence of preoperative nutritional assessments, which hinders a comprehensive evaluation of postoperative outcomes.

Conclusion

Both OAGB and RYGB are effective procedures for treating morbid obesity, providing similar improvements in obesity-related diseases. Large, randomized trials with long-term follow-up are needed to evaluate these operations in terms of nutritional outcomes and complications.

Disclosures

Ethics Committee Approval: This prospective anatomical and clinical study was approved by the Ethics Committee of the Ethics Committee of Samsun University Research and Training Hospital (Approval Number: 2024/5/11) and was conducted in the Department of Surgery at Samsun Training and Research Hospital Research and Training Hospital.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – S.K.; Design – S.K., S.S., O.K., H.E.; Supervision – S.K.; Materials – S.S.S.K.O.K.; Data collection and processing – S.K., S.S.; Analysis and interpretation – O.K., H.E.; Literature search – S.K., S.S.; Writing – S.K.; Critical review – S.K., S.S., O.K., H.E.

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Comparison of the effects of endoscopic intragastric balloons: A single-center study

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ABSTRACT

Introduction: Obesity is a major health care problem and one of the sustained solutions of obesity is bariatric surgery and bariatric endoscopic procedures. An endoscopic intragastric balloon (IGB) is a procedure for achieving weight loss in obese patients. This study evaluated the effects of two types of endoscopic IGBs and compared their outcomes at our center.

Materials and Methods: This retrospective analysis included patients who had endoscopic IGBs between 2021–2024 and recorded their demographic data: age, gender, weight, height, and body mass index (BMI). The patients were divided into two groups according to balloon type—adjustable IGB and non-adjustable IGB—to compare their weight loss, excess weight loss percentage (EWL%), and total weight loss percentage (TWL%). We also analyzed initial balloon volume, increase in balloon volume, balloon intolerance, and balloon complications.

Results: Among the 93 patients included, 50 had non-adjustable IGBs, and 43 had adjustable IGBs. Their mean age was 34.9±8.8 years, 82.8% were women, and the mean BMI was 32.7±4.2 kg/m^2. Eight patients (8.6%) removed the balloon due to intolerance. The mean weight loss was 9.1±7.6 kg, the mean TWL% was 9.9±7.9, and the mean EWL% was 42.6±66%. IGBs achieved sufficient weight loss ($p<0.00$), with no significant difference in weight loss, EWL%, or TWL% changes found between the adjustable IGB and the non-adjustable IGB groups. Furthermore, no relationship was observed between balloon type or initial balloon volume in patients with early removal. No major complication was observed.

Conclusion: Endoscopic IGBs achieved significant weight loss in patients with obesity, with low complication rates and no significant difference in weight loss between adjustable or non-adjustable IGBs of different volumes.

Keywords: Bariatric Endoscopy, Endoscopic Balloon, Intragastric Balloon, Weight Loss

Introduction

Obesity is a major health care problem affecting more than 600,000 patients worldwide, according to the World Health Organization. The increase in obesity and obesity-related comorbidities has increased the number of patients presenting at bariatric centers. Bariatric surgeries and bariatric endoscopic interventions are frequently performed to solve these conditions.[1–6]

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The use of balloons as a bariatric intervention was inspired by the notion of placing objects, such as bezoars, to take up volume in the stomach. The first intragastric balloon (IGB) was produced by Nieben in 1982 after observing the early satiety effect of gastric bezoars in the stomach.[2,7] An additional mechanism of weight loss is achieved by delaying gastric emptying time through the closing of the stomach antrum.[8] The balloons are classified in many different ways, including endoscopic balloons or swallowable balloons, air-filled balloons or fluid-filled balloons, adjustable balloons, or non-adjustable balloons. The balloons are made to reach the desired volume by filling with 400–700 ml of air, saline with or without methylene blue, as approved by the Food and Drug Administration.[7,8]

IGB has gained popularity due to its minimally invasive, reversible, and nonsurgical nature. It is mostly used for weight loss in the patient population with a body mass index (BMI) between 27–35 kg/m^2. Additionally, fear of bariatric surgery complications, such as bleeding, leakage, and venous thrombosis, may cause patients to prefer balloon application. Furthermore, surgeons refer male patients with a BMI over 50 kg/m^2, high subcutaneous fat tissue thickness, high volume of left side of liver, and thick mesentery, as well as patients with high comorbid diseases, for balloon applications as a bridging treatment before surgery.[2,4,5,9]

