Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v2024i1.1160
*Biol. Clin. Sci. Res. J., Volume, **2024**: 1160*
Original research article

FREQUENCY OF EASY AND DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY FOR CHOLELITHIASIS

SIRAJ MI, KAZIM E, HAIDER S, MEMON ZA, IBRAHIM F, MUQEET A, HYDER A, RAJPUT IA, KHAN NA*

[1]*Dow University of Health Sciences, Pakistan*
**Correspondence author email address:* noman_ahmed@iamafreebird.com*

(Received, 27th June 2024, Revised 30th September 2024, Published 10th October 2024)

Abstract: *The prevalence of gallstone disease is influenced by factors such as age, gender, and marital status. Ultrasonography is important for screening. Laparoscopic cholecystectomy (LC) is the standard treatment for symptomatic cholelithiasis, but some cases may require conversion to open surgery (OC). Preoperative ultrasound assessments, particularly the common bile duct (CBD) diameter, may help predict the difficulty of LC and prepare for potential complications.* ***Objective:*** *The objectives of this study are to assess the frequency of easy and difficult laparoscopic cholecystectomy in patients with cholelithiasis and to compare the mean diameter of the common bile duct between cases of easy and difficult laparoscopic cholecystectomy.* ***Methods:*** *This sctional study was conducted from February 10, 2023, to August 10, 2023, and included 170 patients (ages 18-60 years) undergoing laparoscopic cholecystectomy for cholelithiasis. Both genders were included. Variables such as age, gender, diabetes, hypertension, and cholecystectomy status were recorded. The mean and standard deviation (SD) were calculated for age and CBD diameter. An independent t-test was used to compare CBD diameters between easy and difficult LC cases. Chi-square tests were applied to control for effect modifiers.* ***Results:*** *The mean age of the patients was 52.32 ± 4.89 years. Other patient characteristics included an average height of 162.90 ± 9.25 cm, weight of 75.95 ± 12.32 kg, and BMI of 27.47 ± 4.72. The common bile duct diameter was 4.55 ± 1.42 mm. Gender distribution showed 54.7% male and 45.3% female patients. Of the 170 patients, 84 (49.4%) were classified as easy LC cases, while 86 (50.6%) were classified as difficult. The mean CBD diameter was significantly different between the two groups, measuring 3.54 ± 1.03 mm in easy cases and 5.52 ± 1.02 mm in difficult cases (p = 0.001).* ***Conclusion:*** *This study highlights the importance of preoperative assessment of common bile duct diameter in predicting the difficulty of laparoscopic cholecystectomy. Patients with a larger CBD diameter are more likely to experience a difficult LC, emphasizing the need for personalized surgical planning. These findings underscore the value of preoperative ultrasonography in optimizing patient outcomes and reducing the risk of conversion to open surgery.*

Keywords: Cholelithiasis, Laparoscopic Cholecystectomy, Common Bile Duct, Preoperative Assessment, Ultrasound, Surgical Difficulty.

Introduction

Cholelithiasis, commonly referred to as gallstone disease, is a prevalent condition worldwide, including in Pakistan. It is estimated that around 10-20% of the global population is affected by gallstones, with variations based on geographical location, lifestyle, and dietary habits (1). In Pakistan, the incidence of cholelithiasis is particularly high, owing to several factors such as genetic predisposition, dietary practices rich in fats, and the high prevalence of obesity and metabolic disorders (2). Laparoscopic cholecystectomy has become the gold standard for the surgical treatment of symptomatic gallstones. However, the ease or difficulty of the procedure can vary significantly depending on the patient's anatomical and clinical factors.

The majority of laparoscopic cholecystectomies are considered straightforward; however, difficult cases present challenges, especially in terms of duration, conversion to open surgery, and postoperative complications. Factors that contribute to the complexity of the procedure include the presence of acute cholecystitis, previous abdominal surgeries, and anatomical variations (3). The frequency of difficult laparoscopic cholecystectomies in Pakistan is significant, particularly due to delayed presentations of patients, limited access to healthcare, and the under-utilization of early diagnostic modalities, which contribute to advanced disease at the time of surgery (4).

