

EXPLORING GALLBLADDER RADIOLOGICAL PARAMETERS FOR PREDICTING DIFFICULTY IN LAPAROSCOPIC CHOLECYSTECTOMY

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Abstract: Laparoscopic cholecystectomy is the standard treatment for symptomatic cholelithiasis. In this study, gallbladder radiological parameters, including size and wall thickness, were assessed on ultrasound for their association with the difficulty of laparoscopic cholecystectomy. **Methods:** In this retrospective cross-sectional study, the size of the gallbladder and wall thickness were assessed through ultra-sonographic assessment, which was related to the duration of laparoscopic cholecystectomy. All adult patients undergoing laparoscopic cholecystectomy for symptomatic cholelithiasis at Dow University of Health Sciences, Ojha Campus, in 2020 were enrolled in the study. **Results:** Thirty-three patients, including 25 (75.8%) females and 8 (24.2%) males, with a mean age of 45.76 ± 13.18 years, were included in the study. The mean operative time for the patients was 98.18 ± 32.28 minutes. Mean gallbladder length and breadth were 7.66 ± 2.30 cm and 2.44 ± 0.76 cm, respectively, whereas mean wall thickness was 3.05 ± 1.52 mm. Gallbladder size, area, and ratio were not significantly associated with patients' operative time. However, a subgroup analysis of the female population revealed a significant association between gallbladder area and operative time. **Conclusion:** Most gallbladder radiological parameters are not associated with the difficulty level of laparoscopic cholecystectomy. Gallbladder area, especially in females, may be able to predict the difficulty level of the surgery.

Keywords: Gallbladder Radiology; Laparoscopic Cholecystectomy; Difficult

Introduction

Cholelithiasis is a prevalent surgical condition that requires cholecystectomy to avoid future episodes.(1, 2) Laparoscopic cholecystectomy has revolutionised the general surgical practice for its management as it offers shorter hospital stays and a lower risk of complications postoperatively.(3-5) the general surgery and hepatobiliary surgical team routinely perform the procedure, and it is considered a relatively shorter case than the major laparotomy procedures. However, surgeons still face difficulty regarding visceral exposure, intraoperative complications, and gallbladder resection.(3, 4, 6) Limited data is available to predict a difficult laparoscopic cholecystectomy based on preoperative radiology to make adequate preparations before the surgery. In this study, operative time was utilised to measure the difficulty level of the surgery, as complicated cases require more time for completion. Prolonged operative time has been reported as an independent risk factor for bile duct injury.(7) We

compared the preoperative parameters of the gallbladder on ultrasound with the patient's operative time.

Methodology

This retrospective cross-sectional study received an IRB exemption from the institutional ethical review committee (IRB-2204) in 2021. Adult patients undergoing elective laparoscopic cholecystectomy for symptomatic cholelithiasis were enrolled in this study. Enrolled patients were operated on between January and December 2020. This study was conducted at Dow University Hospital, DUHS, Karachi, Pakistan. We excluded patients with preoperative ultrasounds performed outside our facility due to a lack of access to reporting. Patients with neither gallbladder wall thickness nor size reported in the abdominal ultrasound were excluded. As it was a retrospective study, no sample size was predetermined.

