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Clinical & Ultrasonography Based Scoring to Predict Pre-Operatively the Conversion of Laparoscopic to Open Cholecystectomy - A Prospective Observational Study

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HIGHLIGHTS

- LC is standard minimally invasive procedure.
- Conversion to OC increases morbidity.
- USG score >8.5 predicts conversion.
- Thick GB wall and neck stones risk factors.
- Early prediction improves surgical outcomes.

Key Words:

Laparoscopic cholecystectomy
Conversion
Ultrasonographic scoring
Gallstone disease
Predictive model

ABSTRACT

Introduction: Laparoscopic cholecystectomy (LC) is the standard procedure for gallbladder removal due to its minimally invasive nature and better postoperative outcomes. However, conversion to open cholecystectomy (OC) may be required in certain high-risk cases, leading to longer operative times and increased morbidity. Early identification of factors predictive of conversion is essential to improve surgical preparedness and patient counseling. **Materials & Methods:** This prospective observational study was conducted at the Department of General Surgery, J.A. Group of Hospitals, Gwalior, over 18 months. A total of 330 patients diagnosed with cholelithiasis and planned for LC were evaluated preoperatively using a clinical and ultrasonographic scoring system. Parameters included gallbladder morphology, wall thickness, stone size and location, number of attacks, duration of complaints, and comorbidities. Standard laparoscopic cholecystectomy was performed, and intraoperative conversion rates were recorded. Statistical analysis was done using SPSS-25, with ROC curve analysis used to identify predictive cutoff scores. **Results:** Out of 330 patients, 38 (11.5%) required conversion to OC. The conversion rate was significantly higher in patients aged 51–60 years (29.6%), those with multiple prior attacks (up to 83.3%), and those with complaints longer than 12 months (60.5%). Ultrasonographic factors such as gallbladder wall thickness >3 mm, stone at the neck, stone size ≥ 2 cm, and pericholecystic collection were significantly associated with conversion. A USG score cutoff of >8.5 predicted conversion with moderate sensitivity and specificity. **Conclusion:** Clinical and ultrasonographic parameters effectively predict the likelihood of conversion from LC to OC. The scoring system aids in risk stratification, surgical planning, and informed consent, ensuring better outcomes and resource optimization..



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INTRODUCTION

Laparoscopic cholecystectomy (LC) has revolutionized the surgical management of symptomatic gallstone disease and is now considered the gold standard for gallbladder removal. Since its introduction in the late 1980s, LC has rapidly replaced open cholecystectomy (OC) as the preferred technique due to its minimally invasive approach, offering patients reduced postoperative pain, shorter hospital stays, and faster recovery [1]. However, despite its widespread adoption and proven benefits, LC is not without limitations, particularly in certain patient subsets where anatomical or pathological complexities arise during surgery. In such cases, surgeons are occasionally required to convert LC to OC intraoperatively, a decision made to ensure patient safety and operative success when laparoscopic access is deemed insufficient [2]. Although the overall conversion rate remains relatively low, the need for conversion often signals underlying complications, such as severe inflammation, dense adhesions, or unclear anatomy. Conversion is associated with longer operative durations, increased blood loss, heightened postoperative morbidity, and extended hospital stays, all of which contribute to a more challenging perioperative course [3].

Given these implications, the ability to predict the likelihood of conversion before surgery is of significant clinical value. Accurate preoperative risk stratification enables improved surgical planning, more effective resource allocation, and enhanced patient counseling regarding potential outcomes and risks [4]. A growing body of evidence has identified several factors that can be assessed preoperatively to predict conversion risk. Among these, demographic characteristics have emerged as important indicators. Male gender and older age are consistently associated with higher conversion rates. Men tend to present with more severe forms of gallbladder disease, including fibrosis and chronic inflammation, while older patients frequently have comorbidities and tissue characteristics that complicate laparoscopic dissection [5,6].

