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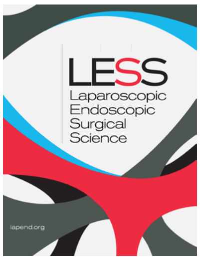

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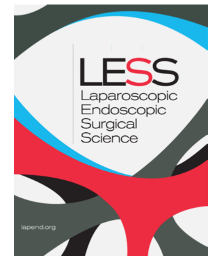

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Laparoscopic Endoscopic Surgical Science (LESS) is a peer-reviewed, independent, international periodical that considers for publication clinical and experimental studies, reviews, case reports, technical contributions, and letters to the editor. Scope 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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Original Article

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Impact of thoracic outlet diameter on surgical outcomes in laparoscopic cholecystectomy

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ABSTRACT

Introduction: This study assesses the influence of inferior thoracic aperture dimensions on the outcomes of laparoscopic cholecystectomy for cholelithiasis. It aims to determine if the size of the thoracic outlet, akin to pelvic measurements in obstetrics, can predict surgical complexity and complications.

Materials and Methods: In this prospective anatomical and clinical study, 32 patients who underwent laparoscopic cholecystectomy between April 2014 and December 2015 at Bursa Yuksek Ihtisas Research and Training Hospital were evaluated. Anteroposterior (AP) and laterolateral (LL) diameters of the inferior thoracic aperture were measured using CT or MRI. The study focused on dissection time and intraoperative blood loss, quantitatively.

Results: Twenty-three of 32 patients (71.9%) were female, and 9 (28.1%) were male. The mean age of the patients was 57.97±16.11 years (min: 29; max: 85). The mean overall dissection time was 1,172.43±427.58 seconds (min: 550; max: 2,157), and the median amount of intraoperative hemorrhage was 6.5 cc (min: 1; max: 23). The mean LL diameter of the patients was 26.02±2.29 cm (min: 21.50; max: 31.50), and the median value of the AP diameter was found to be 11.35 cm (min: 9.40; max: 19.40). A positive relationship was found between the LL and AP diameters (r=0.574; p=0.001). There was a negative relationship between operational time and both LL and AP diameters (r=-0.418; p=0.017 and r=-0.405; p=0.022).

Conclusion: Findings suggest that narrower thoracic apertures can prolong the standard 4-port-access laparoscopic cholecystectomy procedure. This study underscores the importance of measuring thoracic outlet diameters for anticipating surgical difficulty in general surgery, analogous to pelvic measurements in obstetrics. Such measurements could be pivotal in preoperative planning and in improving surgical outcomes.

Keywords: Cholelithiasis, Inferior Thoracic Aperture, Laparoscopic Cholecystectomy, Thoracic Outlet, Thorax Anatomy

Introduction

Cholelithiasis, a prevalent gastrointestinal condition, is categorized into cholesterol stones, pigment stones, and mixed stones, based on its structural features.[1,2] Cholesterol stones affect approximately 10-20% of the global population, with prevalence rates ranging from 10-15% in Western countries to 3-15% in Eastern countries.[3]

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Cholelithiasis presents asymptomatically in approximately 25% of patients; however, the development of inflammation can lead to severe complications, including biliary pancreatitis, cholecystitis, and cholangitis.[4,5]

Laparoscopic cholecystectomy has been recognized as the most effective treatment for gallstone disease, although its complication rate ranges from 6.8% to 7.7%.[6] Major complications of this procedure include bile leakage, occurring at a rate of 1%; gastrointestinal organ injury, occurring at a rate of 0.2%; massive hemorrhage, occurring at a rate of 0.1%; and injury to the common bile duct, occurring at a rate of 0.2-0.4%.[6,7]

The inferior thoracic aperture, defined by the twelfth thoracic vertebral body, the eleventh and twelfth ribs, their connected costal cartilages, and the xiphisternal joint, serves as the lower boundary of the thoracic cavity. Its importance lies not only in separating the thoracic cavity from the abdomen but also in its role in influencing respiratory mechanics and the positioning of abdominal organs such as the liver and gallbladder.[8,9]

This study investigated the potential significance of the inferior apertura thorica as a predictive parameter for the outcomes of laparoscopic cholecystectomy, based on its ability to reflect the anatomical position of the gallbladder. Surgical outcomes were assessed by considering the duration of surgery, the estimated amount of blood loss, and the presence or absence of gallbladder perforation during surgery.

Materials and Methods

This prospective anatomical and clinical study was approved by the Ethics Committee of Bursa Yuksek Ihtisas Research and Training Hospital (Approval Number: 2014/07-01) and was conducted in the Department of General Surgery at Bursa Yuksek Ihtisas Research and Training Hospital. Written informed consent was obtained from all patients who underwent surgery.

Thirty-two patients who were evaluated by computed tomography (CT) or magnetic resonance imaging (MRI) for several additional reasons, such as uncertain comorbidities and suspicion of concomitant common bile duct stones, and who underwent laparoscopic cholecystectomy (LC) between April 2014 and December 2015, were included in the study. We hypothesized that as the diameter of the inferior thoracic aperture narrows, there will be an increase in surgery time, blood loss, and frequency of gallbladder perforation. To minimize errors, 17 patients were excluded from the study due to concomitant pathologies: one patient with extra-hepatic biliary tract anomalies, four patients with intraabdominal adhesions because of previous upper abdominal surgeries, six patients with perihepatic adhesions due to several acute relapses of cholecystitis, and six patients with inconvenient anatomy due to acute or chronic cholecystitis, which may affect the dissection time and distort the results. Additionally, two patients were excluded from the study because of cooperation deficiencies with the radiology technician. Patients were also excluded if their ASA score was ≥3 and if their body mass index was ≥30 kg/m^2.

To ensure the homogeneity of the study, patients underwent a standard 4-port-access laparoscopic cholecystectomy performed by a single surgeon who had already performed more than 500 laparoscopic cholecystectomy procedures. Patients were placed in the supine position during the surgical procedure. The trocars were placed as follows: a 10-mm port for the camera was inserted just below the umbilicus, a 10-mm right-hand port was inserted approximately 2 cm below the xiphoid process, a 5-mm left-hand port was inserted approximately 1 cm below the intersection of the midclavicular line and the right costal margin, and a 5-mm traction port was inserted 1 cm below the intersection of the right anterior axillary line and the right costal arc.

The age and sex of all patients were evaluated. The period between the placement of all four trocars and the completion of gallbladder dissection from the liver bed was considered the operational (overall dissection) time. During surgery, the overall dissection time was measured using a digital chronometer. The amount of aspirated blood in the subhepatic space was measured with the help of an injector for the quantitative evaluation of perioperative bleeding. In addition, the gallbladder perforation rate during dissection was investigated as a minor intraoperative complication.

From cross-sections of pre-surgical CT or MRI scans, two diameters of the patients' inferior thoracic apertures were measured at the end of the surgery:

- Anteroposterior (AP) diameter: from the anterior edge of the 10th thoracic vertebra's body to the xiphoid process tip (Fig. 1).
- Transverse or laterolateral (LL) diameter: between the midpoints of the right and left 9th costal bodies (Fig. 2).

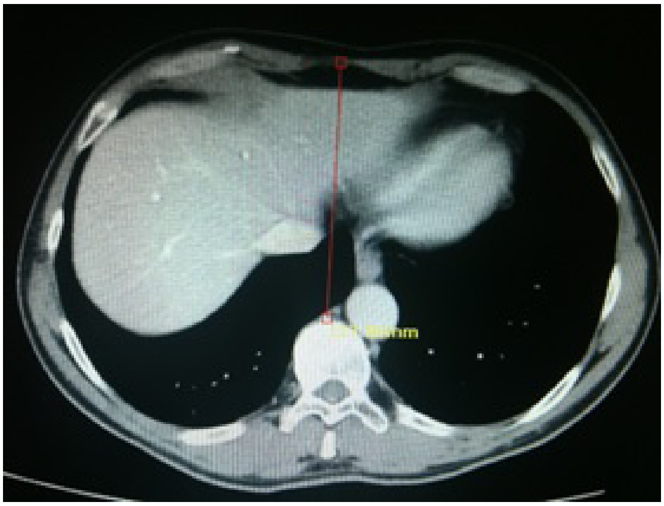

Figure 1. Anteroposterior (AP) diameter: from the anterior edge of 10th thoracic vertebra's body to xiphoid process tip.

Figure 2. Transverse or laterolateral (LL) diameter: between the midpoint of right and left 9th costal bodies.

All patients' CT or MRI scans were performed by the same devices, with high resolution, in the same training and research hospital's radiology department. Images were captured during the deep breath-holding phase.

The relationships between total operation time, intraoperative gallbladder perforation rate, total amount of blood loss during surgery, and the AP-LL diameters of the thoracic outlet were examined.

No early major complications, such as massive bleeding requiring re-laparotomy, biliary fistula, or surgical site infections, were detected in any of the patients included in the study.

Statistical Analyses

Statistical analyses were performed using SPSS (Statistical Package for the Social Sciences, ver. 21.0; SPSS Inc., Chicago, Illinois, USA). The Shapiro-Wilk test was used to analyze normality because the number of samples was less than 50. In descriptive analyses, the mean±standard deviation was used for data following normal distribution, and median and minimum-maximum values for non-parametric data. Pearson and Spearman correlation coefficients were used to calculate the relationships between inferior thoracic aperture diameters and other variables. In all statistical tests conducted as part of the study, α values of 0.05 and p-values of less than 0.05 were considered statistically significant.

Results

Of the 32 patients, 23 (71.9%) were female, and 9 (28.1%) were male. The mean age of the patients was 57.97±16.11 years (min: 29; max: 85). Eight patients' radiologic measurements were performed using magnetic resonance cross-sectional imaging, and 24 patients (75%) underwent CT (Table 1).