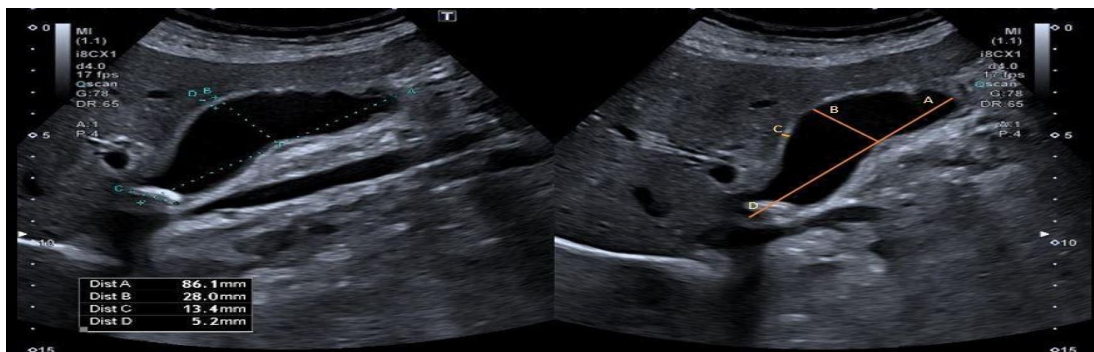


Figure 1: measurement technique for GB length and breadth

Clinical records were reviewed retrospectively for demographics and operative notes, whereas abdominal ultrasound reports were assessed for gallbladder size and wall thickness, as shown in Figure 1. Gallbladder size was recorded as length and width. Gallbladder area was calculated as the product of length and width available from the report. The gallbladder ratio was calculated as the ratio of the gallbladder's length and width.

The continuous data was analysed as mean and standard deviation for normally distributed variables, whereas categorical data was analysed as frequency and percentages. Linear regression assessed the correlation between continuous parameters, whereas logistic regression was used for categorical and continuous variables. A subgroup analysis was conducted to determine the gender of the study population. All the data was analysed using SPSS v26

Results

Thirty-three patients, comprising 25 (75.8%) females and 8 (24.2%) males, with a mean age of 45.76 ± 13.18 years, were enrolled in the study. The mean operative time was 98.18 ± 32.28 minutes. The mean length and breadth of the gall bladder were 7.66 ± 2.30 and 2.44 ± 0.76 cm, respectively. The calculated gall bladder area and ratio were

19.69 ± 10.58 cm² and 3.29 ± 0.88 , respectively. The patient characteristics can be observed in Table 1.

Table 1: Characteristics of enrolled patients

Patient Characteristics	n	Mean \pm s.d.
Age (years)	33	45.76 \pm 13.18
Sex	33	
Female		25
Male		8
Gall Bladder		
Length (cm)	30	7.66 \pm 2.30
Breadth (cm)	29	2.44 \pm 0.76
Area (length x breadth)	29	19.69 \pm 10.58
Ratio (length/ breadth)	29	3.29 \pm 0.88
Wall Thickness (mm)	32	3.05 \pm 1.52
Operative Time (min)	33	98.18 \pm 32.28

Table 2 and figures 2-5 show the analysis of the patient's age and radiological parameters concerning their operative time. No statistically significant association of operative time was observed with gallbladder length, breadth, area, ratio, and wall thickness ($p > 0.05$). However, subgroup analysis of the female patients revealed a significant association of operative time with the calculated area of the gallbladder on ultrasound ($p = 0.032$). Male participants were not analysed separately due to the small group size.

Table 2: Regression analysis for duration of surgery

Patient Characteristics	All Participants		Only Females	
	n	p-value	n	p-value
Age	33	0.457	25	0.475
Length (cm)	30	0.283	24	0.090
Breadth (cm)	29	0.225	23	0.155
Area (length x breadth)	29	0.180	23	0.032*
Ratio (length/ breadth)	29	0.772	23	0.759
Wall Thickness (mm)	32	0.256	24	0.305

*significant association as $p < 0.05$.