Many studies have suggested the safety and effectiveness of IGBs. A study from Brazil showed that the mean total weight loss percentage (TWL%) and mean weight loss were 18.4±2.3% (range 0–52%) and 18.3±4.4 kg (range 0–87.5), respectively.[2,10] Another study suggested that balloons showed the same effectiveness with adolescent populations, with a reduction in BMI of 5.87±3.4.[11]

However, IGBs may cause complications. Balloon intolerance, described by symptoms such as nausea, vomiting, and abdominal pain, was frequently observed. Spontaneous deflation of the balloon and removal of the balloon before the expected time could be considered minor complications. However, in rare cases, serious complications, such as esophageal or stomach perforation, intestinal obstruction or perforation, and gastric bleeding, may occur, and patients need emergent surgical intervention.[2,7,12]

The aim of this study was to evaluate the effects of endoscopic IGBs and compare adjustable intragastric balloons (aIGBs) and non-adjustable intragastric balloons (naIGBs) in our center.

Materials and Methods

The study was designed as a retrospective data analysis. Patients who had endoscopic IGBs at our bariatric center between January 2021 and January 2024 were included in the study. Patient demographic data, such as patients' age, gender, pre-balloon weight, height, BMI value, and weight loss, were collected from patient files retrospectively. TWL% and excess weight loss percentage (EWL%) were analyzed statistically. Balloon removal due to patient intolerance, gastric ulcers, or balloon deflations before the expected balloon removal time was recorded. Further, balloon starting volume and increasing balloon volume data were documented and analyzed. Informed consent was not applied due to retrospective study.

Inclusion/Exclusion Criteria

The included patients were those who underwent endoscopic intragastric balloon application with naIGBs and aIGBs. Patients who underwent non-endoscopic intragastric balloon application and those whose data were inaccessible were excluded. A total of 128 patients who underwent intragastric balloon application were accessed from January 2021 to January 2024. Eighteen patients were excluded due to non-endoscopic balloons. Seventeen patients were excluded from the study due to the inaccessibility of their data. Finally, after the exclusion, 93 patients were included in the study: 43 patients who had aIGB for 12 months (Spatz III®), 50 patients who had naIGB for 6 months (MEDSIL®) (Fig. 1).

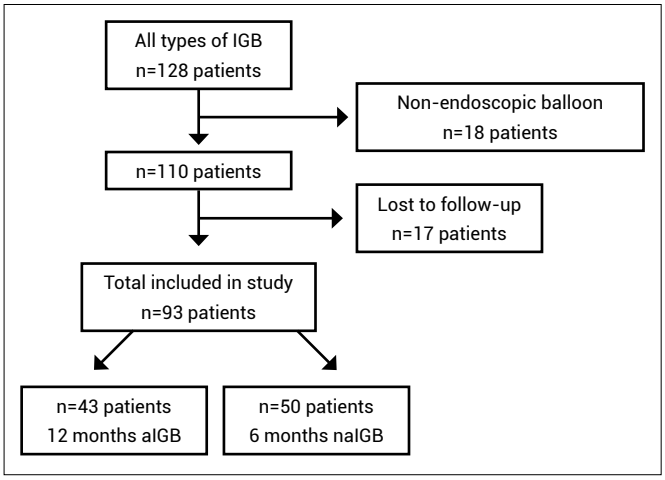

Figure 1. Patient selection data and exclusion process. IGB: Intra-gastric balloon; aIGB: Adjustable IGB; naIGB: Non-adjustable IGB

Balloon Insertion Technique

Intragastric balloon insertion was performed under sedo-analgesia. Routine esophago-gastro-duodenoscopy was performed to control the inside of the upper gastrointestinal tract for esophageal disease, gastric ulcers, gastric malignancy, or giant hiatal hernia. Balloons were then sent into the stomach, and their volume was increased by saline added methylene blue under direct vision. After all the procedures were completed, a third endoscopy was performed to confirm that there were no complications. The aIGBs remained in the stomach for 12 months, while the naIGBs remained in the stomach for 6 months. After the balloon time expired, they were removed endoscopically under sedo-analgesia.

Anti-Emetic Protocol

Aprepitant was routinely administered to each patient two hours before the endoscopic evaluation. After the balloon was placed, proton pump inhibitors, metoclopramide, ondansetron, hyoscine butylbromide, and paracetamol were applied by parenterally. Only liquid diets were allowed for the first three days. Aprepitant (2 more days, once a day), ondansetron (1 week, twice a day), and metoclopramide (1 week, 3 times a day) were administered to all patients.