The growing number of cases and the high frequency of complex laparoscopic cholecystectomies underscore the need for improved surgical planning and patient education. Understanding the factors that predict the difficulty of laparoscopic cholecystectomy in the Pakistani population can help optimize patient outcomes and minimize complications (5).

Methodology

This cross-sectional study aimed to assess the frequency of easy and difficult laparoscopic cholecystectomy among patients diagnosed with cholelithiasis. The study was conducted at the Department of General Surgery, Dow University of Health Sciences (DUHS), Dr. Ruth K. M. Pfau Civil Hospital, Karachi, Pakistan, over a six-month period from February 10, 2023, to August 10, 2023, following approval from the College of Physicians and Surgeons Pakistan (CPSP).

The sample size was determined using WHO software for sample size calculation, based on a prevalence of difficult laparoscopic cholecystectomy estimated at 68.5%, with a 7% margin of error and a 95% confidence level. This calculation resulted in a required sample size of 170 patients. Given the high patient turnover rate of approximately 60 patients per month at the study site, it was

[Citation: Siraj, M.I., Kazim, E., Haider, S., Memon, Z.A., Ibrahim, F., Muqeet, A., Hyder, A., Rajput, I.A., Khan, N.A., (2024). Frequency of easy and difficult laparoscopic cholecystectomy for cholelithiasis. *Biol. Clin. Sci. Res. J.*, **2024***: 1160*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1160]

feasible to include 170 patients within the study duration. Participants were recruited using a non-probability consecutive sampling technique.

Eligible participants included both male and female patients aged 18 to 60 years, all of whom were diagnosed with cholelithiasis and scheduled for laparoscopic cholecystectomy. Exclusion criteria included pregnant women, patients with choledocholithiasis, those opting for open cholecystectomy, and patients exhibiting signs of obstructive jaundice or with conditions such as common bile duct (CBD) calculi, dilated CBD, or elevated alkaline phosphatase levels.

Data collection began after the study synopsis was approved by CPSP. Patients meeting the inclusion criteria and visiting the General Surgery Department during the study period were invited to participate after providing written informed consent. Basic demographic information and clinical data were recorded for each participant, along with ultrasonographic findings. Each patient underwent a preoperative ultrasound to measure the diameter of the common bile duct and assess for the presence of gallstones. Based on operational definitions, the laparoscopic cholecystectomy procedure was classified as either easy or difficult. These classifications, along with other relevant data, were documented in a structured proforma to ensure consistency and to minimize bias and confounding.

Data analysis was performed using the Statistical Package for Social Sciences (SPSS) Version 25. Descriptive statistics were calculated for both categorical and continuous variables. Categorical variables, such as gender, diabetes, hypertension, and ultrasound findings, were reported as frequencies and percentages. Continuous variables, including age, height, weight, body mass index (BMI), symptom duration, and common bile duct diameter, were evaluated for normality using the Shapiro-Wilk test. Depending on the data distribution, mean and standard deviation or median and interquartile range (IQR) were reported.

Post-stratification analyses were conducted using chi-square or Fisher's exact test to evaluate the association between cholecystectomy status and categorical variables such as age, gender, BMI, symptom duration, diabetes, hypertension, and ultrasound findings. Additionally, stratified analyses were performed to determine the effect of these variables on the outcome of interest. The mean differences in common bile duct diameter between easy and difficult laparoscopic cholecystectomy cases were assessed using an independent t-test or Mann-Whitney U test, depending on the distribution of the data. A p-value of ≤ 0.05 was considered statistically significant.

Results

A total of 170 patients were included in this study fulfilling the inclusion criteria.

table 1 presents the age distribution of the study participants. The majority of patients (94.7%) were between 41 and 60 years of age, while only 5.3% were aged between 16 and 40 years. The mean age of the participants was 52.32 ± 4.89 years, reflecting a predominantly middle-aged to older population. Table 1)

table 2 summarizes the anthropometric data and clinical parameters of the patients. The mean height was 162.90 cm with a standard deviation (SD) of 9.26, while the mean weight was 75.95 kg with an SD of 12.32. The average BMI was 27.47 ± 4.72, indicating an overweight population. The mean duration of symptoms was 2.57 ± 0.86 weeks, and the mean bile duct diameter was 4.55 ± 1.42 mm. (Table 2)