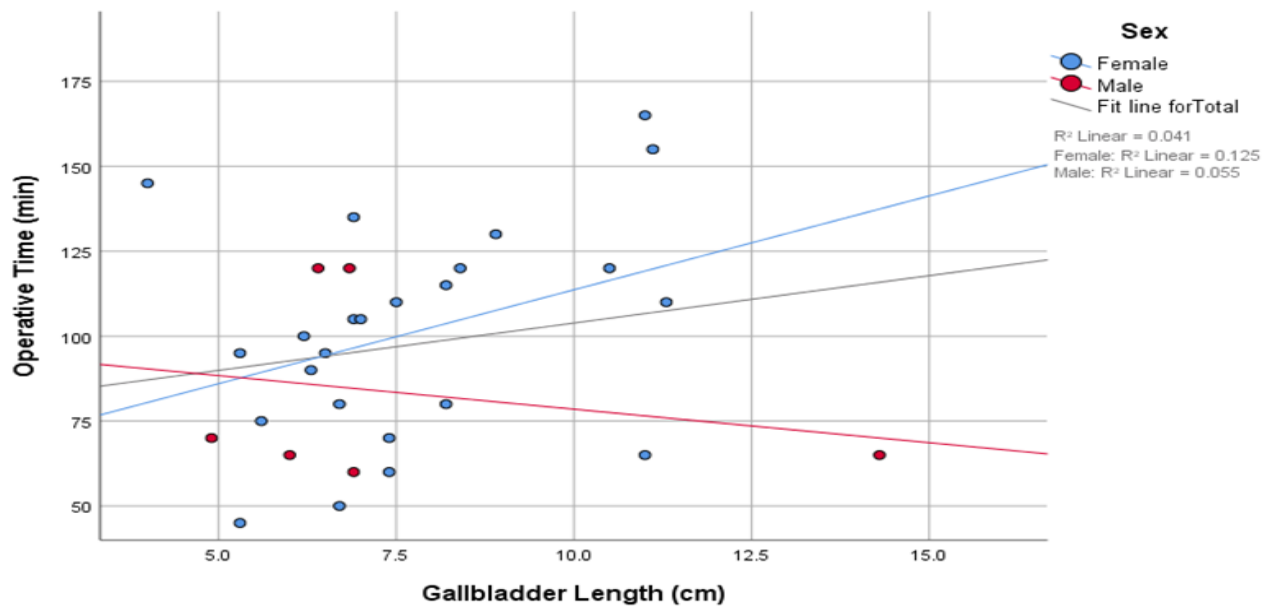


Figure 2: analysis of operative time and GB length

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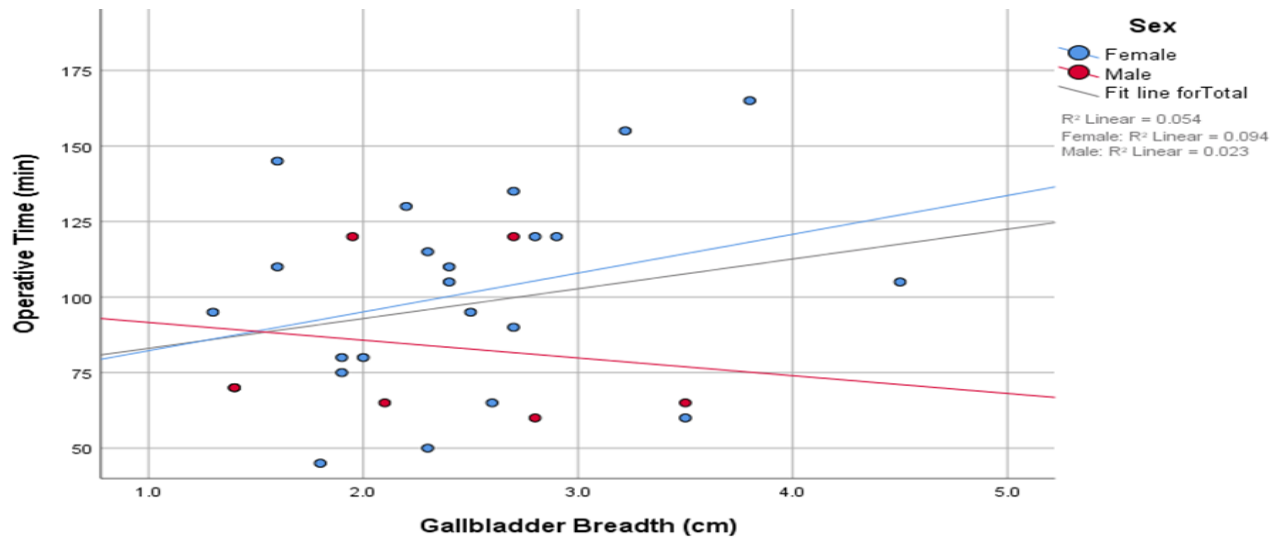