Calculation of TWL% and EWL%

The total weight loss percentage was obtained by dividing the amount of weight loss by the total body weight. To calculate the excess weight loss percentage (EWL%), the ideal weight was calculated by accepting the BMI as 25 kg/m^2. The amount of excess weight was determined by subtracting the ideal weight from the starting weight. EWL% was calculated by dividing weight loss by excess weight. The primary outcome of the study was to evaluate the effect of IGB and compare the effects of IGB in our unit.

Statistical Analysis

Mean, standard deviation, median, minimum, maximum, frequency, and ratio values were used in the descriptive statistics of the data. The distribution of variables was measured using the Kolmogorov–Smirnov and Shapiro–Wilk tests. An independent sample t-test was used in the analysis of quantitative independent data with a normal distribution. The Mann–Whitney U test was used in the analysis of quantitative independent data with a non-normal distribution. The Wilcoxon test was used in the analysis of dependent quantitative data, and the chi-square test was used in the analysis of qualitative independent data. Spearman correlation analysis was used in the correlation analysis. The SPSS 27.0 program was used in all analyses.

Complications

A total of 14 patients (15.1%) had to remove their balloons before the expected expiry date, eight (8.6%) of whom presented with complaints of severe abdominal pain, nausea, and vomiting in the first 10 days; thus, their balloons were removed due to intolerance. In three (3.2%) patients, the balloon had to be removed before its expiry date because of discontinuation of gastric protection medication, which caused gastric ulcers. Spontaneous deflation of the balloon caused early balloon removal in another three (3.2%) patients. Severe complications such as bleeding, gastric, or esophageal perforation, and balloon migration to the intestine were not observed.

Results

The study included 93 patients with a mean age of 34.9±8.8 and a mean BMI value of 32.7±4.2 kg/m^2 and of whom 82.8% were women. Fourteen patients had their balloons removed before the expected time, and eight patients (8.6%) could not tolerate the balloon procedure (5 cases: 10% naIGB, 3 cases: 6.9% aIGB). Thus, for a subgroup analysis, 50 patients (53.8%) were included in the naIGB group, and 43 patients (46.2%) were included in the aIGB group. The mean weight loss in both balloon groups was 9.1±7.6 kg. The mean TWL% was 9.9±7.9, and the EWL% was 42.6±66%. The mean balloon volume was 449.3±54.1 ml, and 55.8% of the adjustable balloons showed an increased volume. The patients' demographic data are shown in Table 1.

An examination of all patients revealed that they all achieved statistically significant weight loss (p=0.000) (Table 2, Fig. 2).

We divided the patients according to their balloon removal time, yielding two groups: the early balloon removal group and the on-time balloon removal group. A comparison of the groups revealed no significant difference between the two groups in terms of demographic features or BMI values. There was also no relationship between balloon type and balloon volume or balloon removal time (Table 3).

Table 1. Patient demographics

	Min–Max	Median	Mean±SD	
			n	%
Age	17.0–55.0	35.0	34.9±8.8	
Gender				
Female			77	82.8
Male			16	17.2
Weight	64.0–140.0	88.0	90.6±15.3	
Weight loss	0.0–40.0	9.0	9.1±7.6	
Height (m)	1.5–1.9	1.7	1.7±0.1	
BMI	23.0–44.1	32.8	32.7±4.2	
BMI at the removal time	20.5–44.1	29.5	29.6±4.2	
TWL%	0.0–38.1	10.2	9.9±7.9	
EWL%	-390.6–242.5	37.3	42.6±66.0	
Balloon volume (ml)	350.0–550.0	450.0	449.3±54.1	
Last balloon volume (ml)	350.0–720.0	550.0	530.3±82.4	
Increase of balloon volume				
(-)			19	44.2
(+)			24	55.8
Early removal of balloon				
(+)			14	15.1
(-)			79	84.9
Balloon type				
naIGB			50	53.8
aIGB			43	46.2

Min–Max: minimum-maximum; SD: standard deviation; BMI: body mass index; TWL%: Total weight loss percentage; EWL%: excess weight loss percentage; naIGB: non-adjustable intragastric balloon; aIGB: adjustable intragastric balloon.

Table 2. Comparison of weight loss

	Pre-balloon weight		Last weight		p
	Mean±SD	Median	Mean±SD	Median	
Weight	90.6±15.3	88.0	81.5±14.8	80.0	0.000[w]

[w]Wilcoxon test.