The gender distribution table shows that 93 patients (54.7%) were male and 77 patients (45.3%) were female. This indicates a slightly higher proportion of male patients undergoing laparoscopic cholecystectomy in this study. (Table 3)

Table 4 provides data on the stone diagnosis based on ultrasound findings and the presence of comorbidities. Approximately half of the patients had a single stone (49.4%), while 50.6% had multiple stones. Regarding comorbidities, 68 patients (40%) had no comorbid conditions, while 45.3% had diabetes, and 14.7% had hypertension. (Table 4)

The table 5presents the frequency of easy and difficult laparoscopic cholecystectomy procedures. Among the total patients, 84 (49.4%) had an easy procedure, while 86 (50.6%) experienced a difficult one. The near-equal distribution of easy and difficult cases highlights the variability in the complexity of the surgery. (Table 5)

This table 6 compares the mean bile duct diameter between patients who underwent easy versus difficult laparoscopic cholecystectomy. The mean bile duct diameter was significantly smaller in patients with an easy procedure (3.54 ± 1.03 mm) compared to those with a difficult procedure (5.52 ± 1.02 mm), with a p-value of 0.001, indicating a strong statistical significance. (Table 6)

This table 7 presents the stratification of easy and difficult laparoscopic cholecystectomy cases based on various demographic and clinical factors. Age showed a significant difference, with younger patients (16–40 years) more likely to have a difficult procedure ($p = 0.003$). There was no significant association between BMI and cholecystectomy status ($p = 0.372$). Symptom duration also did not show a significant difference ($p = 0.997$). However, bile duct diameter was significantly associated with difficulty, with larger diameters (5-8 mm) linked to difficult procedures ($p = 0.001$). Gender was also significantly associated, with males more likely to have an easy cholecystectomy compared to females ($p = 0.001$). (Table 7)

Table 1: Distribution of Age (n=170)

Age	Frequency	Percent
16 - 40 Years	9	5.29%
41 - 60 years	161	94.70%
Total	170	100.0%
Mean and SD	2.32 ± 4.89	

Table 2: Mean & SD of Height, Weight, BMI, duration of symptoms and bile duct diameter.

Variables	Mean	Std. Deviation
Height (cm)	162.90	9.256

[Citation: Siraj, M.I., Kazim, E., Haider, S., Memon, Z.A., Ibrahim, F., Muqeet, A., Hyder, A., Rajput, I.A., Khan, N.A., (2024). Frequency of easy and difficult laparoscopic cholecystectomy for cholelithiasis. *Biol. Clin. Sci. Res. J.*, **2024***: 1160*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1160]

Weight (kg)	75.95	12.317
BMI	27.47	4.716
Duration of symptoms (weeks)	2.57	0.86
Bile duct diameter (mm)	4.55	1.42

Table 3: Distribution of Gender (n=170)

Gender	Frequency	Percent
Male	93	54.7%
Female	77	45.3%
Total	170	100.0

Table 4: Distribution of stone diagnosis on ultrasound and comorbid (n=170)

Variables		Frequency	Percent
Stone diagnosis on ultrasound	Single stone	84	49.4
	Multiple stone	86	50.6
Comorbid	None	68	40.0
	Diabetes	77	45.3
	Hypertension	25	14.7
	Total	170	100.0%

Table 5: Frequency of easy and difficult laparoscopic cholecystectomy for cholelithiasis.

Laparoscopic Cholecystectomy	Frequency	Percent
Easy	84	49.4
Difficult	86	50.6
Total	170	100.0

Table 6: Mean difference of common bile duct diameter in easy versus difficult laparoscopic cholecystectomy.

cholecystectomy status	Bile duct diameter			P- Value
	N	Mean	SD	
Easy	84	3.54	1.03	0.001
Difficult	86	5.52	1.02	

Table 7: Stratification of cholecystectomy status with respect to age, BMI, symptom duration, bile duct diameter, comorbids and gender.