Figure 3: Comparison between operative time and GB breadth in cm

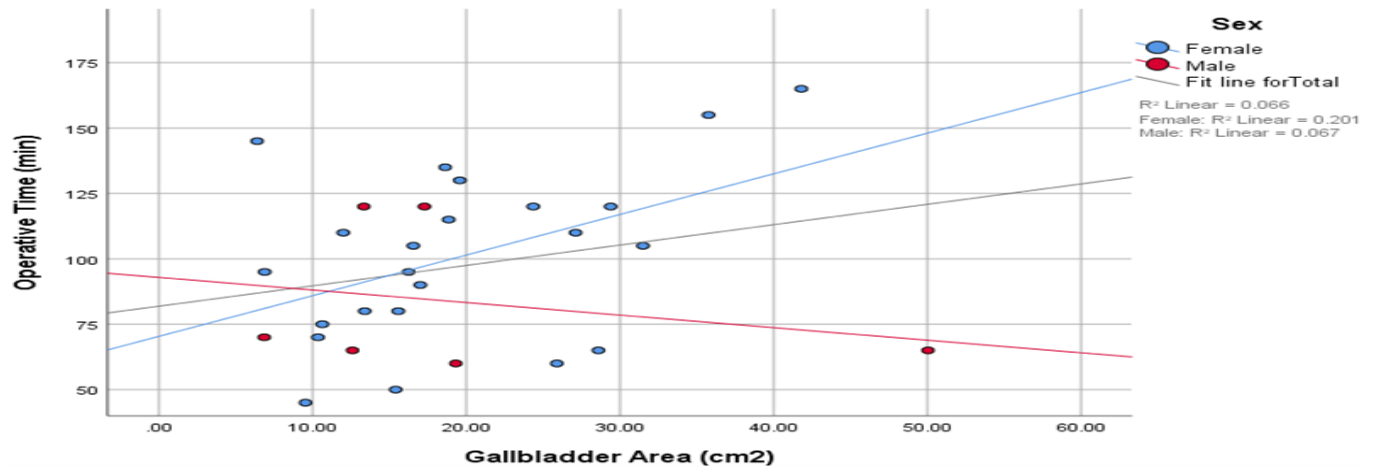


Figure 4: Comparison between operative time and GB area

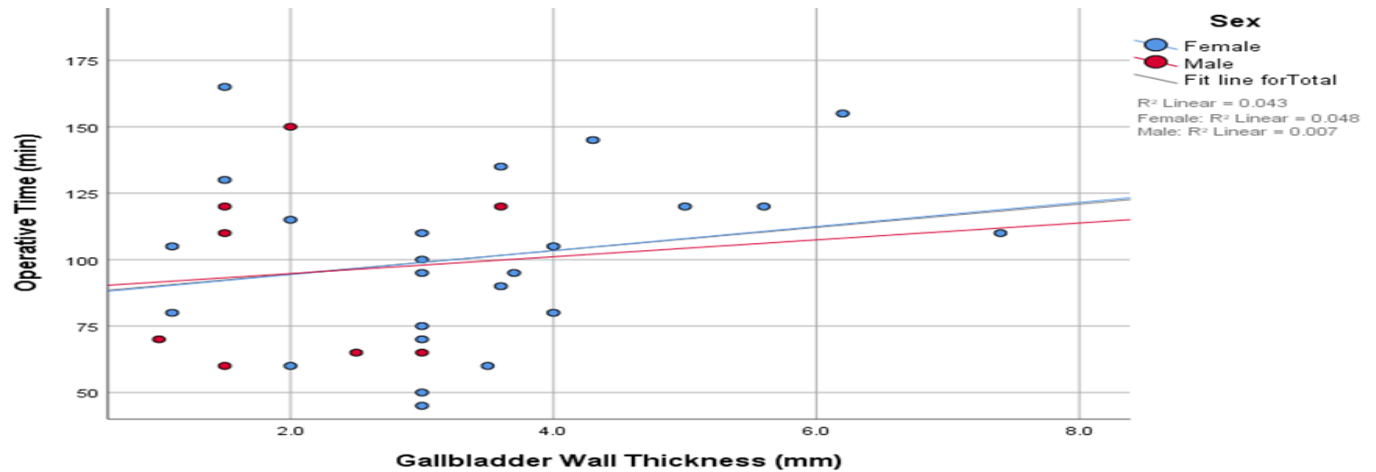


Figure 5: Comparison between operative time and GB wall thickness

Discussion

Laparoscopic cholecystectomy has revolutionised the overall surgical practice because of its shorter length of stay in hospital, minimal pain and good cosmetic outcomes. (3-5) Laparoscopic Cholecystectomy is now routine, even in a few developing countries. The procedure has been practised