Based on the type of balloon, patients in the aIGB group had significantly higher BMI and weight than the naIGB group ($p<0.05$). There was no statistically significant difference between the two groups in the analysis of weight loss, EWL%, and TWL%, as shown in Table 4.

Further comparison of two aIGB patient subgroups—those who had and those who did not have increased balloon—revealed no significant difference in terms of weight loss, EWL%, TWL% or balloon removal time (Table 5).

Discussion

Obesity has become an epidemic disease, and the number of obese or overweight individuals is increasing daily, with concurrent increases in patients treated at bariatric centers for bariatric surgical operations or bariatric endoscopic procedures. Endoscopic methods for weight loss are frequently preferred by patients because they are reversible and have low complication rates. IGBs are being used in in-

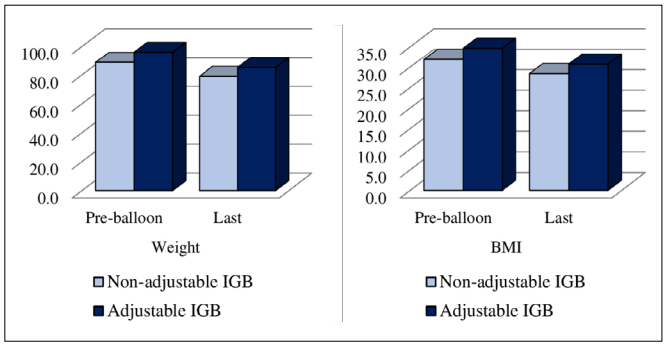

Figure 2. Weight and BMI loss.

creasing numbers due to weight loss, bridging treatments, or fear of complications from bariatric surgeries.[2,13–17]

Many studies have suggested that IGBs provide statistically significant weight loss. A systematic review of 26 studies and over than 6000 patients demonstrated a mean weight loss of 15.7±5.3 kg and a mean BMI change of 5.9±1.0 kg/m2 with naIGB. The findings also showed that the EWL% changed by 36.2±6.3%.[7] Another study from Brazil consisting of 41863 patients suggested a mean weight loss of 18.3±4.4 kg and a mean total weight loss percentage of 18.4±2.9%.[2] A randomized controlled study related to aIGB indicated that median weight loss was 15 kg (0-34 kg) in 1 year.[3] A meta-analysis and review showed that IGBs decrease total body weight loss percentage by 7.6-14.1% at 6 months and 7.5–14% at 12 months.[1] Our results are compatible with the literature, as we recorded a mean weight loss of 9. 1±7.6 kg, a mean TWL% of 9.9±7.9%, and a mean EWL% of 42.6±66.0% (Table 1). When the weight loss was compared according to balloon types, no significant difference was observed in terms of TWL%, EWL% or weight loss in both balloon types. Although the BMI and excess weight of patients who underwent aIGB were statistically significantly higher and aIGB was used for longer period of time, our study showed that there was no significant difference in terms of weight loss between aIGB and naIGB. It could be said that naIGB provides same efficiency (in term of weight loss) in a shorter time than aIGB (Table 4).

A systematic review and meta-analysis consisting of 5549 patients suggested that there was no relationship between

Table 3. Comparison of groups according to balloon removal time

	Early balloon removal			On-time balloon removal			p
	Mean±SD		Median	Mean±SD		Median	
	n	%		n	%		
Age	36.4±9.2		38.5	34.6±8.8		35.0	0.500[t]
Gender							
Female	12	85.7		65	82.3		0.754[X²]
Male	2	14.3		14	17.7		
Weight	83.8±9.70		83.5	91.8±15.8		89	0.095[m]
Height	166.2±6.6		165.2	169.4±7.5		168.1	0.109[m]
BMI	31.7±4.0		32.6	32.9±4.2		32.9	0.327[t]
TWL%	4.8±6.1		0.0	10.8±7.9		10.9	0.011[m]
EWL%	17.9±22.6		0.0	47.0±70.1		41.7	0.006[m]
Balloon volume (ml)	426.8±47.5		400.0	453.3±54.5		475.0	0.084[m]
Last balloon volume (ml)	550.0±0.0		550.0	528.5±85.9		550.0	0.734[m]
Increase in balloon volume							
(-)	6	66.7		13	38.2		0.127[X²]
(+)	3	33.3		21	61.8		
Balloon type							
NaIGB	5	35.7		45	57.0		0.142[X²]
aIGB	9	64.3		34	43.0		

[t]independent sample t-test; [m]Mann–Whitney U test; [X²]chi-square test; TWL%: total weight loss percentage; EWL%: excess weight loss percentage; BMI: body mass index.