Clinical history also plays a pivotal role in identifying high-risk patients. A history of acute cholecystitis characterized by right upper quadrant pain, fever, and leukocytosis increases the likelihood of encountering intraoperative challenges. Furthermore, a longer interval between the onset of symptoms and surgical intervention allows for the development of fibrotic adhesions, further complicating laparoscopic access [7]. Radiological evaluation, particularly via ultrasonography, has proven to be an indispensable tool in this context. Specific ultrasonographic findings such as gallbladder wall thickening greater than 5 mm, pericholecystic fluid, impacted stones at the gallbladder neck, and dilated common bile ducts are associated with technically demanding procedures and an elevated risk of conversion [8,9].

To facilitate standardized and objective risk assessment, various predictive scoring systems have been developed that integrate both clinical and radiological parameters. These scor-

ing tools provide a quantitative estimate of conversion risk, enhancing preoperative decision-making. For example, ultrasonographic scoring systems evaluate multiple features, including gallbladder wall thickness, pericholecystic collection, stone impaction, and ductal dilation. Clinical scoring models may include factors such as age, sex, body mass index (BMI), fever, and symptom duration to provide a composite risk score [10,11]. These predictive models not only guide the surgeon's intraoperative strategies but also support logistical preparation. Anticipating conversion can lead to practical measures such as having open surgery instruments ready, assigning more experienced surgeons to complex cases, or utilizing operating theaters equipped for advanced surgical intervention. Moreover, awareness of potential conversion encourages a more thoughtful intraoperative approach, where the decision to convert is made proactively rather than reactively, prioritizing patient safety above procedural persistence [12].

Preoperative prediction of conversion from LC to OC is a critical component of modern surgical planning. By integrating clinical insights, ultrasonographic findings, and evidence-based scoring systems, surgeons can identify high-risk cases, modify their surgical strategy accordingly, and ensure optimal patient care. Recognizing and addressing these factors enhances safety, improves outcomes, and reinforces the importance of individualized surgical management in gallstone disease [13].

The aim of the study is to preoperatively predict the conversion of laparoscopic to open cholecystectomy. The prediction will be based on a scoring system that incorporates both ultrasonographic and clinical factors. The ultrasonographic parameters include gallbladder size, gallbladder wall thickness, number of stones, location of stones, size of stones, and presence of pericholecystic collection. Clinical factors considered are the duration of illness, presence of co-morbid conditions, and the number of previous attacks.

MATERIAL & METHODS

This prospective observational study was conducted at the Department of General Surgery, G.R. Medical College & J.A. Group of Hospitals Gwalior (M.P.) from May 1, 2023, to November 30, 2025. Ethical approval has been obtained from the Ethical Approval Committee of G.R. Medical College & J.A. Group of Hospitals Gwalior (M.P.).

Study Population

The study population comprised 330 patients diagnosed with cholelithiasis admitted for evaluation and management with laparoscopic cholecystectomy, who were assessed preoperatively using clinical and ultrasonographic scoring systems to predict conversion to open surgery. Patients younger than 13 or older than 60 years, those with common bile duct stones, elevated alkaline phosphatase, obstructive jaundice, suspected gallbladder malignancy, cases requiring CBD exploration, or deemed medically unfit for laparoscopic surgery were excluded from the study.

Data Analysis

Data analysis was performed using SPSS version 25, with normality of variables assessed through the Kolmogorov-Smirnov test. Descriptive statistics, including mean, standard deviation, and frequency distribution, were used to summarize patient demographics and ultrasonographic parameters. Receiver Operating Characteristic (ROC) curve analysis was conducted to identify the cutoff score that provided the optimal balance of sensitivity and specificity for predicting conversion from laparoscopic to open cholecystectomy in patients with cholelithiasis.