Table 1. Descriptive statistics

Age	57.97±16.11		
Gender, n (%)			
Male	9 (28.1)	32 (100)	
Female	23 (71.9)		
Radiodiagnostic modality, n (%)			
CT	24 (75)	32 (100)	
MRI	8 (25)		
Operational time (second)	1172.43±427.58	p=0.285	Between male and female patients
Hemorrhage (cc)	6.5 (Min: 1; Max: 23)	p=0.376	
LL diameter (cm)	26.02±2.29	**p=0.006**	
AP diameter (cm)	11.35 (Min: 9.40; Max:19.40)	p=0.356	

The mean operative time was 1172.43±427.58 (min:550; max:2157) seconds, and the median amount of intraoperative blood loss was 6.5 cc (min: 1; max: 23) (Table 1). During dissection, gallbladder perforation occurred in four patients (12.5%). No statistically significant difference was found between the sexes in terms of the duration of surgery and intraoperative bleeding (p=0.285 and p=0.376) (Table 1).

The mean LL diameter of the patients was 26.02±2.29 cm (min: 21.50; max: 31.50), and the median value of the AP diameter was 11.35 cm (min: 9.40; max: 19.40) (Table 1 and Fig. 3).

As expected, a positive relationship was found between the LL and AP diameters (r=0.574; p=0.001). There was a negative relationship between operational time and both the LL and AP diameters (r=-0.418; p=0.017 and r=-0.405; p=0.022, respectively). The relationship between hemorrhage and diameter was not significant. Although no statistically significant correlation was found between perioperative bleeding and LL diameter, the p-value of the Spearman correlation analysis was just above the α value (r=-0.346; p=0.052). Correlation coefficients (r) and p-values for the correlation coefficients were calculated, and the results are presented in Table 2. Statistically significant relationships are shown in Figures 4-6.

Although the difference between the LL diameter and perforation was not statistically significant, the difference between sex and LL diameter was statistically significant. The laterolateral diameter of the inferior thoracic aperture was wider in male patients (p=0.006). Comparisons between the AP diameter and other parameters were not statistically significant (Table 3).

Discussion

According to the literature, the mean operational time of standardized four-port laparoscopic cholecystectomy is approximately 29.56 to 63.9 minutes.[10-12] In our study, we found the mean operational time to be 1172.43±427.58 seconds (~19.5±7.13 minutes). Our results seem shorter than those reported in the literature because we excluded the time spent on peritoneal insufflation, placement of the trocars, removal of the gallbladder from the abdom-

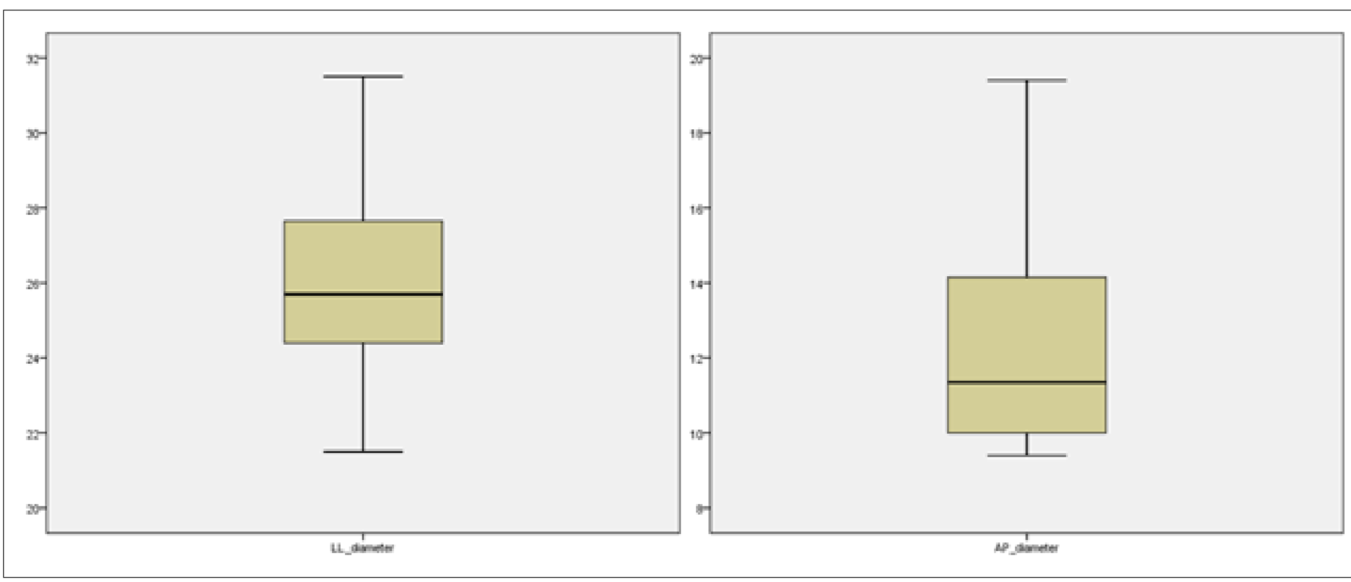

Figure 3. Boxplot graphics of LL and AP diameters.

Table 2. Correlations between diameters and other variables

	LL diameter			AP diameter		
	n	r	p	n	r	p
Operational time	32	-0.418	0.017	32	-0.405	0.022
Hemorrhage	32	-0.346	0.052	32	-0.288	0.110
AP diameter	32	0.574	0.001	-	-	-

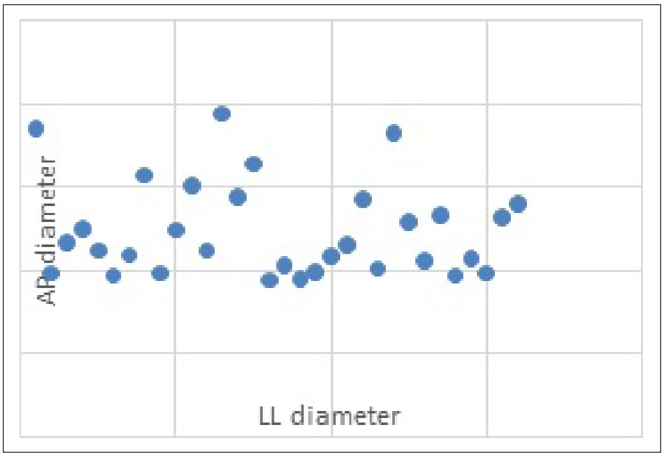

Figure 4. LL diameter and AP diameter relationship.

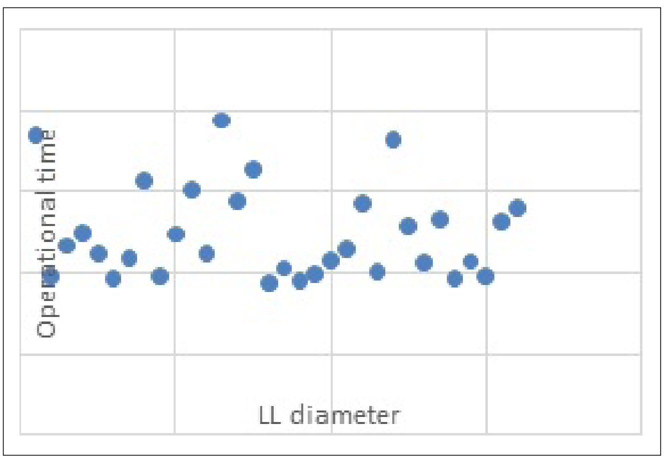

Figure 5. LL diameter and operational time relationship.

inal cavity, and measured only the dissection time (cystic artery, cystic duct, and fossa vesica).

According to our findings, the median amount of intraoperative blood loss was 6.5 cc (min: 1; max: 23) and the gallbladder perforation ratio during dissection was 12.5%. The incidence of gallbladder perforation was 4% in the Bari et al.[13] series and 16% in the case series by Sharma et al.[14] In a systematic review and meta-analysis of the literature published in 2020 by Lyu et al.,[15] the intraoperative

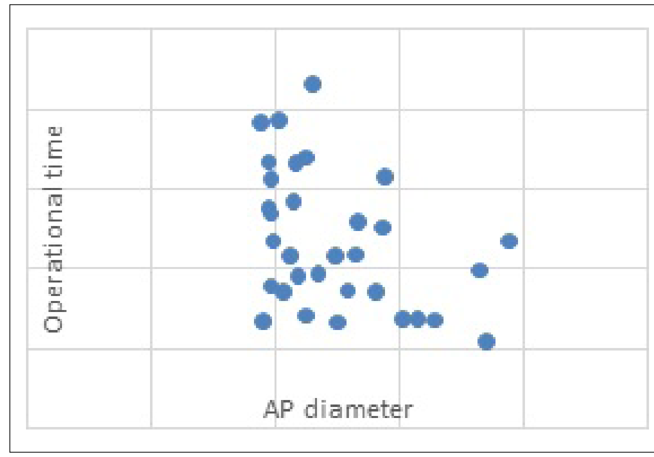

Figure 6. AP diameter and operational time relationship.

blood loss volume varied between 7.69 and 44 cc. Our perioperative "minor" complication results were concordant with the literature.

Several studies evaluating the surgical difficulties of cholecystectomy and related problems, such as blood loss due to difficult dissection or prolonged surgical time, have been reported. The main factors include inflammation or necrosis of the gallbladder wall, including Mirizzi syndrome, intraperitoneal fibrotic adhesions due to previous cholecystitis exacerbations or surgeries, conversion to an open operation, and anatomical variations/abnormalities of the extrahepatic biliary tract.[16,17] In 2021, Asai et al.[18] created a scoring system to predict problematic laparoscopic cholecystectomies, which includes criteria such as inflammation of the gallbladder, appearance of the Calot triangle, appearance of the gallbladder bed, findings regarding the surroundings of the gallbladder (abscess formation, cholecystoenteric fistula, etc.), and intraabdominal factors unrelated to inflammation (excessive visceral fat, adhesions around the gallbladder, anomalous bile duct, etc.).

