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A PROSPECTIVE STUDY OF GALLBLADDER WALL THICKNESS AS A SINGLE PREDICTOR FOR DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY AT A TERTIARY CARE CENTER

General Surgery

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) remains the gold standard for symptomatic cholelithiasis, yet conversion rates to open surgery range from 1–13%. Preoperative identification of difficult cases is essential for surgical planning and patient counseling. Gallbladder wall thickness (GBW) represents an objective, measurable predictor, yet its precise role remains incompletely defined. **Objectives:** To assess GBW as a predictor of operative difficulty during LC and to evaluate its correlation with intraoperative parameters and postoperative complications. **Methods:** A prospective observational study was conducted at Akash Institute of Medical Sciences from March 2024 to August 2025. Seventy-one patients with symptomatic cholelithiasis undergoing LC were stratified into four groups based on preoperative ultrasound GBW: normal (≤2 mm), mild (3–4 mm), moderate (5–6 mm), and severe (>6 mm). Intraoperative findings, operative time, conversion rates, and postoperative complications were recorded. **Results:** Mean age was 45.3 years with 69% female predominance; mean GBW was 3.83 mm. GBW demonstrated exceptionally strong positive correlation with total operative time ($r = 0.914$, $p < 0.001$) and dissection time at Calot's triangle ($r = 0.899$, $p < 0.001$). All conversions to open surgery (4.2%) and prolonged operative times (≥120 minutes) occurred exclusively in patients with GBW ≥5 mm. Drain placement was required in 45.1% of cases, with seroma in 15.5%, suggesting increased technical difficulty with thicker gallbladders. **Conclusion:** Gallbladder wall thickness is a statistically robust and clinically valuable predictor of difficult LC. The strong correlations with operative and dissection duration-coupled with the clustering of conversions within the severe thickening category-underscore its utility in preoperative risk stratification and informed consent discussions.

KEYWORDS

Gallbladder wall thickness, Cholelithiasis, Laparoscopic cholecystectomy, Difficult cholecystectomy, Conversion to open surgery, Risk stratification.

INTRODUCTION

Cholelithiasis is the most common disease of the gallbladder and biliary tree, affecting 10–15% of the population worldwide. Although many patients remain asymptomatic, symptomatic gallstones frequently require surgical intervention, and laparoscopic cholecystectomy has become the gold standard treatment. Since the first laparoscopic cholecystectomy by Erich Mühe in 1985, and its subsequent popularization, LC has largely replaced open cholecystectomy because of smaller incisions, less pain, and shorter hospital stay.

Despite its advantages, LC can be technically difficult in a subset of patients, leading to longer operative times, higher complication rates, and conversion to open cholecystectomy. Reported conversion rates range widely from 1–13%, often due to dense adhesions, distorted anatomy, or severe inflammation. Identifying these difficult cases preoperatively is crucial for planning, resource allocation, and patient counseling.

Transabdominal ultrasonography (USG) is the first-line imaging modality for gallstone disease and allows measurement of gallbladder wall thickness. Normal gallbladder wall thickness is typically less than 3 mm, and thickening has traditionally been considered a hallmark of acute or chronic cholecystitis. Multiple studies have shown that increased GBW is associated with increased operative difficulty, including longer dissection time, higher risk of bleeding, and increased conversion rates.

However, there is still variability in the cut-off values used and in how strongly GBW predicts specific intraoperative and postoperative outcomes. The present study aims to evaluate gallbladder wall thickness as a single, objective preoperative predictor of difficult laparoscopic cholecystectomy and to quantify its association with operative time, dissection difficulty, conversion to open surgery, and postoperative complications.

METHODS

Study Design And Setting

This was a prospective observational study conducted in the Department of General Surgery, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, from March 2024 to August 2025.

Study Population

All adult patients (≥18 years) with symptomatic cholelithiasis diagnosed on USG and planned for elective laparoscopic cholecystectomy were eligible for inclusion. Written informed consent was obtained from all participants.

Inclusion Criteria

Age ≥18 years.
Symptomatic cholelithiasis as demonstrated by USG.
Gallbladder wall thickness measurable on USG.
Willingness to undergo laparoscopic cholecystectomy and to participate in the study.

Exclusion Criteria

Cholangitis, gallstone pancreatitis, carcinoma gallbladder.
Cholelithiasis with choledocholithiasis.
Previous hepatobiliary or pancreatic surgeries.
Gallbladder perforation, generalized peritonitis.
Altered coagulation profile or chronic liver disease.
Biliary-enteric fistula.
Pregnancy.
BMI ≥30 kg/m².
Patients planned primarily for open cholecystectomy.