RESULTS

This prospective study aimed to predict the conversion of laparoscopic to open cholecystectomy using preoperative clinical and ultrasonographic parameters including gallbladder size, wall thickness, number and location of stones, stone size, and the presence of pericholecystic collection. A total of 330 patients scheduled for laparoscopic cholecystectomy under general anesthesia were evaluated. The age distribution revealed a mean age of 41.96 ± 12.81 years, with the highest proportion (25.8%) in the 16–30 year group, and a smaller segment (6.7%) over 60 years. The gender distribution was predominantly female (84.2%), with a female-to-male ratio of 5.35:1. Regarding the clinical history, 45.8% of patients had one attack of acute cholecystitis, 45.5% had two, and smaller proportions had three (7.0%) or four (1.8%) attacks, with a mean of 1.65 ± 0.69 . The duration of symptoms varied, with most patients experiencing symptoms between 6–12 months (37.3%), followed by 3–6 months (33.9%), and a mean duration of 6.48 ± 4.31 months. Co-morbidities were present in 11.8% of participants, with hypertension (3.6%), obesity (3.3%), and diabetes (2.4%) being most common. Ultrasound findings showed 77.9% had normal gallbladder morphology, 7.6% contracted, and 14.5% distended gallbladders. Gallbladder wall thickness was ≤ 3 mm in 89.7% and > 3 mm in 10.3% of patients, with a mean thickness of 2.60 ± 0.58 mm. Most patients (78.2%) had multiple stones, while 21.8% had a single stone. Stones were predominantly located in the gallbladder lumen (93.9%) with only 6.1% impacted at the neck. In terms of stone size, the majority (60.3%) had stones measuring 1–2 cm, with fewer having sizes < 5 mm (5.5%), 5 mm–1 cm (28.5%), or ≥ 2 cm (5.8%), and a mean size of 11.29 ± 4.77 mm. Pericholecystic fluid was noted in 4.2% of patients. Ultrasound scoring revealed that most patients scored between 7 and 9, with the highest frequency at score 8 (33.0%), followed by score 7 (29.7%), and a mean USG score of 8.11 ± 1.51 . These findings collectively suggest that pre-operative ultrasonographic scoring is a valuable tool for assessing the risk of conversion to open surgery, enhancing surgical planning and patient counselling (Table 1). Out of 330 laparoscopic cholecystectomy cases, 38 (11.5%) were converted to open surgery during the study period in the surgery department. The majority (88.5%) were completed la-

paroscopically (Table 2). Among all age groups, the highest conversion rate from laparoscopic to open cholecystectomy was observed in the 51–60 years group (29.6%), with significantly increased risk (OR 6.72, $p < 0.05$), indicating age as a significant factor for conversion.

In this study, the rate of conversion to open cholecystectomy was found to be the same among males and females, both at 11.5%, with no statistically significant difference (OR: 1.00; 95% CI: 0.40–2.53; $p = 1.00$). However, the number of cholecystitis attacks significantly influenced conversion rates. Patients with one or two attacks had conversion rates of 4.0% and 9.3%, respectively, while those with three and four attacks had markedly higher rates of 56.5% and 83.3%, indicating a significant increase in conversion risk with more frequent attacks ($p < 0.001$), with odds ratios of 31.42 and 120.83, respectively. Similarly, longer symptom duration significantly raised the risk: patients with symptoms ≤ 3 months had a conversion rate of 3.5%, increasing to 60.5% for those symptomatic ≥ 12 months (OR: 42.17; 95% CI: 8.92–199.38; $p < 0.001$). Co-morbid conditions also played a crucial role. Conversion rates were significantly higher in patients with diabetes (37.5%; OR: 6.68), hypertension (25.0%; OR: 3.71), and obesity (54.5%; OR: 13.35) compared to patients without comorbidities (8.2%). The highest conversion rate (100%) was observed in patients with both obesity and diabetes, underlining a sharp rise in surgical complexity. These findings demonstrate that while gender does not affect conversion likelihood, the number of attacks, duration of symptoms, and presence of comorbidities-especially obesity and diabetes-are strong, statistically significant predictors of conversion from laparoscopic to open cholecystectomy (Figure 1). Conversion to open cholecystectomy was significantly higher in patients with contracted (44.0%) and distended (33.3%) gallbladders compared to normal morphology (4.3%), with markedly increased risks (OR 17.57 and 11.18, respectively; $p < 0.001$).