Surgeons must prioritize preoperative assessment of the technical challenges associated with laparoscopic chole-

Table 3. Comparions between diameters and other variables

	LL diameter (cm)			AP diameter (cm)		
Perforation	n		p	n		p
Positive	4	26.30 (23.10-28.30)	0.842	4	9.75 (9.40-18.50)	0.169
Negative	28	26.03±2.29		28	11.60 (9.50-19.40)	
Gender	n		p	n		p
Male	9	28.20 (25.20-31.50)	0.006	9	13.30 (9.50-18.50)	0.356
Female	23	25.32±2.01		23	11.20 (9.40-19.40)	

cystectomy.[19] As mentioned, some authors have focused on the presurgical assessment of procedural difficulties. However, very few studies have examined the relationship between normal anatomical structures and cholecystectomy time. For instance, Shinozaki et al.[20] reported an assessment of the gallbladder bed's height and width. They defined a "gallbladder bed pocket score" with the help of CT imaging for presurgical estimation of the difficulties in dissecting the gallbladder from the gallbladder fossa vesica biliaris. The authors concluded that while the height and width of the gallbladder fossa did not affect the amount of intraoperative bleeding, they did influence dissection time, suggesting that cases with a "gallbladder bed pocket score" less than 0.4 were more suitable for general surgery residents at the beginning of their learning curve.

Daradkeh published another study, concluding that gallbladder and liver size affect the overall difficulty score as perceived by the patient. Increased liver and/or gallbladder size makes the operation more challenging.[21] Sakuramoto et al.[22] investigated another parameter, the anatomic neck position of the gallbladder. However, they did not find any significant correlation between the gallbladder neck's anatomy and the technical challenges and complications during laparoscopic cholecystectomy. Kapoor et al.[23] conducted a study on the identification of adhesions using preoperative ultrasonography during laparoscopic cholecystectomy. Their findings showed that the presence of preoperative adhesions detected by ultrasonography can predict challenging cholecystectomies.

The major limitation of this study was the relatively small number of patients. However, there might be an ethical conflict in irradiating patients with tomography before cholecystectomy without any suspicion, such as comorbidity. Magnetic resonance imaging (MRI) is a radiation-free imaging modality, yet it is challenging for patients to tolerate the noise and feelings of claustrophobia without any indication for radiological scanning methods other than ultrasonography. Thus, we evaluated only patients who required CT or MRI scans.

Another limitation is the lack of assessment of patients with comorbidities and a high body mass index (BMI). Additionally, other anatomical parameters, such as liver volume, should be evaluated in future studies. More detailed studies conducted using subgroup and multivariate analyses with larger series may provide more accurate results in the future.

Numerous publications in the literature have documented that laparoscopic cholecystectomy has become more challenging due to anatomical difficulties. Thus, it is important to anticipate these difficulties and estimate the risks before surgery.

It is evident that many factors influence the difficulties and potential complication rate of minimally invasive cholecystectomy. Likewise, it appears that cholecystectomy can take a much longer time in patients with a narrow thoracic outlet, which may be considered an anatomical difficulty.

Conclusion

In our opinion, this study has revealed the importance of the thoracic outlet aperture and its influence on the minimally invasive cholecystectomy procedure. We believe that the diameter of the inferior thoracic aperture might be considered one of the many predictive factors for a challenging laparoscopic cholecystectomy. The measurements of these diameters could be clinically useful in general surgery, akin to the use of pelvic diameters in obstetrics.

Disclosures

Ethichs Committee Approval: This prospective anatomical and clinical study was approved by the Ethics Committee of Bursa Yuksek Ihtisas Research and Training Hospital (Approval Number: 2014/07-01) and was conducted in the Department of General Surgery at Bursa Yuksek Ihtisas Research and Training Hospital.

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References

1. Sun H, Warren J, Yip J, Ji Y, Hao S, Han W, et al. Factors influencing gallstone formation: A review of the literature. Biomolecules 2022;12:550.
2. Portincasa P, Di Ciaula A, Bonfrate L, Stella A, Garruti G, Lamont JT. Metabolic dysfunction-associated gallstone disease: Expecting more from critical care manifestations. Intern Emerg Med 2023;18:1897–918.
3. Pisano M, Allievi N, Gurusamy K, Borzellino G, Cimbanassi S,

Boerna D, et al. 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. World J Emerg Surg 2020;15:61.

4. Montalvo-Javé EE, Contreras-Flores EH, Ayala-Moreno EA, Mercado MA. Strasberg's critical view: Strategy for a safe laparoscopic cholecystectomy. Euroasian J Hepatogastroenterol 2022;12:40–4.
5. Majumdar G, Agarwal SK. Commentary: Comments on thoracic outlet syndrome. Ann Card Anaesth 2018;21:74–5.
6. Li ZZ, Guan LJ, Ouyang R, Chen ZX, Ouyang GQ, Jiang HX. Global, regional, and national burden of gallbladder and biliary diseases from 1990 to 2019. World J Gastrointest Surg 2023;15:2564–78.
7. Swarne E, Srikanth MS, Shreyas A, Desai S, Mehdi S, Gangadharappa HV, et al. Recent advances, novel targets and treatments for cholelithiasis: A narrative review. Eur J Pharmacol 2021;908:174376.
8. Parson SH. Clinically oriented anatomy. 6th ed. Baltimore: Wiley; 2009. p. 474.
9. Skandalakis JE, Mirilas P. Benign anatomical mistakes: The thoracic outlet syndrome. Am Surg 2001;67:1007–10.
10. Vejdan SAK, Khosravi M, Amirian Z, Noorimoghddam M. Comparison of 3-port with standard 4-port laparoscopic cholecystectomy: A clinical trial. J Surg Trauma 2020;8:52–7.
11. Liu Q, Zhang G, Zhong Y, Duan C, Hu S. Meta-analysis of the clinical application on gasless laparoscopic cholecystectomy in China. Int J Clin Exp Med 2015;8:1684–90.
12. Nip L, Tong K-S, Borg CM. Three-port versus four-port technique for laparoscopic cholecystectomy: Systematic review and meta-analysis. BJS Open 2022;6:zrac013.
13. Bari Su, Islam Fu, Rather AA, Malik AA. Three port versus four port laparoscopic cholecystectomy: A prospective comparative clinical study. Int J Res Med Sci 2019;7:3054–9.
14. Sharma PK, Mehta KS. Three port versus standard four port laparoscopic cholecystectomy - a prospective study. JK Sci 2015;17:38–42.
15. Lyu Y, Cheng Y, Wang B, Zhao S, Chen L. Single-incision versus conventional multiport laparoscopic cholecystectomy: A current meta-analysis of randomized controlled trials. Surg Endosc 2020;34:4315–29.
16. Buhavac M, Elsaadi A, Dissanaike S. The bad gallbladder. Surg Clin North Am 2021;101:1053–65.
17. Ashfaq A, Ahmadieh K, Shah AA, Chapital AB, Harold KL, Johnson DJ. The difficult gall bladder: Outcomes following laparoscopic cholecystectomy and the need for open conversion. Am J Surg 2016;212:1261–4.
18. Asai K, Iwashita Y, Ohyama T, Endo I, Hibi T, Umezawa A, et al. Application of a novel surgical difficulty grading system during laparoscopic cholecystectomy. J Hepatobiliary Pancreat Sci 2022;29:758–67.
19. Iwashita Y, Ohyama T, Honda G, Hibi T, Yoshida M, Miura F, et al. What are the appropriate indicators of surgical difficulty during laparoscopic cholecystectomy? Results from a Japan-Korea-Taiwan multinational survey. J Hepatobiliary Pancreat Sci 2016;23:533–47.
20. Shinozaki K, Ajiki T, Okazaki T, Ueno K, Matsumoto T, Ohtsubo I, et al. Gallbladder bed pocket score as a preoperative measure for assessing the difficulty of laparoscopic cholecystectomy. Asian J Endosc Surg 2013;6:285–91.
21. Daradkeh S. Laparoscopic cholecystectomy: What are the factors determining difficulty? Hepatogastroenterol 2001;48:76–8.
22. Sakuramoto S, Sato S, Okuri T, Sato K, Hiki Y, Kakita A. Preoperative evaluation to predict technical difficulties of laparoscopic cholecystectomy on the basis of histological inflammation findings on resected gallbladder. Am J Surg 2000;179:114–21.
23. Kapoor A, Sidhu BS, Singh J, Brar N, Singh P, Kapur A. Adhesions detection and staging classification for preoperative assessment of difficult laparoscopic cholecystectomies: A prospective case-control study. J Med Ultrasound 2022;31:137–43.

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Original Article

Peptic ulcer complications, surgical treatment, comparison of open and laparoscopic approach, minimally invasive approach recommendations

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ABSTRACT

Introduction: The treatment of peptic ulcer disease (PUD) has undergone significant changes over time. Elective surgical treatment of PUD has been replaced by medical treatment. Surgical treatment of PUD is limited to ulcer complications and disease resistant to medical treatment. The main issue to be decided during surgery is whether to add a definitive anti-ulcer surgery in addition to treating the immediate ulcer complication. Our aim in this study is to share the results of gastric ulcer complications treated with open and laparoscopic methods in our clinic and the postoperative endoscopy results of these patients.

Materials and Methods: Patients who underwent open or closed ulcer surgery due to ulcer complications in our General Surgery clinic between 2014 and 2023 were retrospectively scanned from the hospital information system. In addition to demographic data such as patients' age and gender, the surgical method applied, duration of hospital stays, and endoscopy findings in patients who underwent endoscopy during the postoperative period were recorded. The results were examined.

Results: A total of 194 patients were included in the study. Of the patients, 178 (91.8%) were male and 16 (8.2%) were female. The patients were between the ages of 18 and 93, with a mean age of 45.4±20.4 years. Endoscopy was performed on 44 patients after surgery. The mean duration between surgery and endoscopy was 504±586 days. Of the surgeries, 145 (74.7%) were open and 49 (25.3%) were laparoscopic. Gastritis and erosion were the most frequently observed findings in postoperative endoscopies, with bleeding in 2 patients, stenosis in 4 patients, and recurrent ulcers in 16 patients.

Conclusion: Surgical treatment of PUD can be performed using open and laparoscopic methods. Despite the advances in medical treatments, ulcer complications are still observed after surgery. The dilemma of whether to add anti-ulcer treatment to emergency surgeries continues, and more comprehensive studies are needed in this regard.