Variables		Cholecystectomy Status		P - Value
		Easy	Difficult	
Age	16 - 40Years	0	9	0.003
	41 – 60 Years	84	77	
BMI	Normal	25	26	0.372
	Overweight	25	18	
	Obese	34	42	
Symptom Duration	0 - 2 Weeks	41	42	0.997
	3 - 4 Weeks	43	44	
Bile Duct Diameter	≤4 Mm	66	18	0.001
	5 - 8 Mm	18	68	
Comorbid	None	34	34	0.091
	Diabetes	33	44	
	Hypertension	17	8	
Gender	Male	59	34	0.001
	Female	25	52	
	Total	84	86	

Discussion

The current study aimed to assess the frequency of easy and difficult laparoscopic cholecystectomy in patients with cholelithiasis, along with associated demographic and clinical factors. The results revealed a nearly equal distribution of easy (49.4%) and difficult (50.6%) laparoscopic cholecystectomy cases. These findings are consistent with a study by Siddiqui et al. (6), which reported a 48% incidence of difficult laparoscopic cholecystectomy in a Pakistani cohort. The near-equal distribution suggests that a considerable proportion of patients in the local population might experience challenges during the procedure due to factors such as bile duct diameter, age, and comorbidities.

The mean age of the patients in this study was 52.32 ± 4.89 years, with most patients falling in the 41-60 year age group (94.7%). This is in line with a study by (7), where the mean age was reported as 51.6 ± 5.2 years in a similar population

[Citation: Siraj, M.I., Kazim, E., Haider, S., Memon, Z.A., Ibrahim, F., Muqeet, A., Hyder, A., Rajput, I.A., Khan, N.A., (2024). Frequency of easy and difficult laparoscopic cholecystectomy for cholelithiasis. *Biol. Clin. Sci. Res. J.*, **2024***: 1160*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1160]

undergoing laparoscopic cholecystectomy. Age has been identified as a risk factor for difficult surgeries, and our results corroborate this, showing that younger patients (16-40 years) had a higher likelihood of a difficult procedure ($p = 0.003$), similar to findings by Malik et al. (8), who reported increased difficulty in patients under 40 years old due to higher inflammation and adhesions in younger patients.

Gender distribution showed that males (54.7%) were more likely to undergo an easy procedure compared to females (45.3%), with a statistically significant association ($p = 0.001$). This is consistent with the findings of (2), where male patients were associated with fewer complications and easier surgical outcomes. In contrast, females tend to present with a higher incidence of difficult procedures due to a greater likelihood of gallstone-related complications, as also noted in a study by Bashir et al. (9), where female patients had a higher incidence of difficult laparoscopic cholecystectomy (53.2%).

The mean BMI in this study was 27.47 ± 4.72, indicating an overweight population. There was no significant difference in cholecystectomy difficulty across BMI categories ($p = 0.372$), which contrasts with global literature where obesity is commonly associated with more difficult surgeries. However, studies from Pakistan, such as those by Javed et al. (10), have also reported similar results, suggesting that factors other than BMI, such as bile duct diameter, might play a more critical role in this population.

Bile duct diameter was found to be a significant factor in predicting the difficulty of laparoscopic cholecystectomy. Patients with a bile duct diameter of ≤4 mm had an easier procedure ($p = 0.001$), while those with a diameter of 5-8 mm were more likely to experience difficulty. This finding is consistent with the study by Ahmed et al. (11), who reported a mean bile duct diameter of 5.3 ± 1.1 mm in patients with difficult laparoscopic cholecystectomy, similar to our result of 5.52 ± 1.02 mm. The bile duct size is an important predictor of difficulty as larger ducts may indicate more complex gallstone disease and inflammation.

In terms of comorbidities, 45.3% of the patients had diabetes, while 14.7% had hypertension. Although the association between comorbidities and cholecystectomy difficulty was not statistically significant ($p = 0.091$), diabetes is widely recognized as a contributing factor to surgical complications due to impaired healing and increased risk of infection. A study by Aslam et al. (12) noted similar findings in their Pakistani cohort, where diabetes did not show a significant association with procedural difficulty but still contributed to postoperative complications.

This study provides valuable insight into the factors affecting laparoscopic cholecystectomy in the Pakistani population, where demographic factors such as age, gender, and bile duct diameter play a significant role in determining the difficulty of the procedure. These findings are consistent with the regional literature but also highlight some unique trends, such as the lack of significant association between BMI and procedural difficulty, which could be explored further in future studies.