In this study, several ultrasonographic parameters were significantly associated with the risk of conversion from laparoscopic to open cholecystectomy. Patients with gallbladder wall thickness > 3 mm had a 50.0% conversion rate compared to only 7.1% in those with wall thickness ≤ 3 mm, reflecting a 13.09-fold higher risk ($p < 0.001$). Regarding the number of stones, conversion was more frequent among patients with a single stone (19.4%) than those with multiple stones (9.3%), and this difference was statistically significant (OR: 0.42; $p = 0.022$). Stone location also played a critical role; patients with stones located at the neck of the gallbladder had a conversion rate of 55.0% versus 8.7% for those with stones in the lumen, corresponding to a significantly higher risk (OR: 12.81; $p < 0.001$). Stone size showed a clear trend where larger stones increased the likelihood of conversion. No conversions occurred in patients with stones < 5 mm, while conversion rates rose to 3.2% for 5 mm–1 cm stones, 11.6% for 1–2 cm stones, and peaked at 63.2% for stones ≥ 2 cm. The conversion risk incr-

eased significantly with stone size ($p < 0.001$). These findings underscore the predictive value of specific ultrasonographic features- especially wall thickness, stone number, size, and location in assessing surgical difficulty and anticipating the need for conversion to open surgery (Figure 2). Patients with pericholecystic collection had a significantly higher conversion rate to open cholecystectomy (78.6%) compared to those without (8.5%), with a 39.25 times increased risk ($p < 0.001$) (Table 2).

Patients converted to open cholecystectomy had significantly higher mean values across all parameters, including age, number of attacks, duration of complaints, gallbladder wall thickness, stone size, and USG score, indicating these factors are strongly associated with conversion risk ($p < 0.001$) (Figure 3). A USG score cut-off of 8.5 significantly predicts conversion

to open cholecystectomy, with 92.1% sensitivity, 78.4% specificity, and an AUC of 0.920 ($p < 0.001$), indicating strong diagnostic accuracy (Table 3). The logistic regression model using a USG score ≥ 8.5 showed strong predictive ability for conversion to open cholecystectomy, with an odds ratio of 42.4 ($p < 0.001$), good model fit ($-2LL = 159.794$), and 40.3% variance explained (Nagelkerke $R^2 = 0.403$) (Table 4). Using USG score as a continuous variable, the logistic regression model showed strong predictive power for conversion to open cholecystectomy (OR 4.50, $p < 0.001$), with good model fit ($-2LL = 118.879$), high specificity (98.6%), and 58.4% variance explained (Nagelkerke $R^2 = 0.584$) (Table 5). Patients with a USG score ≥ 8.5 had a significantly higher conversion rate to open cholecystectomy (35.7%) compared to those with scores < 8.5 (1.3%), with a 42.41 times increased risk ($p < 0.001$) (Figure 6).