Keywords: Esophagogastroduodenoscopy, Peptic ulcer complications, Laparoscopy

Introduction

Elective surgical methods that have played a leading role in the treatment of peptic ulcer disease (PUD) have gradually become a thing of the past, and medical treatment has taken the forefront. Most cases of peptic ulcer disease (PUD) heal by proton pump inhibitors (PPIs), eradication of Helicobacter pylori (HP) infection, and discontinuing drugs contributing to the pathology, such

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as nonsteroidal anti-inflammatory drugs (NSAIDs).[1] Surgical treatment for PUD is indicated in the presence of complications. Non-emergency surgical procedures for PUD are now limited to patients with pyloric stenosis. Bleeding is the first and perforation is the second leading cause of operations performed for complicated PUD.[2] In complicated peptic ulcer disease, the aim of surgery should be to eliminate the complication that led to surgery, prevent ulcer recurrence, perform a rapid and safe surgery, and reduce the gastrointestinal side effects of surgery.[3] Elective surgical options for PUD include drainage procedures, vagotomies, and gastric resections. All of these procedures can disrupt the physiology of the upper gastrointestinal system.[3]

The main dilemma for the surgeon during surgery is whether to add an anti-ulcer surgical procedure to eliminate the immediate complication and reduce the recurrence of ulcer. However, studies show a trend toward less complex procedures in emergencies, avoiding vagotomy or gastric resection.[4]

The aim of this study was to share the results of gastric ulcer complications treated with open and laparoscopic methods in our clinic and the postoperative endoscopy results of these patients.

Materials and Methods

After obtaining local Ethics Committee approval, patients who underwent open or closed ulcer surgery due to ulcer complications in our clinic between 2014 and 2023 were retrospectively scanned from the hospital information system. The study was conducted in accordance with the Helsinki Declaration protocol. In addition to demographic data such as patients' age, gender, surgical method applied (open, laparoscopic, Graham patch, pyloroplasty, vagotomy, gastroenterostomy), duration of hospital stay, endoscopy findings in patients who underwent endoscopy during the postoperative period to determine the recurrence of ulcer or complication development (ulcer, bleeding, stenosis, gastritis, presence of erosion) were recorded and evaluated. All patients over 18 years old who underwent ulcer surgery due to ulcer complications through open or closed methods were sequentially included in the study.

The median superior incision was used for open surgery. Laparoscopic procedures were performed using 4 trocars, one of which was a camera port under the umbilicus (Fig. 1).

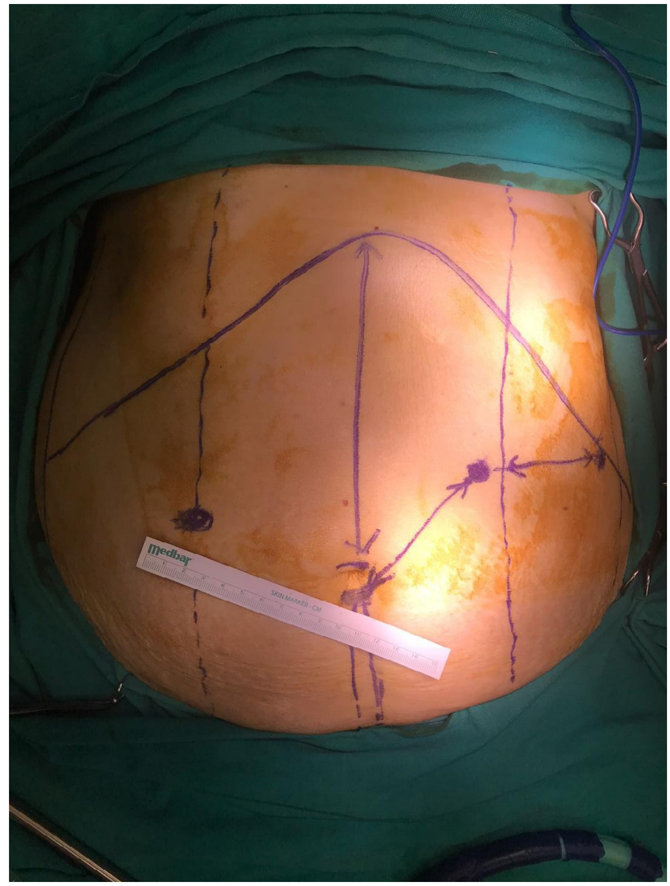

Figure 1. Port placement in laparoscopic surgery.

Postoperative treatment with PPI was applied to all patients for 2 months. Records of H. pylori eradication therapy for patients could not be accessed. Endoscopy was performed on patients who had complaints after surgical treatment for PUD perforation. Patients who underwent gastroenterostomy and vagotomy were all subjected to endoscopy after the 2nd month post-surgery. Surgical procedures and endoscopies were performed by multiple surgical specialists with the same expertise at a single center.

Statistical Analysis

IBM Statistical Package for the Social Sciences, Version 20.0 for Windows (IBM Corp., Armonk, NY, USA) was used to evaluate statistical data. Numerical data were presented as median±standard deviation (SD), and minimum-maximum, while categorical data were presented as number (n) and percentage (%). Normal distribution of patient data was tested using the Kolmogorov-Smirnov test. Numeric data not meeting parametric test conditions were compared using the Mann-Whitney U test. Fisher's exact test was applied for evaluating categorical data. $p<0.05$ was accepted as statistically significant in all analyses.

Results

A total of 194 patients were included in the study, comprising 178 males (91.8%) and 16 females (8.2%). Patients were between 18 and 93 years of age, with a mean age of 45.4±20.4 years. Of these patients, 145 (74.8%) were ASA I and II. Endoscopy was performed on 44 patients postoperatively. Among those who underwent endoscopy, H.pylori was pathologically examined in 24 patients, of whom 17 (70%) tested positive for H.pylori infection. The mean duration between surgery and endoscopy was 504±586 days. There was no intraoperative or postoperative mortality within the first month.

Of the surgeries performed, 145 were open surgeries (74.7%) and 49 were laparoscopic surgeries (25.3%). The surgical methods applied are shown in Table 1.

When the length of hospital stay was compared between open and closed surgery, there was no statistically significant difference between the groups (Table 2) (p>0.05). However, when only perforated ulcers were evaluated, the length of hospital stay was found to be statistically significantly lower in the laparoscopic surgery group (p=0.025).

BTV+ drainage procedure was performed on 38 patients (19.6%) and not performed on 156 patients (80.4%). The distribution of pathologies detected in patients' control endoscopy is shown in Figure 2.

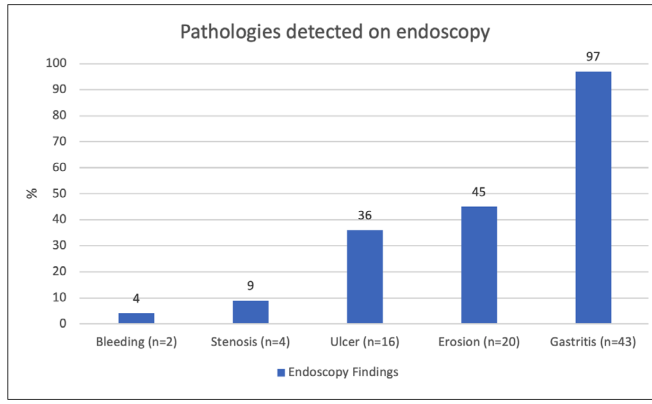

Figure 2. Distribution of pathologies detected in control endoscopy.

Regarding the pathologies detected during endoscopy in patients who underwent endoscopy, no statistically significant difference was observed between those who underwent BTV + drainage and those who did not in terms of bleeding, stenosis development, ulcer recurrence, erosion, and gastritis (p>0.05). However, bleeding, ulcer, and stenosis were more frequently observed in patients who underwent the Graham procedure (BTV+ drainage n:5, Graham: n:19). Statistical analysis is shown in Table 3.

Discussion

Peptic ulcer disease is a prevalent issue showing significant geographic differences alongside a decreasing prevalence in Western countries.[5] Complications of PUD include

Table 1. Surgical methods applied

Indication	Surgery	n	%
Ulcer perforation	Graham omentoplasty	128	66.0
	Laparoscopic Graham omentoplasty	28	14.4
Bleeding	Suturing of bleeding ulcer, truncal vagotomy, drainage of bleeding ulcer	5	2.6
Pyloric stenosis	Truncal vagotomy, drainage	12	6.2
	Laparoscopic truncal vagotomy, drainage	21	10.8
	Total	**194**	**100.0**

Table 2. Length of Hospital Stay

	Minimum	Maximum	Median	p*
Open surgery	2	67	8	0.13
Laparoscopic surgery	2	24	7	
Open Perforated Ulcer surgery	2	67	8	0.025
Laparoscopic Perforated Ulcer surgery	2	16	7	

*Mann-Whitney U test.

Table 3. Statistical analysis

	Endoscopy for bleeding		Total	p
	No	**Yes**		
Vagotomy drainage				
No	35	1	36	.334**
Yes	7	1	8	
Total	42	2	44	
	Stenosis at Endoscopy		**Total**	
	No	**Yes**		
Vagotomy drainage				
No	33	3	36	.566**
Yes	7	1	8	
Total	40	4	44	
	Ulcer on endoscopy		**Total**	
	No	**Yes**		
Vagotomy drainage				
No	23	13	36	1.000**
Yes	5	3	8	
Total	28	16	44	
	Erosion on Endoscopy		**Total**	
	No	**Yes**		
Vagotomy drainage				
No	20	16	36	1.000**
Yes	4	4	8	
Total	24	20	44	
	Gastritis		**Total**	
	No	**Yes**		
Vagotomy drainage				
No	0	36	36	.182**
Yes	1	7	8	
Total	1	43	44	

**Fisher exact test.

bleeding, perforation, and pyloric stenosis, and recurrent or uncontrolled bleeding is a predictive contributor to mortality. Approximately 30% to 35% of patients presenting to the operating room due to perforated PUD will exhibit signs of shock and sepsis, with approximately half of these patients resulting in mortality.[6] Ulcer perforation and bleeding necessitate surgical emergencies when endoscopic interventions are inadequate, while gastric outlet obstruction is an elective surgical practice.[3] The complications of PUD vary by geographical region; while bleeding ranks high in the United States, other complications may be more common in different geographies.[7,8] In our study, perforation was the most encountered complication, unlike Western societies, with a rate of 80.4%. Additionally, pyloric stenosis with a rate of 17% ranked second.