Table 4. Comparison of balloon types

	NaIGB			aIGB			p
	Mean±SD		Median	Mean±SD		Median	
	n	%		n	%		
Age	36.3±8.6		37.0	33.3±8.9		32.0	0.105[t]
Gender							
Female	42	84.0		35	81.4		0.740[X²]
Male	8	16.0		8	18.6		
Weight	87.5±14.0		84.0	94.2±16.0		90.0	0.035[m]
Weight loss	8.5±7.3		9.0	9.9±8.0		9.0	0.501[m]
Change in groups p	0.000[W]			0.000[W]			
Height	169.4±7.6		67.7	168.4±7.2		168.1	0.784[m]
BMI	31.4±4.0		31.1	34.3±3.8		34.6	0.000[m]
TWL%	9.2±7.6		10.0	10.7±8.3		10.7	0.463[m]
EWL%	49.6±50.5		39.1	34.4±80.2		37.3	0.652[m]
Balloon volume (ml)	487.1±23.4		500.0	405.3±45.8		400.0	0.000[m]
Excess Weight	19.7±10.2		19.7	25.8±11.7		25.6	0.011[t]
Early removal of balloon							
(+)	5	10.0		9	20.9		0.142[X²]
(-)	45	90.0		34	79.1		

[t]independent sample t-test; [m]Mann–Whitney U test; [X²]chi-square test; NaIGB: non-adjustable intragastric balloon; aIGB: adjustable intragastric balloon; TWL%: total weight loss percentage; EWL%: excess weight loss percentage; BMI: body mass index.

balloon volume and weight loss and that an increased volume of up to 700 ml did not cause early removal. The analysis also found that decreased volume could cause distal esophagitis.[18] In our study, the mean balloon volume was 449.3±54.1 ml. Change in balloon volume or increased balloon volume did not result in a statistically significant difference in weight loss, EWL%, or TWL%, as in the literature (Table 5).

Although IGBs take up space in the stomach and provide early satiety, it was observed that four patients in the naIGB group gained weight with the balloon in their stomachs. Furthermore, we had five patients who, although lost weight with the balloon, could not lose any weight as soon as the balloon was removed. Thus, 18% of the patients with naIGB did not benefit from the balloon. We also observed that six patients in the aIGB group lost weight but remained at the same weight after the balloon was removed. These findings show that 16.1% of all patients in our study did not achieve weight loss with balloons, which indicates that the balloon should be supported with a strict diet program and exercise and that it does not produce the same results for every patient.

One of the most undesirable aspects of balloon application is early balloon removal due to intolerance, which manifests as severe abdominal pain, nausea, and vomiting following insertion. In the literature, balloon removal rates due to intolerance vary widely. A study related to aIGB showed that balloon removal due to intolerance was 17%.[3] A systemic review showed that the rate of early balloon removal was 3.5%.[7] Another study suggested an early removal rate of 2.2% that consisted of 2.5% with aIGBs, 2.4% with naIGBs, and 0.8% with air-filled IGBs.[2] A study that consisted of 1770 elipse gastric balloons suggested that the early removal rate was 2.9%. In our study, the early removal of IGBs due to intolerance was 8.6%, which is compatible with the literature. All patients who could not tolerate the balloon were female, and the intolerant patients in the balloon group had a statistically lower BMI. Additionally, neither balloon type nor initial balloon volume resulted in a change in balloon tolerance (Table 4).

A Brazilian study showed 141 gastric ulcers with IGBs and the need for removal in 28 cases. The authors suggested that the percentage of gastric ulcers with aIGB was 5.7%.

Table 5. Comparison of groups due to increase of balloon volume

	Increase of balloon volume (-)			Increase of balloon volume (+)			p
	Mean±SD		Median	Mean±SD		Median	
	n	%		n	%		
Age	34.3±8.7		37.0	32.5±9.2		31.0	0.527[t]
Gender							
Female	16	84.2		19	79.2		0.673[X²]
Male	3	15.8		5	20.8		
Weight	89.9±14.8		86.0	97.6±16.4		95.5	0.056[m]
Height	166.0±7.1		64.0	170.3±6.8		70.6	0.047[t]
BMI	33.9±3.0		34.4	34.6±4.3		34.8	0.553[t]
TWL %	9.3±6.8		10.0	11.8±9.3		13.1	0.335[t]
EWL %	36.6±28.5		34.4	32.8±105.4		40.7	0.749[m]
Balloon volume (ml)	428.9±45.1		400.0	386.7±37.5		377.5	0.001[m]
Early balloon removal							
(+)	6	31.6		3	12.5		0.127[X²]
(-)	13	68.4		21	87.5		

[t]independent sample t-test; [m]Mann–Whitney U test; [X²]chi-square test.