Table 1: Rate of conversion of laparoscopic to open cholecystectomy

Converted to open	Number	Percentage
Yes	38	11.5
No	292	88.5
Total	330	100.0

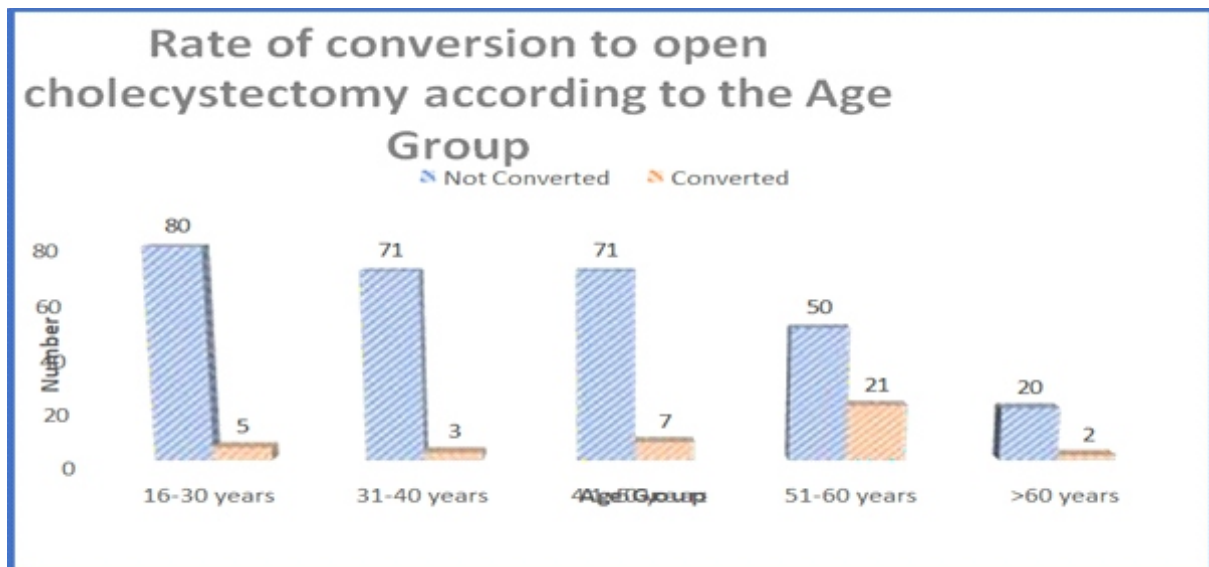


Figure 1: Rate of conversion to open cholecystectomy according to the Age Group

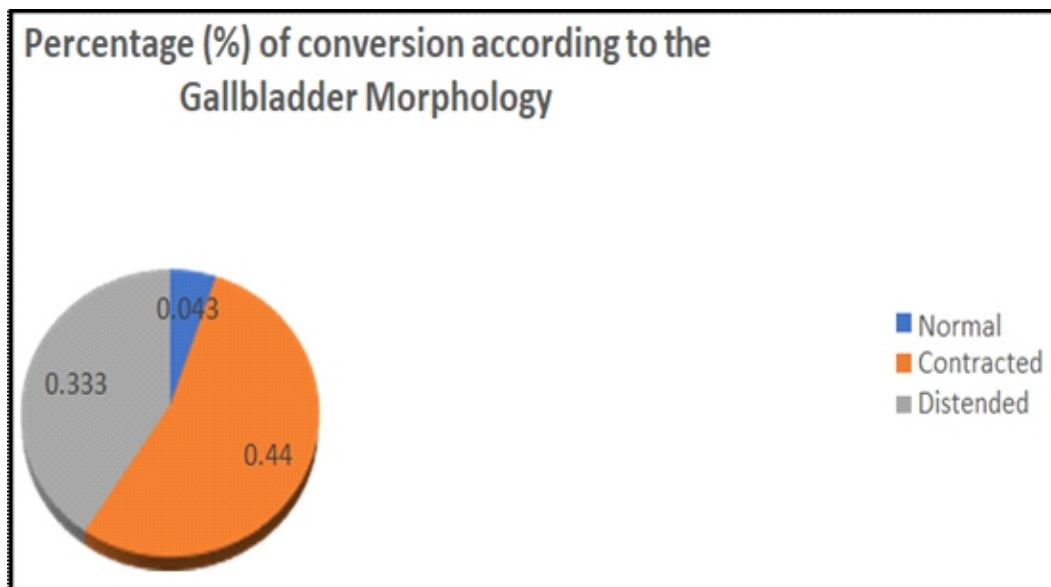


Figure 2: Rate of conversion to open cholecystectomy according to the Gallbladder Morphology

Table 2: Rate of conversion to open cholecystectomy according to the Pericholecystic collection

Pericholecystic collection	Number of conversions	Percentage (%) of conversion	OR (95% CI)	Chi Square	p- value
Yes	11	78.6%	39.25 (10.32 -149.31)	64.520	0.000
No	27	8.5%	1 (ref)		