Surgical procedures can be performed using open or laparoscopic methods. Laparoscopic repair of perforated peptic ulcer is considered a safe practice.[9] It provides advantages such as shorter surgical duration, reduced postoperative pain, decreased lung problems, shorter hospital stay, and early return to daily activities compared to open surgery.[10] In a study conducted by Birol et al.,[11] 15 out of 52 patients with perforated peptic ulcer were treated using the laparoscopic method, over 90% of the patients were male, and no mortality was observed. In contrast to most studies in the literature, our study included all complications of PUD.[12-14] Male patients constituted the majority, and no mortality was observed. Furthermore, the length of hospital stay was shorter in the laparoscopic surgery group when only perforated peptic ulcer patients were evaluated.

One of the major dilemmas in the treatment of PUD complications, particularly in emergency situations, is whether to add anti-ulcer therapy to the treatment to reduce the recurrence of the disease or to reduce the recurrence of complications. The addition of anti-ulcer surgery may have a negative effect by prolonging the operation time in emergency cases but might be significant in preventing recurrences. With advances in medical therapy, in the era of proton pump inhibitors (PPIs), it has been shown that lifelong PPIs can reduce the complications of PUD without vagotomy.[15] With increasing laparoscopic surgical applications, PPI drug therapy with vagotomy or gastrojejunostomy has started a revival in the treatment of pyloric stenosis.[3] In our study, we performed BTV + drainage procedure in cases of bleeding and pyloric stenosis in the surgical treatment of PUD and gave PPI treatment routinely for 2 months. When the complications were analyzed individually, there was no statistically significant difference between those who underwent vagotomy+drainage and patients who did not receive anti-ulcer surgery, but bleeding, ulcer, and stenosis complications were more common in the second group. This may be due to the fact that patient records of eradication treatment were not available and some of the patients did not receive eradication treatment.

The absence of an anti-ulcer procedure might result in recurring ulcer complications. This risk can be significantly reduced in patients who test positive for HP by HP therapy.[16] Intraoperative rapid HP testing is not available. In most cases, the patient's HP status is usually unknown during surgery. In cases where HP positivity cannot be tested during surgery, the benefits of anti-ulcer surgery should be considered.[3] In a study, it was shown that 81% of patients with perforated duodenal ulcer were HP positive. In this study, perforation was simply closed in all patients. In postoperative HP positive patients, one group received only PPI and the other group received treatment to eradicate HP. In the control endoscopy, the ulcer recurrence rate in one year was 5% in the eradication treatment group and 38% in the group treated only with PPI.[16] This study demonstrates the importance of HP eradication in perforated acute duodenal ulcers when antiulcer procedures are not included in the treatment. Moreover, in patients in whom NSAIDs cannot be discontinued as medical treatment, anti-ulcer surgery can be performed in patients who develop ulcer complications despite treatment with PPIs.[3] On the other hand, the addition of anti-ulcer surgery can cause serious gastrointestinal problems in inappropriate patients. Definitive surgery should generally be avoided during emergency procedures with underlying major medical illness or intraoperative hemodynamic instability.[3] In our study, no patient operated for perforation received anti-ulcer therapy. This may have been due to the surgeon's concern that a prolonged surgery may impair hemodynamic balance. In our study, the rate of HP positivity was 70% during the control endoscopy. This suggests that the necessary importance was unfortunately not given to eradication in our clinic, which could be related to complications.

Acute NSAID-induced perforations, patients who have not been previously treated with PPIs but who can be treated with PPI and HP therapy, as well as cases of concomitant delayed presentation, severe comorbid disease, or significant peritoneal contamination are suitable for surgery aimed solely at correcting complications without the addition of anti-ulcer surgery.[3] In our study, Graham omentoplasty was performed in all perforated patients but antiulcer therapy was not added.

Our study has several limitations. Its retrospective nature, the unrecorded NSAID usage histories of patients, whether eradication treatment was received or not, and the unknown gastrin levels are its negative aspects.

Conclusion

In our study, the laparoscopic method in stomach perforation showed advantages in terms of shorter hospital stays and safety concerning mortality, particularly in pyloric obstruction and perforation. When only patients with perforated peptic ulcers were evaluated, the duration of hospital stay was shorter in the laparoscopic surgery group, but no difference in hospital stay was observed when all patients were evaluated. The majority of the cases in our study underwent simple closure (all perforation cases), and the rest underwent trunkal vagotomy and drainage. When the endoscopy results of cases that underwent anti-ulcer surgery and those treated only for complications were evaluated, no statistical difference was found between the two groups. However, the observation of complications such as bleeding, ulcer, and stenosis in the endoscopy results of both groups suggests that despite advancements in medical treatment of PUD, recurrences and repeated complications are still encountered.

Disclosures

Ethichs Committee Approval: After obtaining local Ethics Committee approval, patients who underwent open or closed ulcer surgery due to ulcer complications in our clinic between 2014 and 2023 were retrospectively scanned from the hospital information system. The study was conducted in accordance with the Helsinki Declaration protocol.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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

References

1. Kempenich JW, Sirinek KR. Acid peptic disease. Surg Clin North Am 2018;98(5):933–44.
2. Zittel TT, Jehle EC, Becker HD. Surgical management of peptic ulcer disease today - indication, technique and outcome. Langenbecks Arch Surg 2000;385(2):84–96.
3. Ali A, Ahmed BH, Nussbaum MS. Surgery for peptic ulcer disease. In Shackelford's Surgery of the Alimentary Tract: 2 Volume Set. 8th ed. Elsevier; 2019. p. 673–701.
4. Smith BR, Wilson SE. Impact of nonresective operations for complicated peptic ulcer disease in a high-risk population. Am Surg 2010;76(10):1143–6.
5. Sung JJY, Kuipers EJ, El-Serag HB. Systematic review: The global incidence and prevalence of peptic ulcer disease. Aliment Pharmacol Ther 2009;29(9):938–46.
6. Søreide K, Thorsen K, Harrison EM, Bingener J, Møller MH, Ohene-Yeboah M, et al. Perforated peptic ulcer. Lancet 2015;386(10000):1288–98.
7. Wang YR, Richter JE, Dempsey DT. Trends and outcomes of hospitalizations for peptic ulcer disease in the United States, 1993 to 2006. Ann Surg 2010;251(1):51–8.
8. Irabor DO. An audit of peptic ulcer surgery in Ibadan, Nigeria. West Afr J Med 2005;24(3):242–5.
9. Sartelli M, Chichom-Mefire A, Labricciosa FM, Hardcastle T, Abu-Zidan FM, Adesunkanmi AK, et al. The management of intra-abdominal infections from a global perspective: 2017 WSES guidelines for management of intra-abdominal infections. World J Emerg Surg 2017;12(1):29.
10. Siu WT, Leong HT, Law BKB, Chau CH, Li ACN, Fung KH, et al. Laparoscopic repair for perforated peptic ulcer: A randomized controlled trial. Ann Surg 2002;235(3):313–19.
11. Birol S, Çakır C, Ökmen H, Bektaşoğlu HK, Ulusoy Aİ, İdiz UO, et al. Management of peptic ulcer perforations; Comparison of open and laparoscopic procedures. Laparosc Endosc Surg Sci 2019;26(1):19–23.
12. Celik MF, Dural AC, Akarsu C, Unsal MG, Gok I, Kones O, et al. The growing role of laparoscopic repair in patients with early diagnosed peptic ulcer perforation. Turkish J Surg 2014;30(3):120–4.
13. Ergin A, Güneş Y, Taşdelen İ, Fersahoğlu MM, Bulut NE, Çakmak A, et al. Comparison of laparoscopic and conventional repair in the treatment of peptic ulcer perforation. Bosphorus Med J [Article in Turkish] 2022;9(2):73–80.
14. Katar MK, Başer M, Ersoy PE. What is the place of laparoscopy in perforated peptic ulcer repair? Bozok Med J 2020;10(4):84–90.
15. Coblijn UK, Lagarde SM, de Castro SMM, Kuiken SD, van Tets WF, van Wagensveld BA. The influence of prophylactic proton pump inhibitor treatment on the development of symptomatic marginal ulceration in Roux-en-Y gastric bypass patients: A historic cohort study. Surg Obes Relat Dis 2016;12(2):246–52.
16. Ng EK, Lam YH, Sung JJ, Yung MY, To KF, Chan AC, et al. Eradication of helicobacter pylori prevents recurrence of ulcer after simple closure of duodenal ulcer perforation: Randomized controlled trial. Ann Surg 2000;231(2):153–8.

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Original Article

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Assessment of helicobacter pylori colonization in patients with duodenogastric reflux: A retrospective study

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ABSTRACT

Introduction: This study investigates the relationship between duodenogastric reflux (DGR), Helicobacter pylori (HP) colonization, and their impact on gastric health. Given the established risks of both DGR and HP for gastric mucosal damage and the development of pre-cancerous lesions, we aimed to explore their interrelation and the effect of bile reflux on HP colonization in an acidic environment.

Materials and Methods: A retrospective analysis was conducted on patients who underwent gastroscopy at our hospital between December 2022 and December 2023. DGR diagnosis was based on the endoscopic observation of bile-stained fluid or reflux, while HP presence was confirmed via giemsa staining of biopsy samples. Statistical analysis utilized SPSS software, with significance set at $p<.05$.

Results: Out of 4.316 gastroscopies performed, 743 patients were identified with DGR, and HP positivity was found in 34.9% of the cohort. Comparison of HP infection rates between patients with and without DGR revealed no significant difference, indicating the independent nature of these conditions regarding gastric colonization.

Conclusion: HP and DGR synergistically inflict damage on the gastric mucosa. However, consistent with the existing literature, our study also demonstrates that, although both DGR and HP infection are significant risk factors for gastric mucosal injury independently, there is no observed association between HP colonization and DGR. Given the complexity of the gastric mucosal structure and its acidic environment, we believe further research is needed to understand the underlying mechanisms of these relationships.