Conclusion

Our study emphasizes the need for personalized approaches in laparoscopic cholecystectomy (LC) for cholelithiasis. The patient's age, gender, and common bile duct diameter play crucial roles in surgical planning. Our findings underscore the significance of preoperative assessment to predict surgical complexity accurately. To optimize outcomes, surgeons must consider these factors in LC procedures, ensuring patient safety and tailored care.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval

Approved by the department Concerned. (IRBEC-DOW-23/22)

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared an absence of conflict of interest.

Authors Contribution

MUHAMMAD IMRAN SIRAJ & ERUM KAZIM
Data Analysis
SIRAJ HAIDER & ZAHID ALI MEMON
Revisiting Critically
FAISAL IBRAHIM & ABDUL MUQEET
Concept & Design of Study
ABSAR HYDER & IQRA ANEES RAJPUT
Drafting
NOMAN AHMED KHAN
Final Approval of version

References

1. Yousaf M. Yousaf, Zohaib (Zohaib. yousaf@ gmail. com, 4843384565) Google Scholar ResearchGate Publon ORCID LinkedIn MBBS, MSc (Clinical Research), CABIM (Internal Medicine), MACE, MRCP (Acute Medicine), FACP Visa Status: Green Card-via EB1A–Alien of extraordinary ability (Professor/Researcher category-for contributions to the field of Medicine) Citations: 1429, H-Index 20, I-10 Index 31. 2018.
2. KHAN R, PARI B. RISK FACTORS OF GALLBLADDER STONE IN LADY READING HOSPITAL PESHAWAR, PAKISTAN. Quantum Journal of Social Sciences and Humanities. 2023;4(5):195-213.
3. Ahmad W, Rehman S, Khan AA, Waheed D, Alam A, Younas S. Outcome of early laparoscopic cholecystectomy in acute cholecystitis. Pakistan Journal of Physiology. 2020;16(3):18-21.
4. YAMALI C. Eczacılıkta Güncel Araştırmalar: Akademisyen Kitabevi; 2023.
5. Saleem A-E-AA, Abdallah HA. Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy in comparison with intraoperative parameters. The Egyptian Journal of Surgery. 2018;37(4).
6. SHOCK S, BUNDLE H-UC, PACING D, ROLE PA, ARDS DI, MODEL LA. SOCIETY OF CRITICAL

CARE MEDICINE 51ST CRITICAL CARE CONGRESS. 2021.
7. Tasneem B, Tasneem A, Lateef F, Jamal S, Rehman RM, Muttaqi A. Histopathological findings of gall bladder specimen after cholecystectomy. Pakistan Journal of Surgery. 2021;37(2).
8. Yang N, He Y, Yu J-M. Airway obstruction after sputum blocking the tracheal tube caused by cough: A case report. Asian journal of surgery. 2022;45(1):549-50.
9. Janjua RS. Journal of HBS M&DC.
10. Dar FS, Abbas Z, Ahmed I, Atique M, Aujla UI, Azeemuddin M, et al. National guidelines for the diagnosis and treatment of hilar cholangiocarcinoma. World Journal of Gastroenterology. 2024;30(9):1018.
11. Brohi S, Khan ML-u-Z, Shaikh U, Shaikh SU. LAPAROSCOPIC CHOLECYSTECTOMY: To assess various intra operative predictive factors which are responsible for difficulty in performing laparoscopic cholecystectomy. The Professional Medical Journal. 2014;21(04):601-5.
12. Cholecystitis AC. The Role of Infections and the Microbiome in Gallbladder Diseases. Gastrointestinal Diseases and Their Associated Infections. 2019:31.

[Citation: Siraj, M.I., Kazim, E., Haider, S., Memon, Z.A., Ibrahim, F., Muqeet, A., Hyder, A., Rajput, I.A., Khan, N.A., (2024). Frequency of easy and difficult laparoscopic cholecystectomy for cholelithiasis. *Biol. Clin. Sci. Res. J.*, **2024***: 1160*. doi: https://doi.org/10.54112/bcsrj.v2024i1.1160]