Gallbladder Wall Thickness Measurement

GBW was measured preoperatively using transabdominal ultrasonography at the level of the gallbladder fundus, with the probe perpendicular to the wall. Patients were stratified into four groups based on GBW:

Normal: ≤2 mm
Mild: 3–4 mm
Moderate: 5–6 mm
Severe: >6 mm

Operative Technique and Data Collection

All patients underwent standard four-port laparoscopic cholecystectomy under general anesthesia. Intraoperative data collected included:

Total Operative Time (skin incision to closure).
Time for dissection at Calot's triangle.
Time for dissection of gallbladder from liver bed.
Presence of dense adhesions, hemorrhage, gallbladder perforation, bile spillage.
Need for conversion to open cholecystectomy and reason for conversion.
Need for drain placement.

Postoperative data included:
Duration of drain placement and nature of drain output.
Postoperative complications (bile leak, seroma, wound infection, etc.).
Length of hospital stay and day of suture removal.

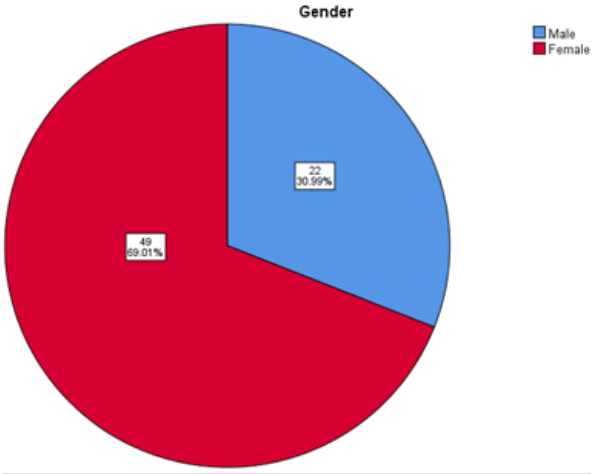
Sample Size And Statistical Analysis
A minimum sample size of 71 was calculated based on prevalence data and absolute error margin of 7% at 95% confidence interval. Data were analyzed using standard statistical software. Continuous variables were expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Pearson's correlation coefficient was used to evaluate the relationship between GBW and operative parameters. A p-value <0.05 was considered statistically significant.

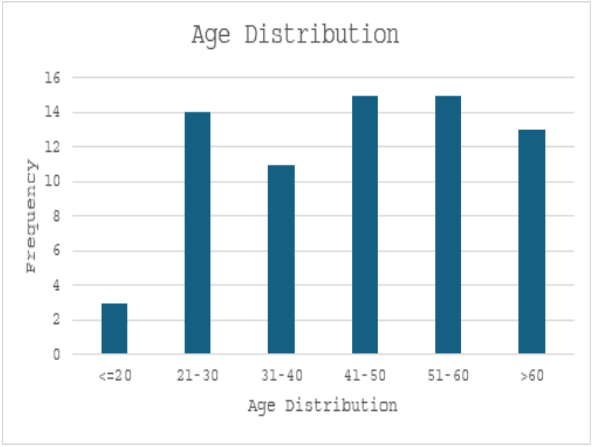
RESULTS

Demographic Profile

A total of 71 patients were included. The mean age was 45.3 years, with a range from early adulthood to elderly. Females comprised 69% of the study population, reflecting the known female predominance in cholelithiasis.

Gender			
		Frequency	Percent
Valid	Male	22	31.0
	Female	49	69.0
	Total	71	100.0





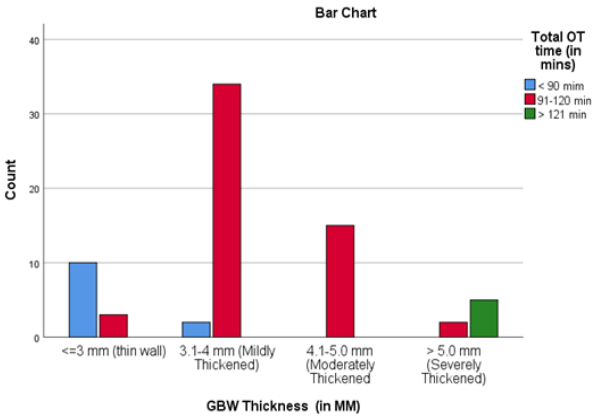
Age Distribution			
		Frequency	Percent
Valid	<=20	3	4.2
	21-30	14	19.7
	31-40	11	15.5
	41-50	15	21.1
	51-60	15	21.1
	>60	13	18.3
	Total	71	100.0

Distribution by Gallbladder Wall Thickness
The mean GBW in the cohort was 3.83 mm. Distribution across GBW groups:

Normal (≤2 mm): 15 patients (≈21.1%)
Mild (3–4 mm): 25 patients (≈35.2%)
Moderate (5–6 mm): 21 patients (≈29.6%)
Severe (>6 mm): 10 patients (≈14.1%)

Correlation with Operative Parameters
GBW showed a strong positive correlation with:
Total operative time: $r = 0.914$, $p < 0.001$.
Dissection time at Calot's triangle: $r = 0.899$, $p < 0.001$.