Keywords: Bile reflux, Duodenogastric reflux, Gastric mucosal damage, Helicobacter pylori, Pre-cancerous lesions

Introduction

Helicobacter pylori (HP) is a gram-negative bacterium that colonizes the human stomach and is associated with various diseases, including stomach-related cancers.[1] The prevalence of HP varies globally and is influenced by numerous factors such as age, ethnicity, and socioeconomic status.[2]

Duodenogastric reflux (DGR) can be described as the retrograde flow of alkaline duodenal contents into the stomach, ultimately causing inflammation of the gastric mucosa. DGR is commonly observed following gastric surgery, cholecystectomy, and pyloroplasty, but can also occur due to antroduodenal motility disorders (Primary DGR).

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To date, there is no established gold standard for the diagnosis of DGR.[3] Studies have observed a prevalence of 16.7% in groups without any biliary intervention and 61.8% in others.[4] In the pediatric population, among 804 cases undergoing endoscopic examination due to abdominal pain, bile reflux was observed at a rate of 23.9%.[5]

Bile acids possess antibacterial effects and bile itself is a potent alkaline and chemical irritant. It causes a change in the pH of the stomach, where the usual environment is acidic.[6] The median pH of the human stomach is 1.4. During the inter-digestive phase, which typically lasts about 16 hours a day, the pH can rise to as high as 5.0, while during the short phases when food is ingested, the pH can drop to <1.0.[7] HP can colonize and cause infection in this acidic environment. Moreover, in-vitro studies have demonstrated that an alkaline environment has a negative effect on the development of HP.[8]

Our study aims to determine whether there are changes in the colonization of HP, a bacterium that thrives and grows in the normally acidic environment of the stomach, under higher pH levels (due to bile reflux).

Materials and Methods

Between December 2022 and December 2023, data of patients who underwent gastroscopy for any reason in the endoscopy department of our hospital were retrospectively reviewed.

The study was approved by our hospital. Local Ethics Committee, 2024/44.

The diagnosis of DGR was based on the observation of bile-stained fluid in the stomach or bile reflux during the procedure as seen by endoscopy. The control group, without a diagnosis of DGR, consisted of patients who underwent gastroscopy for any reason within the last six months of 2023.

The diagnosis of HP was established through the direct visualization of the bacterium in endoscopic biopsy material taken from at least two different sites, stained with Giemsa.

Demographic data of the patients were obtained through file scanning. Patients with missing or inaccessible data, those who had biopsies taken from only one location, those with malignancies, those under 18 years of age, or those who had received HP eradication treatment were excluded from the study.

All statistical analyses were performed with SPSS software, Windows version 25.0 (SPSS Inc., Chicago, IL, USA). Data were summarized as mean±standard deviation, numbers (n), and percentages (%). Categorical variables were compared using the chi-square test. When a categorical variable was compared with a numerical value, the Mann-Whitney U test was used. All statistical calculations were two-tailed, and a p-value <.05 at the 95% confidence interval was considered statistically significant.

Results

Between December 2022 and December 2023, a total of 4,316 patients underwent gastroscopy. DGR was identified in 743 of these patients, resulting in a detection rate of 17.2% among those who underwent gastroscopy. The number of patients who underwent gastroscopy and had their data reviewed in the last six months of 2023 was 827.

The total number of patients included in the study was 249, with 107 patients identified as having bile reflux. The number of patients without bile reflux was 142. Among all patients, HP positivity was found in 87 patients (34.9%).

According to the inclusion criteria, the number of patients identified with DGR was 107. Among these patients, 40.2% (n=43) were male and 59.8% (n=64) were female, with a mean age of 51.3±14.2 years.

In the group without DGR, there were a total of 142 patients. Of these, 40.1% (n=57) were male, and 59.9% (n=85) were female, with a mean age of 52.2±14.0 years.

No statistical difference was found between the two groups in terms of gender distribution (p=0.994) and age (p=0.632) (Table 1).

Among the patients diagnosed with DGR, 29 (27.1%) had undergone cholecystectomy, while 15 (14.0%) patients had gallstones. In the group with DGR, HP positivity was detected in 31.8% (n=34) of patients, whereas in the other group, this rate was 37.3% (n=53) (p=0.363) (Table 2).

Discussion

In our study, when patients with DGR were compared with the control group, there was no significant difference in HP infection. A review of the literature and similar studies revealed that a study conducted in 2021 found no significant effect of DGR on HP colonization and the development of pre-malignant gastric lesions.[9] Similarly, a study in 2022 observed a negative correlation between the presence of

Table 1. Comparison of Helicobacter pylori Presence in Patients with and without Duodenogastric Reflux

	Duodenogastric Reflux		
	No	Yes	p
H. Pylori, n (%)			
No	69 (48.6)	72 (68.6)	0.363
Yes	73 (51.4)	33 (31.4)	

Table 2. Demographic Characteristics of Patients by Duodenogastric Reflux Status

	Duodenogastric Reflux		
	No	Yes	p
Age (Mean±SD)	52.2±14.0	51.3±14.2	0.994
Sex, n (%)			
Male	57 (40.1)	43 (40.2)	0.632
Female	85 (59.9)	64 (59.8)	

bile reflux and the likelihood of HP infection, though the finding was not statistically significant (p=0.104).[10] A study within a pediatric group in our country in 2019 also found no significant difference between cases with DGR and the control group in terms of the presence and intensity of HP alongside the presence and severity of gastritis (p=0.947).[11]

The prevalence of DGR in our study was found to be 17.2%. According to the literature, while one study reported a detection rate of 16.7%,[4] another study found this rate to be 21.3%.[12] It is known that interventions involving the biliary tract or cholecystectomy can increase bile reflux[4]; however, since our study did not review data from patients who had undergone cholecystectomy or had biliary interventions, we cannot provide information about the prevalence of DGR in these patients.

The rate of HP positivity among all patients in our study was found to be 34.9%. Worldwide, the prevalence of HP varies from 18.9% to 87.8% and increases with worsening socioeconomic conditions. In the same vein, the prevalence of HP in our country has been determined to be approximately 77.2% (ranging from 71.4% to 83.1%).[13]

The relationship between bile reflux and intestinal metaplasia, a pre-cancerous lesion for gastric cancer, has been widely reported and accepted. DGR causes mucosal damage in the stomach. Regardless of HP infection, DGR is an independent risk factor for the development of gastric cancer.[14] The role of bile reflux in the process of intestinal metaplasia continues even after the eradication of HP. Intestinal metaplasia caused by bile reflux is primarily mediated by bile acids and regulated by several critical molecules and signaling pathways.[15] A study conducted in 1998 found no significant difference in the frequency of HP infection between patients with and without bile reflux (p=0.67); however, a significant difference was observed in the rate of metaplasia between patients with both bile reflux and HP infection compared to those without either condition (p=0.02). As a result, it was concluded that bile reflux and HP infection play a significant role in the development of gastric cancer through a synergistic effect.[16]

A study conducted in 2022 showed that DGR causes changes in the stomach microbiota aside from HP In patients with DGR in the absence of HP infection when compared to other patients, the richness (according to Sobs and Chao1 indexes; p<0.05) and diversity (according to Shannon indexes; p<0.05) of the gastric mucosa microbiota were found to be higher. In patients with bile reflux, genera such as Comamonas, Halomonas, Bradymonas, Pseudomonas, Marinobacter, Arthrobacter, and Shewanella were more prevalent, while in those without bile reflux, genera such as Haemophilus, Porphyromonas, and Subdoligranum were more dominant.[17]

Our study has certain limitations. It is retrospective in nature. We lacked standardization in detecting bile reflux. The use of proton pump inhibitors (PPI) or ursodeoxycholic acid by patients was not considered.

Conclusion

When the studies in the literature are considered, it is evident that there is a strong relationship between DGR, HP infection, and the development of gastric mucosal damage and pre-cancerous lesions. However, consistent with the data in the literature, as observed in our study, these two factors are independent of each other, and no relationship has been identified between HP infection and bile reflux.

Disclosures

Ethichs Committee Approval: The study was approved by our hospital. Local Ethics Committee, 2024/44.

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References

1. Vilchis J, Navarro F, Mera R, Torres J, Correa P, de la Luz Kageyama-Escobar M, et al. Association of helicobacter pylori infection and height of mexican children of low socioeconomic level attending boarding schools. Am J Trop Med Hyg 2009;81:1091–6.
2. Iwańczak B, Buchner A, Iwańczak F. Clinical differences of Helicobacter pylori infection in children. Adv Clin Exp Med 2017;26:1131–6.
3. Shi X, Chen Z, Yang Y, Yan S. Bile Reflux gastritis: Insights into pathogenesis, relevant factors, carcinomatous risk, diagnosis, and management. Gastroenterol Res Pract 2022;2022:1–7.
4. Othman AA, Dwedar AA, ElSadek HM, AbdElAziz HR, Abdelrahman AA. Post-cholecystectomy bile reflux gastritis: Prevalence, risk factors, and clinical characteristics. Chronic Illn 2023;19:529—38.
5. Taşcı EK, Karakoyun M, Sezak M, Doğanavsargil B, Çetin F, Aydoğdu S. Does bile reflux reduce helicobacter pylori gastritis? Turk J Pediatr 2022;64:122.
6. Hyun JJ, Yeom SK, Shim E, Cha J, Choi I, Lee SH, et al. Correlation between bile reflux gastritis and biliary excreted contrast media in the stomach. J Comput Assist Tomogr 2017;41:696–701.
7. Sachs G, Scott DR, Wen Y. Gastric infection by Helicobacter pylori. Curr Gastroenterol Rep 2011;13:540–6.
8. Mathai E, Arora A, Cafferkey M, Keane Ct, O'moraın C. The effect of bile acids on the growth and adherence of Helicobacter pylori. Aliment Pharmacol Ther 1991;5:653–8.
9. Szőke A, Mocan S, Negovan A. Helicobacter pylori infection over bile reflux: No influence on the severity of endoscopic or premalignant gastric lesion development. Exp Ther Med 2021;22:766.
10. Zhuo XH, Sun JC, Zhong WJ, Lu Y. Negative correlations between bile reflux gastritis and Helicobacter pylori infection. Scand J Gastroenterol 2022;57:1430—4.
11. Agin M, Kayar Y. The effect of primary duodenogastric bile reflux on the presence and density of Helicobacter pylori and on gastritis in childhood. Medicina (B Aires) 2019;55:775.
12. Othman AAA, Dwedar AAZ, ElSadek HM, AbdElAziz HR, Abdelrahman AAF. Bile reflux gastropathy: Prevalence and risk factors after therapeutic biliary interventions: A retrospective cohort study. Ann Med Surg (Lond) 2021;72:103168.
13. Hooi JKY, Lai WY, Ng WK, Suen MMY, Underwood FE, Tanyingoh D, et al. Global prevalence of Helicobacter pylori infection: Systematic review and meta-analysis. Gastroenterology 2017;153:420—9.
14. Li D, Zhang J, Yao WZ, Zhang DL, Feng CC, He Q, et al. The relationship between gastric cancer, its precancerous lesions and bile reflux: A retrospective study. J Dig Dis 2020;21:222–9.
15. Qu X, Shi Y. Bile reflux and bile acids in the progression of gastric intestinal metaplasia. Chin Med J (Engl) 2022;135:1664–72.
16. Zullo A, Rinaldi V, Hassan C, Lauria V, Attili AF. Gastric pathology in cholecystectomy patients: Role of Helicobacter pylori and bile reflux. J Clin Gastroenterol 1998;27:335—8.
17. Huang G, Wang S, Wang J, Tian L, Yu Y, Zuo X, et al. Bile reflux alters the profile of the gastric mucosa microbiota. Front Cell Infect Microbiol 2022;12:940687.