[2] Although we recommended the use of proton pump inhibitors for all patients, we had to remove the balloon before its expiry date due to gastric ulcers in three patients (3.2%). Gastric ulcers were seen in patients with aIGB insertion, one of whom was removed in the fourth month and the other two in the third month. This can be related to the balloon or balloon volume increasing to erode the stomach wall and causing ulcers.

IGBs are preferred as an option for patients who want to lose weight but are afraid of the complications of bariatric surgeries. However, although very rare, IGBs can lead to mortal complications and the need for urgent surgery. In the literature, there are case reports of cases that caused intestinal obstruction due to intestinal migration with balloon deflation, cases that required urgent laparoscopic exploration due to gastric perforation, and cases that underwent emergency surgery due to esophageal rupture.[19–22] A review suggested that 22 gastric perforations, 2 esophageal perforations, and 12 bowel obstructions have been reported in the literature.[23] No such major complications were observed in our study. According to our experience, inflating the balloon under direct endoscopic vision protects patients from incidental iatrogenic esophageal injuries. This is one aspect that makes endoscopic balloons more applicable than non-endoscopic balloons.

Furthermore, the fact that intestinal obstruction cases are rarely seen in non-endoscopic balloons[24] is provoking investigations into the reliability of leaving balloons to be excreted through the gastro-intestinal tract rather than removing balloons endoscopically. We noted the benefit of inflating the balloon with methylene blue in three of our patients (3.2%). We prevented the migration of balloons and intestinal obstructions by removing the balloon endoscopically due to the presence of methylene blue in the urine before the expected balloon expiry date.

Limitations

This study was a single-center retrospective study. A multi-center and prospective study might have achieved more statistically significant results in both types of IGBs. Loss of follow-up rates in the obese population and single-day discharge conditions of endoscopic balloon procedures caused the loss of many patient data, thereby reducing the number of patients in the study. Gastric ulcers that occurred due to discontinuing their stomach-protecting agent medications caused early balloon removal, further reducing the number of patients who reached the balloon expiration date. Establishing a more stringent follow-up program can help reduce the loss of patients to follow-up and patients' data.

Conclusion

Endoscopic IGBs achieved sufficient weight loss in both groups without major complications. Balloon type, increase in balloon volume, and initial balloon volume did not cause statistically significant differences in weight loss or TWL%. Further multi-center prospective studies are needed on the sustainability of this weight loss and weight regain rate.

Disclosures

Ethics Committee Approval: This study was approved by the İzmir Bakırçay University Non-Interventional Clinical Trials Ethics Committee on 10.07.2024 with the 1693 decision no 1693.

Peer-review: Externally peer-reviewed.

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Authorship Contributions: Concept – B.K., Y.O.; Design – B.K., S.Ç.E.; Supervision – S.Y., Y.O.; Materials – B.K.; Data Collection – S.Y., Y.O..; Analysis and/ or interpretation – B.K., S.Y.; Literature Search – B.K., S.Ç.E.; Writing – B.K., S.Ç.; Critical Review – S.Y.

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LESS

Letter to the Editor

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A rare case in the literature; isolated cystic duct cyst

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A 38-year-old female patient presents to an external center with dyspeptic complaints. Cholelithiasis is detected in her ultrasonography, and preparations are made for the operation. During laparoscopic cholecystectomy, a choledochal cyst is observed, which was not detected on ultrasonography because it mimicked the gallbladder. The procedure is terminated, and she is referred to our clinic for further examination.

The patient's physical examination is normal; there is no additional illness in her medical history, and no history of drug use. Laboratory values are also normal. The patient undergoes MRCP (Fig. 1), and the report indicates a choledochal cyst, type II.

During the operation, a cystic structure next to the gallbladder with its own walls is observed (Fig. 2). When separated by sharp and blunt dissection, it is noted that the middle part of the cystic duct is dilated (Fig. 3). There is a narrow connection between the cystic structure and the gallbladder, leading to the conclusion that this part is the beginning of the cystic duct. The cyst is dilated in the middle section and enters the main hepatic duct by narrowing again. In the removed specimen, the part where the clip is located corresponds to the junction of the cystic duct and the main hepatic duct. The cystic duct is dilated in isolation.