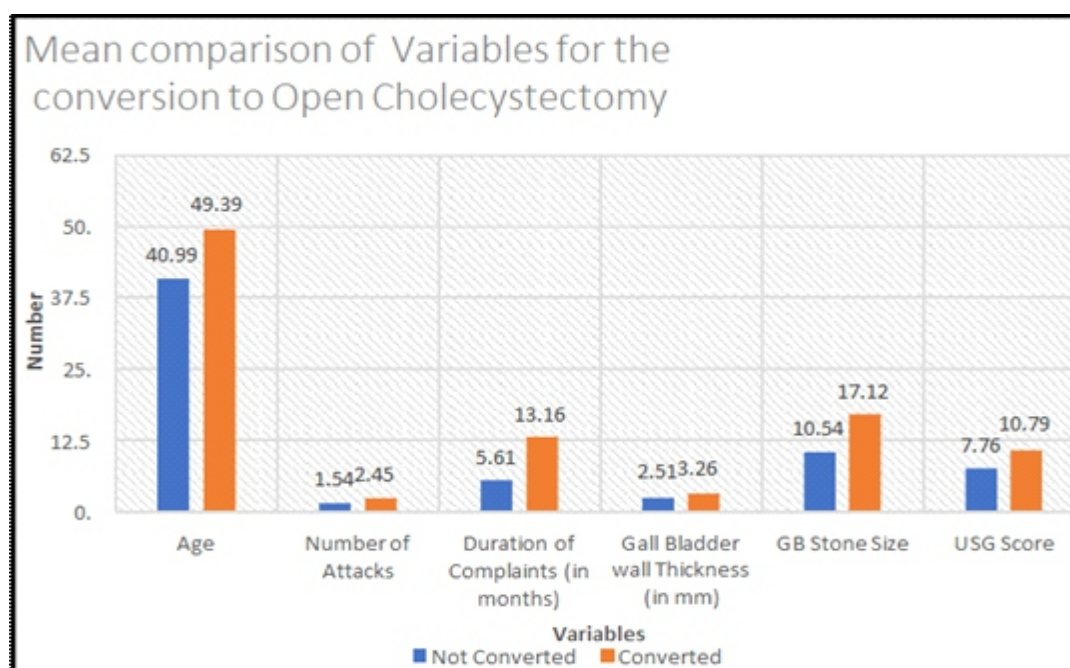


Figure 3: Mean comparison of Variables for the conversion to Open

Table 3: Cut-off Analysis (USG Score Cut -off) for the prediction of conversion to open

Cut-off (USG Score)	Sensitivity	Specificity	Youden Index	Area Under the Curve (AUC)	Std. Error	Asymptotic 95% Confidence Interval for AUC		p-value
						Lower Bound	Upper Bound	
8.50	0.921	0.784	0.705	0.920	0.029	0.862	0.978	0.00

Table 4: Prediction model for conversion to open based on USG Score (cut-off 8.50)

Variables	B	S.E.	Wald	df	Sig.	Exp (B)	95 % C.I. for Exp (B)	
							Lower	Upper
USG Score	3.747	0.618	36.746	1	0.00	42.407	12.625	142.441
Constant	-4.335	0.581	55.650	1	0.00	0.013	-	-

Table 5: Prediction model for conversion to open based on USG Score (USG Score as a continuous variable)

Variables	B	S.E.	Wald	df	Sig.	Exp (B)	95 % C.I. for Exp (B)	
							Lower	Upper
USG Score	1.504	0.220	46.745	1	0.00	4.501	2.924	6.928
Constant	15.466	2.043	57.315	1	0.00	0.000	-	-

Table 6: Rate of conversion to open cholecystectomy according to the USG Score

USG Score	Number of conversions	Percentage (%) of conversion	OR (95% CI)	Chi Square	p-value
<8.50	3	1.3%	1 (ref)	80.115	0.000
≥8.50	35	35.7%	42.41 (12.62-142.44)		

DISCUSSION

Gallstone disease, or cholelithiasis, remains a common gastrointestinal disorder globally, particularly affecting adult females and individuals with obesity and sedentary lifestyles. Laparoscopic cholecystectomy (LC) has emerged as the stand-ard of care due to its minimally invasive nature and favorable outcomes, including reduced postoperative discomfort, faster recovery, and shorter hospital stays.

However, in certain clinical scenarios, conversion to open cholecystectomy (OC) becomes necessary due to factors like dense adhesions, inflammation, anatomical distortion, or intraoperative complications. This conversion is often associated with longer operative times, increased morbidity, and prolonged hospitalizations, underscoring the importance of identifying predictors to anticipate and potentially avoid such outcomes [14].