since the early years of postgraduate training and is conducted by experienced surgical faculty. Despite the extensive surgical practice and adequate preoperative patient evaluation, surgeons commonly face difficulties leading to dreadful complications. The problems usually encountered by surgeons include multiple dense adhesions, distended gall bladder, puckering of the liver and inability

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to identify the proper plane of dissection. A difficult laparoscopic cholecystectomy ultimately leads to complications, including gall bladder perforation, vascular injury, adjacent structure, i.e. hepatic injury, hollow viscus injury, diaphragmatic injury or pneumothorax, bile duct injury and bile leak. Hindrance in performing the procedure smoothly leads to more operative time and increased risks of conversion to open cholecystectomy, and prolonged anaesthesia has its own adverse effects.(3, 4, 6, 8)

Factors that can predict the possibility of complex laparoscopic surgery are needed to ensure further evaluation and optimisation of the patient and decrease operative risk.(3, 8) Several studies have discussed preoperative factors, including BMI, chronic history, palpable gallbladder, and preoperative ERCP.(9-10) In our case, we decided to assess available radiological factors to predict a difficult laparoscopic cholecystectomy. Ultrasound was our choice of radiology as it is cheap and commonly used for the preoperative diagnosis of cholelithiasis.

Shinazaki et al. recommended that the ratio of the gall bladder's height and width on a CT scan be associated with the difficulty of laparoscopic cholecystectomy.(6) However, the gallbladder ratio on ultrasound did not express any statistical significance in our study. Gallbladder length, width, and area also failed to convey a relation with the difficulty of the procedure.

Studies have associated increased gallbladder wall thickness, usually a sign of acute or chronic cholecystitis, with increased risk for longer operative time and conversion to open procedure.(3, 8) However, our study did not observe a statistically meaningful relationship between the wall thickness and the difficulty level of the surgery.

The significant association of the gallbladder area with operative time in female subjects offers an important predictive factor for laparoscopic cholecystectomy. Surgeons operating on females with a high ultrasound gallbladder area can expect difficult resection. Such cases can be scheduled early in the day, or the primary surgeon can be extra cautious during the procedure. In addition, these patients can be optimised preoperatively concerning clinical status or laboratory values.

Our study has a few notable limitations. Its retrospective nature and small population may have adversely affected it. In addition, operative time is an indirect measure of difficult laparoscopic cholecystectomy. Extensive prospective controlled studies are required to further evaluate the relationship of radiological gallbladder parameters with the difficulty level of laparoscopic cholecystectomy.

Conclusion

Most gallbladder radiological parameters have a limited role in predicting difficult laparoscopic cholecystectomy. The gallbladder area on ultrasound, especially in females, may be helpful in warning of the risk of complications or longer operative time for the procedure. A skilled sonographer can assist in predicting operative problems that could help take measures ahead.

Declarations

Data Availability statement

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

Ethics approval and consent to participate

Approved by the department concerned. (IRB-2204) in 2021

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

UMM-E-HABIBA ABDUL RAUF (Resident)

Conception of Study, Development of Research, Study Design, Review of manuscript, final approval of manuscript.

MUJEEB-UR-REHMAN MALIK (Senior Registrar)

Conception of Study, Final approval of manuscript.

OMEMA SALEEM (Assistant Professor)

Coordination of collaborative efforts.

SYED ANOSH ALI NAQVI (House Officer)

Data entry and Data analysis, drafting article.

KARIM RIZWAN NATHANI (House Officer)

Data entry and Data analysis, drafting article\

FAISAL GHANI SIDDIQUI (Professor)

Manuscript revisions, critical input.

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