When reviewing the literature, we find that three cases of isolated cystic duct dilatations have been presented before this case. We believe this to be the fourth reported case in the literature.

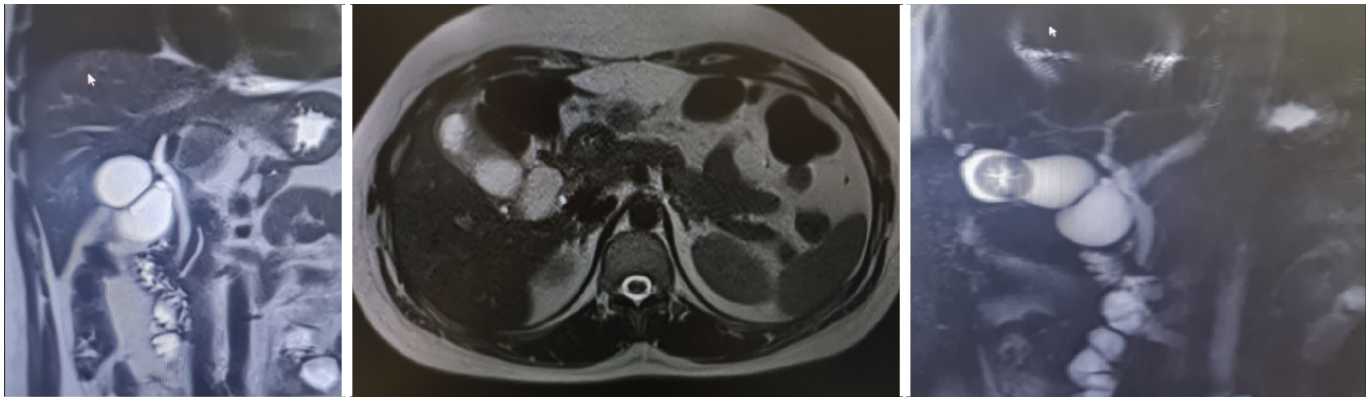

Figure 1. Images from the MRCP of the patient.

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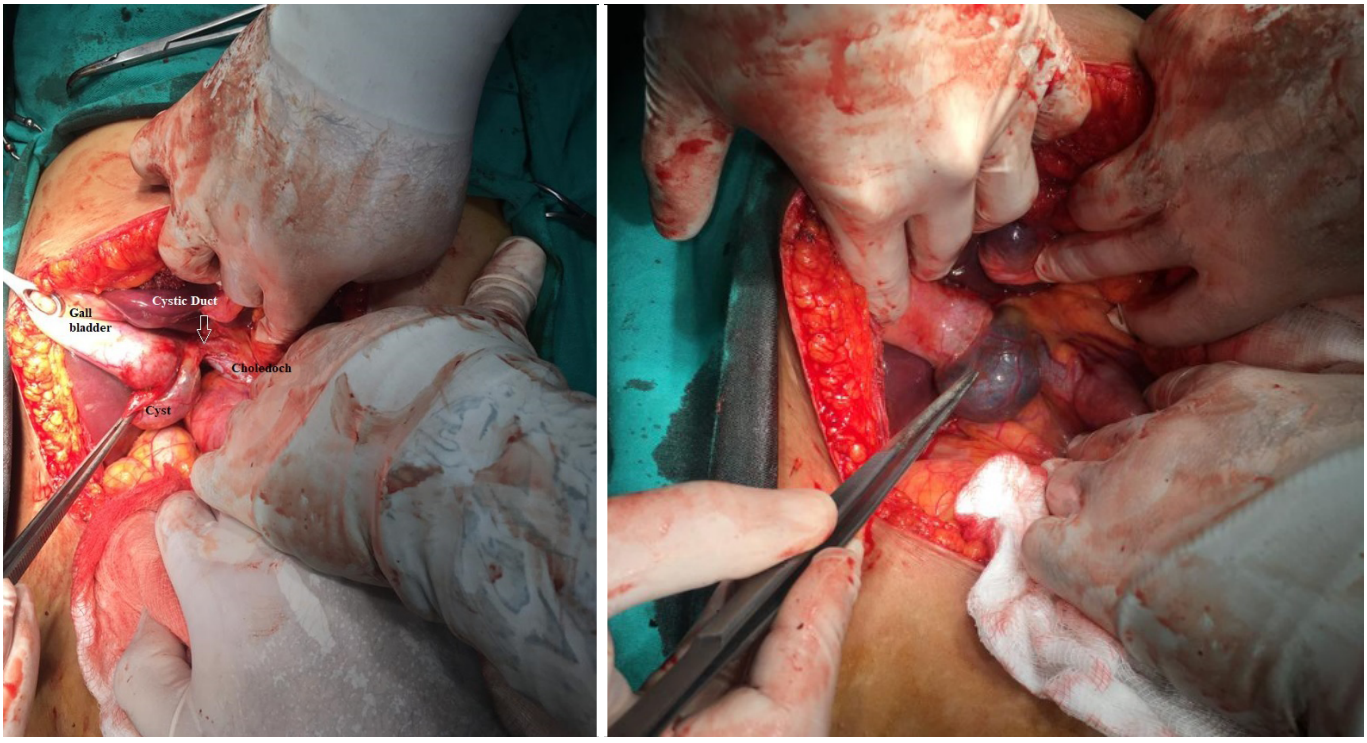