Various clinical and ultrasonographic parameters have been evaluated for their role in predicting conversion. Patient-related factors such as older age, male gender, higher BMI, history of acute cholecystitis, or previous surgeries increase the complexity of LC. Ultrasonographic signs, including a thickened gallbladder wall, distended or contracted gall-bladder, pericholecystic fluid, and impacted stones at the neck, are recognized indicators of difficult laparoscopic procedures. However, there is a lack of a universally accepted scoring system that effectively combines clinical and radiological data to accurately predict conversion risk. Recent studies have attempted to integrate these variables into standardized scoring models, but their predictive accuracy varies and requires further validation across different populations [15].

The current study aimed to validate a combined clinical and ultrasonographic scoring system for predicting conversion from LC to OC. A prospective observational design was used, involving 330 patients diagnosed with cholelithiasis. Preoperative scoring incorporated demographic, clinical, and sonographic features. Analysis revealed significant associations between conversion and several variables. Older age was found to be a strong predictor; patients aged 51–60 years had a conversion rate of 29.6%, compared to just 5.9% in those aged 16–30 years, confirming age as a critical risk factor. Gender analysis showed equal conversion rates of 11.5% in both males and females, diverging from studies like Cianci P, et. al; 2021, which reported higher rates in males (6.8%) compared to females (3.2%) [16].

Another key predictor was the number of acute cholecystitis attacks. Patients with four or more attacks had an 83.3% conversion rate, compared to only 4.0% in those with a single attack. These findings align with a linked repeated inflammatory episode to increased fibrosis and surgical difficulty. Duration of symptoms also influenced outcomes; patients symptomatic for over 12 months had a 60.5% conversion rate, compared to just 3.5% in those with symptoms under 3 months. Komar MH, et. al; 2024 similarly reported higher conversion risks in patients with long-standing disease [17].

Co-morbidities like obesity (conversion rate: 54.5%) and diabetes mellitus (37.5%) further increased conversion risk. These observations are consistent with Beksac K, et. al; 2016., who emphasized the role of systemic health conditions in complicating laparoscopic procedures. Ultrasound parameters added substantial predictive value. Contracted gallbladders had a conversion rate of 44%, distended gallbladders 33.3%, versus only 4.3% in normal gallbladders- a finding supported by Beksac K, et. al; 2016. Gallbladder wall thickness >3 mm showed a 50% conversion rate [18].

Interestingly, gallstone characteristics also impacted outcomes. While multiple stones were more common (78.2%), single stones had a higher conversion rate (19.4% vs. 9.3%), perhaps due to impaction or inflammation. Impacted stones at the gallbl-

adder neck were associated with a 55% conversion rate versus 8.7% for luminal stones, corroborating the findings by Jethwani U, et. al; 2013 [19]. Larger stones (≥ 2 cm) were linked with a 63.2% conversion rate, aligning with observations by Apfel CC, et. al; 2012 [20]. Though pericholecystic collection was seen in only 4.2% of patients, it was strongly associated with conversion (78.6%), reinforcing Siddiqui MA, et. al; 2017 findings [21].

The overall conversion rate in this study was 11.5%, which is higher than other reports such as Yaqub U, et. al; 2020, (8.77%). ROC analysis identified a USG score cutoff of 8.5 as optimal for predicting conversion, yielding a sensitivity of 92.1% and specificity of 78.4%, with an AUC of 0.920 comparable to Siddiqui MA, et. al; 2017, who reported a cutoff of 8.0 with an AUC of 0.89. These findings validate the effectiveness of a combined scoring system in preoperative risk prediction, potentially aiding in surgical planning and improving patient safety [21,22].

CONCLUSION

This study validates the hypothesis that preoperative ultrasonographic and clinical scoring is effective in predicting the conversion of laparoscopic to open cholecystectomy. By incorporating easily accessible ultrasonographic parameters, the scoring system offers a cost-effective and practical approach to anticipating intraoperative difficulties. Key factors associated with increased conversion rates include gallbladder wall thickness >3 mm, pericholecystic collection, stone location at the gallbladder neck, recurrent cholecystitis, and a score >8.50. An ROC analysis confirmed that a score above 8.50 has good sensitivity and specificity, aiding surgical preparedness, patient counseling, and risk reduction, especially in training and peripheral centers.