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Case Report

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Liver hydatid cyst rupture in biliary tree resulting in cholangitis and pancreatitis: A case report

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ABSTRACT

Hydatid disease is commonly observed in the Mediterranean region and North Africa and is caused by Echinococcus species. The liver is the most commonly affected organ, and biliary complications are the most frequent complications of hepatic hydatid disease. Despite this, pancreatitis due to hepatic hydatid disease is rare. In this case report, we describe a patient with cholangitis and pancreatitis resulting from the rupture of a hepatic hydatid cyst into the biliary system.

Keywords: Cholangitis, Hydatid disease, Pancreatitis

Introduction

Hydatid disease is a relatively common problem in the Mediterranean region and North Africa, caused by Echinococcus granulosus (EG). Humans are intermediate hosts, final hosts are dogs and other canines. Humans get the larval form via fecal-oral transmission (handling dogs, contaminated water, etc.). EG can infect almost everywhere in the human body but in most cases, patients have a solitary cyst in the liver.[1] Most of the complications are also seen in the liver, cyst rupture in the biliary system is one of the most common complications.[1,2] Despite biliary complications, pancreatic complications such as pancreatitis are rare.[3]

Case Report

A 33-year-old male patient was admitted to the emergency department with fever, jaundice, and abdominal pain. He did not have any known disease or significant family history. During the physical examination, he has a 38,5ºC fever, other vital signs are in the normal range. Abdominal examination was uneventful except for right upper quadrant tenderness. Laboratory tests showed leukocytosis (21.400/µL), elevated CRP (303 mg/L), elevated liver function tests, and bilirubin levels (AST: 74,5 U/L, ALT: 90,6 U/L, ALP: 541 U/L, GGT: 310 U/L, Total Bilirubin/Direct Bilirubin: 8,72/6,91 mg/dL) and elevated amylase and lipase levels(Amylase: 469 U/L, Lipase: 1490,4 U/L). Abdominal Ultrasonography (USG) showed two hydatid cysts (90x80 mm anteriorly, 105x90 mm posteriorly) located in the right lobe of the liver, dilated intrahepatic biliary tracts near the cysts, and also subcentimetric calculi in the gallbladder. Abdominal computerized tomography (CT) showed two hydatid cysts in segments 7(90x83 mm) and 6 (100x85 mm). Cyst in segment 6 has communications to near intrahepatic biliary tracks (Fig. 1). Magnetic resonance cholangiopancreatography (MRCP) shows similar findings to CT scan, additionally, daughter vesicles and membranes are seen in the intrahepatic, and extra-

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hepatic bile ducts (Fig. 2). The pancreas was normal in radiologic imaging.

The patient has been consulted on infectious diseases, piperacillin-tazobactam, and albendazole therapy were started. INR level was above normal,[1] therefore 1 unit of fresh frozen plasma was given to the patient. Endoscopic retrograde cholangiopancreatography (ERCP) and Sphincterotomy were performed and daughter vesicles and parts of membranes were retrieved from the main hepatic duct. The post-ERCP course was uneventful, piperacillin-tazobactam antibiotherapy continued for 7 days and the patient was discharged. An elective operation for a hydatic cyst is planned.

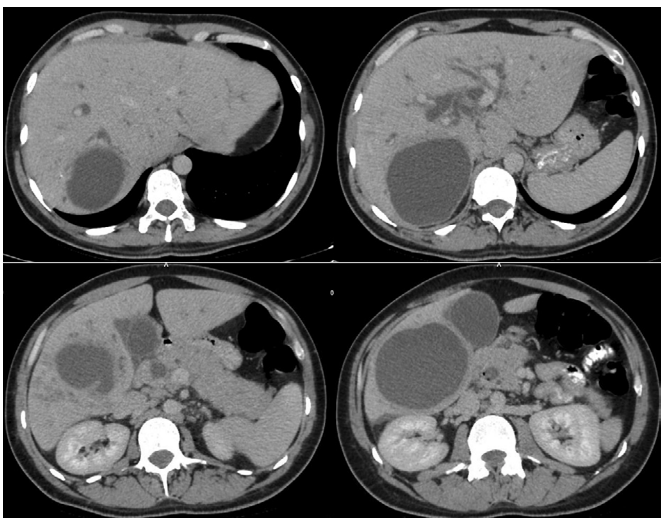

Figure 1. CT imaging of hydatid cysts and dilated intrahepatic biliary tracts.

Figure 2. MR imaging of hydatid cysts and dilated intrahepatic biliary tracts.

Discussion

E. granulosus is a common health problem in the Mediterranean region and the most common type of disease localization is liver and lungs.[1] The course of the disease is generally asymptomatic until complication occurs. Patients who have abdominal pain, elevated LFT, and bilirubin levels may have complicated hydatid cyst in the liver.[2] Rupture of the cyst and opening into biliary tracts are relatively common complications but pancreatitis due to hydatid disease is scarce.[3-6]

Radiologic imaging techniques are important in diagnosis and management. Abdominal USG is cheap, radiation-free, and effective for the diagnosis of hydatic cysts in the liver. CT and MR imaging can be used for treatment planning. CT and MRI provide a more accurate staging of hydatid cysts compared to USG, enabling a better assessment of the bile ducts. Moreover, the location of the cyst and its relationship with surrounding organs can be more accurately evaluated. This allows for the identification of structures that require careful attention during surgery, and in suitable cases, interventional radiologic treatment can be planned.[7]

Treatment of hydatid disease consists of surgery, radiologic interventions, and medical therapy. Complications arising from the rupture of a hydatid cyst into the biliary tract are among the most common, and in some patients, the presence of a hydatid cyst can be detected based on these symptoms.[1,2] The passage of daughter vesicles and germinative membranes from the cyst into the biliary ducts through cystobiliary fistulas can lead to elevated cholestatic enzymes, jaundice, and cholangitis. In cases with biliary obstruction, this obstruction can be treated through endoscopic or surgical methods. In experienced centers, surgical treatment for hydatid cysts is often preferred following endoscopic treatment for cholangitis. For patients with sepsis due to cholangitis who wish to avoid the complications of general anesthesia, fluid resuscitation, antibiotic therapy, and treatment of biliary obstruction with ERCP, can yield better results compared to surgical treatment.[4,8]

Conclusion

Pancreatitis due to hepatic hydatid cyst is a rare condition but can be encountered. In patients where radiological methods for pancreatitis reveal cystic lesions in the liver, hydatid cyst should be considered as an etiological factor.

Disclosures

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

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References

1. Ferrer Inaebnit E, Molina Romero FX, Segura Sampedro JJ, González Argenté X, Morón Canis JM. A review of the diagnosis and management of liver hydatid cyst. Rev Esp Enferm Dig 2022;114:35—41.
2. Toumi O, Ammar H, Gupta R, Ben Jabra S, Hamida B, Noomen F, et al. Management of liver hydatid cyst with cystobiliary communication and acute cholangitis: A 27-year experience. Eur J Trauma Emerg Surg 2019;45:1115—9.
3. Ben Mahmoud A, Atri S, Rebai W, Maghrebi H, Makni A, Kacem MJ. Acute pancreatitis as an uncommon complication of hydatid cyst of the liver: A case report and systematic literature review. Ann Med Surg (Lond) 2021;62:341—6.
4. Ahmad BS, Afzal A, Ashraf P, Abubakar SA, Munir A. Manifestation of hydatid cyst of liver with pancreatitis, cholangitis and jaundice: A case report. J Pak Med Assoc 2018;68:1097—9.
5. Rodríguez-Sicilia MJ, González-Artacho C, Cabello-Tapia MJ, de-la-Torre-Rubio P, de-Teresa-Galván J. Recurrent acute pancreatitis as clinical presentation of hydatid disease of the liver. Rev Esp Enferm Dig [Article in Spanish] 2012;104:441—2.
6. Mahmoudi A, Zouari K. A rare complication of hydatid cyst of the liver: acute pancreatitis. Pan Afr Med J [Article in French] 2015;21:247.
7. Alghofaily KA, Saeedan MB, Aljohani IM, Alrasheed M, McWilliams S, Aldosary A, et al. Hepatic hydatid disease complications: Review of imaging findings and clinical implications. Abdom Radiol (NY) 2017;42:199—210.
8. Dolay K, Akbulut S. Role of endoscopic retrograde cholangiopancreatography in the management of hepatic hydatid disease. World J Gastroenterol 2014;20:15253—61.

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Case Report

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Laparoscopic management of subhepatic appendicitis

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ABSTRACT

Acute appendicitis is one of the most common causes of acute abdomen that requires an emergency surgical approach. Acute appendicitis usually presents with diffuse pain that starts from the periumbilical area and localizes to the right lower quadrant. However, the clinical features might differ if the locations of the appendix change in the abdomen.