Figure 2. In operation photo.

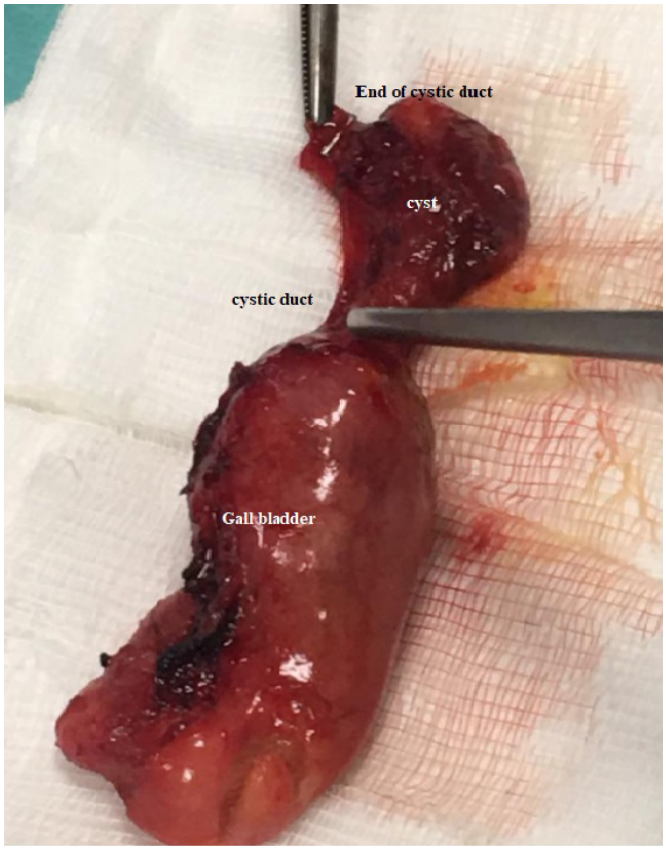

Figure 3. Laparoscopic cholecystectomy specimen.

Macroscopic examination of the surgical specimen did not reveal any biliary tract pathology that could explain the dilatation of the cystic duct.

Cholecystectomy was performed, and the specimen was removed en bloc.

Cystic dilatation of the bile ducts is a very rare condition, with an incidence of approximately 1 in 150,000.[1] It is more common in Asia, with a female-to-male ratio of 4:1, making it more frequent in women. Almost half of the cases (20%-50%) are encountered in adulthood.

It has been reported that the incidence of choledochal cancer in cases of cystic duct dilatation is up to 100 times higher than in the general population.[2]

Choledochal cysts are most commonly classified according to the Todani classification, which includes five types.[1-3] However, dilatation of the cystic duct is not included in Todani's classification. Due to its rarity, no formal classification has been established in the literature. Nonetheless, Serena et al. have named isolated cystic dilatation of the cystic duct as type VI in a modified Todani classification.[4]

Ultrasound, computed tomography, MRCP, and endoscopic retrograde cholangiopancreatography can reveal malformations of the biliary tree;[1-5] however, in some cases, these may not be identified, and detection during surgery is also possible. If necessary, the case should be referred to a higher-level clinic.

Biliary abnormalities should be surgically addressed due to the risk of serious complications such as pancreatitis,

acute cholecystitis, and cholangitis. The treatment of cystic duct dilatation is similar to that of other dilatations, with surgical intervention being the standard approach, as in the treatment of dilatations classified by Todani.

Disclosures

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