Crosstab						
Count		Total OT time (in mins)			Total	P
		< 90 mim	91-120 min	> 121 min		
GBW Thickness (in MM)	<=3 mm (thin wall)	10	3	0	13	0.00
	3.1-4 mm (Mildly Thickened)	2	34	0	36	
	4.1-5.0 mm (Moderately Thickened	0	15	0	15	
	> 5.0 mm (Severely Thickened)	0	2	5	7	
Total	12	54	5	71		



Patients with normal GBW usually had operative times below 60 minutes, while those with GBW ≥5 mm frequently had operative times ≥120 minutes. A weaker but statistically significant correlation was observed between GBW and suture removal day ($r = 0.235$, $p = 0.048$).

Conversion to Open Cholecystectomy
The overall conversion rate was 4.2% (3 out of 71 patients). Importantly, all conversions occurred in patients with GBW ≥5 mm; there were no conversions in patients with normal or mildly thickened walls (≤4 mm). Within the GBW ≥5 mm subgroup (moderate and severe groups combined), the conversion rate was approximately 9.7%.

The main reasons for conversion were:
Dense adhesions with difficult anatomy.
Bleeding from liver bed.
Gallbladder perforation with bile contamination.

Intraoperative Findings and Drain Placement
Adhesions, bleeding, and difficult dissection were more common in

moderate and severe GBW groups. Overall, drains were placed in 45.1% of patients, with the highest frequency in the severe GBW group (>6 mm).

Postoperative Complications and Hospital Stay

Seroma developed in 15.5% of patients and was more frequent in those with thicker gallbladder walls. One patient had postoperative bile leak requiring further intervention. Mean hospital stay was shortest in patients with normal GBW and longest in those with GBW ≥5 mm, often due to drain management and observation for complications.

DISCUSSION

This prospective study demonstrates that gallbladder wall thickness measured on preoperative ultrasound is a powerful predictor of operative difficulty in laparoscopic cholecystectomy. The very strong correlations between GBW and both total operative time (r = 0.914) and dissection time at Calot's triangle (r = 0.899) underscore the clinical importance of this simple measurement.

Thicker gallbladder walls reflect chronic inflammation and fibrosis, leading to obscured anatomy, dense adhesions, and friable tissue. These factors prolong dissection, increase risk of bleeding, and can necessitate conversion to open surgery. In the present study, all conversions and all very prolonged procedures (≥120 minutes) occurred in patients with GBW ≥5 mm, identifying this as a practical risk threshold.

These findings are consistent with other studies that have highlighted GBW as a significant predictor of difficult LC and higher conversion rates, and they support using GBW as part of routine preoperative risk stratification. In patients with GBW ≥5 mm, surgeons should anticipate a more challenging procedure, ensure availability of senior assistance, and counsel patients about the increased likelihood of prolonged surgery, drain placement, extended hospital stay, and possible conversion.

Our study included 71 patients undergoing elective laparoscopic cholecystectomy, with 69% female predominance and mean age of 45.3 years. Approximately 44% had GBW ≥5 mm, marking a high-risk subgroup. In contrast, Dawood Al-Hilfi et al study of 100 patients at Basrah reported mean GBW of 4.2 mm, with GBW >4 mm predicting 28% conversion rate (vs 2% in thin walls, p<0.001) and longer operative time (85 vs 55 min). Raman et al retrospective review of 874 cholecystectomy patients found GBW >3 mm independently predicted conversion (OR 3.2, p=0.01), complications (OR 2.8), and extended length of stay, with mean operative time rising from 68 min (thin) to 112 min (thick walls)— closely paralleling our r=0.914 correlation (p<0.001).

Limitations of this study include its single-center design, relatively small sample size, and lack of long-term follow-up beyond discharge. Nevertheless, the prospective design and clear gradient of risk across GBW groups strengthen the conclusions.

CONCLUSION

Gallbladder wall thickness on preoperative ultrasonography is a reliable, objective, and statistically robust predictor of difficult laparoscopic cholecystectomy. Strong correlations with operative time and dissection difficulty, together with the clustering of conversions and prolonged surgeries in patients with GBW ≥5 mm, highlight its value in preoperative planning.

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