A 25-year-old male patient presented to the emergency department with a complaint of right upper quadrant pain for two days and clinical signs similar to acute cholecystitis. On his first physical examination, there was tenderness in the right upper quadrant. White blood cell count levels and neutrophil levels were elevated on blood test results. He was considered for acute cholecystitis after the first evaluation, and hepatobiliary ultrasonography was performed. The liver parenchyma and the biliary tract structures were shown to be non-pathological on ultrasonography (USG). Thus, computed tomography (CT) of the whole abdomen was planned and performed. It demonstrated the upper location of the cecum and subhepatic appendix. Inflammatory signs were detected on the appendix wall and surrounding tissues on the CT scan. Thereupon, emergency surgery was planned, and a laparoscopic appendectomy was performed.

The subhepatic location of the appendix is reported as extremely rare, with a rate of approximately 0.08% of all appendicitis cases. This clinical presentation was first reported in 1955 by King. This rare anatomic variation may cause delayed diagnosis and treatment difficulties. Subhepatic appendicitis can mimic hepatobiliary, gastric, or renal disorders like acute cholecystitis, hepatic abscess, perforated duodenal ulcer, and right nephrolithiasis.

Keywords: Laparoscopic appendectomy, subhepatic appendicitis, variations of appendix

Introduction

Acute appendicitis is one of the most common surgical emergencies. The appendix is generally located on the cecum at the junction point of three teniae coli in the right lower quadrant. Acute appendicitis generally presents with diffuse pain starting from the periumbilical area and localizes to the right lower quadrant, besides other intraabdominal infection signs like nausea, vomiting, and fever.[1] While the appendix generally presents in normal anatomical regions, it can be located in other areas in some variations. Therefore, clinical symptoms of acute appendicitis might differ according to the intraabdominal location of the appendix. Subhepatic appendicitis is a very rare condition with a rate of 0.08% of all appendicitis cases.[2] The subhepatic location of the appendix can mimic the clinical signs of acute cholecystitis or may cause misdiagnosis and delayed diagnosis of acute appendicitis.

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Case Report

A twenty-five-year-old male was admitted to the emergency department with post-prandial right upper quadrant and right lumbar pain, and nausea for two days. The patient's vital parameters were stable. Abdominal examination showed signs of abdominal defense and rebound on the right middle and upper side of the abdomen. The patient was considered for biliary colic preliminary diagnoses, and spasmolytic and anti-emetic symptomatic treatment and intravenous hydration were administered. However, the patient's complaint was not resolved. Thereupon, further investigations were performed. White blood cell levels and neutrophil levels were detected as elevated with results of 21.22×10^3/uL and 19.37×10^3/uL, respectively, in the laboratory blood test results. Liver function tests and bilirubin levels were normal. Following this, hepatobiliary USG was performed with a pre-diagnosis of acute cholecystitis. No significant pathology was observed on the gallbladder, biliary tract structures, and the liver parenchyma. Therefore, computed tomography (CT) was performed to figure out the exact pathology. However, the gallbladder and the intrahepatic and extrahepatic bile tracts were observed as normal. The cecum was observed localized at the right upper quadrant, and the appendix lying beneath under the liver. Appendix tissue was inflamed and wall-contrasted, and the diameter of the appendix was increased (Fig. 1). The patient was diagnosed with acute subhepatic appendicitis and emergency surgery was planned. The patient was hospitalized and started on 1 g cefazolin and 500 mg metronidazole intravenously for antibiotic prophylaxis. Laparoscopic surgery was planned, and a 10 mm scope was inserted through the umbilicus. Laparoscopic exploration confirmed the subhepatic appendix and right upper located cecum (Fig. 2). The patient was positioned in a left-sided reverse Trendelenburg position. One other 10-mm trocar and two 5-mm trocars were inserted as in a laparoscopic cholecystectomy operation. The appendix was exposed after holding up the gallbladder and right lobe of the liver by grasping and retracting the gallbladder with a laparoscopic grasper. The appendix and the mesoappendix were hyperemic, erect, and surrounded with adhered tissues but not perforated. The surrounding tissues were dissected up to the radix of the appendix. Laparoscopic polymer clips were used for ligation and appendectomy was performed successfully. The procedure was completed without any complications. The patient started enteral feeding at the postoperative 8th hour and was discharged on the postoperative 1st day. The histopathological result confirmed suppurative appendicitis.

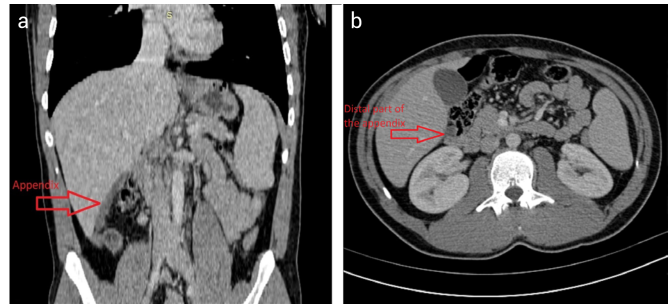

Figure 1. (a) View of the body of the appendix beneath the right lobe of the liver on the coronal section. **(b)** Distal part of the appendix on axial section

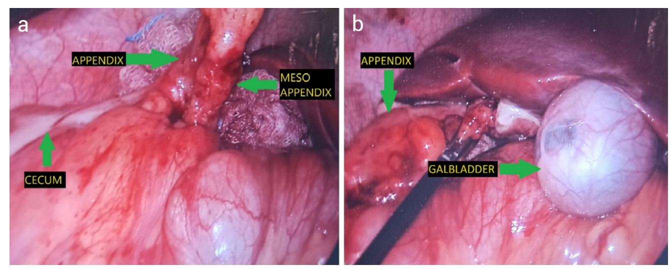

Figure 2. (a) View of appendix after dissection. **(b)** Subhepatic location of the appendix.

Discussion

The appendix vermiformis is a worm-like structure of the digestive system, which is placed in the posteromedial wall of the cecum. The approximate length of the appendix is about 2-9 cm.[3] The most common anatomical variants of the appendix are commonly retrocecal (60%), pelvic (30%), and retroperitoneal (7-10%).[4] However, the subhepatic location for the appendix is reported as extremely rare with a rate of approximately 0.08% of all appendicitis cases, which makes 0.09 per 100,000 population annually.[5]. Incomplete rotation, fixation, or malrotation of the midgut during embryological development results in the subhepatic cecum and appendix.[6] These congenital anomalies generally remain asymptomatic, but in the case of appendicitis, they show up with inconsistent clinical signs and symptoms.[7] Almost 60% of acute appendicitis patients can be easily diagnosed by the symptoms, physical examination findings, and additional laboratory tests.[8] Subhepatic appendicitis can mimic hepatobiliary, gastric, or renal disorders like acute cholecystitis, hepatic abscess, perforated duodenal ulcer, and right nephrolithiasis.[9] This clinical presentation was first reported in 1955 by King.[10] Laboratory test results are generally similar to those in normal appendicitis clinics. An imaging method is required for the differential diagnosis. Abdominal ultrasound can be thought of as the first-line imaging method, but because of its low diagnostic value and individual differences, an abdominal CT should be the first-line diagnostic imaging modality. It is significant to diagnose and make decisions for treatment as soon as possible in acute appendicitis, to prevent complications like perforation and intraabdominal sepsis, which may raise the rate of morbidity and mortality.[11] The surgical treatment method depends on the patient's clinical situation and the surgeon's experience. Open appendectomy is a choice, but laparoscopic treatment is the commonly preferred method for appendectomy for all appendicitis clinics, including those in different anatomical positions.[10] The laparoscopic approach has more advantages in order to see the exact location of pathology, explore additional intraabdominal pathologies if present, and it is less invasive. The placement of laparoscopic instruments in the laparoscopic approach can be modified according to the patient and the anatomical position of the appendix.[2]

Conclusion

The location of the appendix may not be typical in all cases. Different variants of the appendix may mislead clinicians in making diagnoses due to differently presented clinical signs and symptoms. Thus, clinicians should be aware of such unusual variants of appendicitis. Abdominal CT seems like a better option to determine the exact pathology in order to avoid misdiagnosis. The laparoscopic approach should be the first treatment option if available.

Disclosures

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References

1. Liang MK, Anderson RE, Jaffe BM, Berger DH. The Appendix. In: Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, et al., editors. Schwartz's principles of surgery. 10th ed. New York: McGraw-Hill Education; 2015. p. 1241–62.
2. Palanivelu C, Rangarajan M, John SJ, Senthilkumar R, Madhankumar MV. Laparoscopic appendectomy for appendicitis in uncommon situations: The advantages of a tailored approach. Singapore Med J 2007;48:737–40.
3. Parmar PD, Dave J, Vekariya M, Pandya K. Study of variations in position of appendix in 100 operated case of appendicitis. Int J Health Sci 2017;7:42–6.
4. Richmond B. The Appendix. In: Townsend CM, editor. Sabiston textbook of surgery: The biological basis of modern surgical practice. 21st ed. Philadelphia: Elsevier; 2022. p. 1301–19.
5. Zin MHBM, Kosai NR, Hayati F. Perforated subhepatic appendicitis: A case report. Gazi Med J 2021;32:575–6.
6. Hakim M, Mostafa R, Al Shehri M, Sharawy S. Surgical management of subhepatic perforated appendicitis: A case report. J Med Case Rep 2020;14:151.
7. Patel NR, Lakshman S, Hays TV, Thomas E. Subhepatic appendix with fecalith mimicking acute cholecystitis with gallstone. J Clin Ultrasound 1996;24:45–7.
8. Buluş H, Coşkun A. Subhepatik apandisit. Turk J Colorectal Dis 2010;20:29–32.
9. Painuly GP, Singhal M. Difficult diagnosis of acute abdomen caused by sub hepatic caecum with acute appendicitis-A rare case report. Int J Surg Case Rep 2020;72:608–9.
10. Ashwini E, Varun M, Saravanan PS, Julian S, Sandeep P. Hidden appendix: A case report and literature review of perforated acute appendicitis masquerading as acute cholecystitis. Int J Surg Case Rep 2022;97:107480.
11. Algin O, Ozmen E, Ozcan AS, Durmuz S, Karaoglanoglu M. Unusual manifestation of acute retrocecal appendicitis: Pericholecystic fluid. Turk J Trauma Emerg Surg 2013;19:80–2.