LIMITATIONS & FUTURE PERSPECTIVES

The study's limitations include a single-centre setting, a relatively small sample size, and a short study duration, which may limit the broader applicability of the results. Future studies should incorporate multicentre designs with larger populations to enhance validity, assess long-term outcomes, and investigate advanced diagnostic and management approaches. Such efforts will improve overall patient care and help minimize complications.

CLINICAL SIGNIFICANCE

The clinical significance of this study lies in its potential to bridge the gap between research findings and practical healthcare applications. It emphasizes the importance of translating scientific observations into meaningful improvements in patient care, diagnosis, and treatment outcomes. By highlighting real-world relevance, the study contributes to evidence-based medical practice and supports informed clinical decision-making. Ultimately, the findings aim to enhance patient quality of life, optimize therapeutic strategies, and promote bett-

er disease management in clinical settings.

ABBREVIATIONS

LC: Laparoscopic cholecystectomy

OC: Open cholecystectomy

USG: Ultrasonography

GB: Gallbladder

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AUTHOR CONTRIBUTIONS

All authors significantly contributed to the study conception and design, data acquisition, or data analysis and interpretation. They participated in drafting the manuscript or critically revising it for important intellectual content, consented to its submission to the current journal, provided final approval for the version to be published, and accepted responsibility for all aspects of the work. Additionally, all authors meet the authorship criteria outlined by the International Committee of Medical Journal Editors (ICMJE) guidelines.

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CONFLICT OF INTEREST

Authors declared that there is no conflict of interest.

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ETHICAL APPROVAL & CONSENT TO PARTICIPATE

All necessary consent & approval was obtained by authors.

CONSENT FOR PUBLICATION

All necessary consent for publication was obtained by authors.

DATA AVAILABILITY

All data generated and analyzed are included within this research article. The datasets utilized and/or analyzed in this study can be obtained from the corresponding author upon a reasonable request.

USE OF ARTIFICIAL INTELLIGENCE (AI) & LARGE LANGUAGE MODEL (LLM)

The authors confirm that no AI & LLM tools were used in the writing or editing of the manuscript, and no images were altered or manipulated using AI & LLM.

AUTHOR'S NOTE

This article serves as an important educational tool for the scientific community, offering insights that may inspire future research directions. However, they should not be relied upon independently when making treatment decisions or developing public health policies.

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REFERENCES

1. Sujata J, Rana S, Sabina K, Hassan MJ, JaiRajpuri ZS. Incidental gall bladder carcinoma in laparoscopic cholecystectomy: a report of 6 cases and a review of the literature. J Clin Diagn Res. 2013;7(1):85–8. doi: 10.7860/JCDR/2012/5001.2677.
2. Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. Am J Surg. 2002;184(3):254–258. doi: 10.1016/S0002-9610(02)00934-0.
3. Vannucci M, Laracca GG, Mercantini P, Perretta S, Padoy N, Dallemagne B, et al. Statistical models to preoperatively predict operative difficulty in laparoscopic cholecystectomy:

- a systematic review. *Surgery*. 2022;171(5):1158–67. doi:10.1016/j.surg.2021.10.001.
4. Hu A, Menon R, Gunnarsson R, De Costa A. Risk factors for conversion of laparoscopic cholecystectomy to open surgery: a systematic literature review of 30 studies. *Am J Surg*. 2017;214(5):920–930. doi: 10.1016/j.amjsurg.2017.07.029.
5. Chin X, et al. Preoperative and intraoperative risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy: a systematic review of 30 studies. *Am J Surg*. 2023;226(4):715-723. doi:10.1016/j.amjsurg.2023.05.018
6. Jethwani U, Singh G, Mohil RS, Kandwal V, Razdan S, Chouhan J, et al. Prediction of difficulty and conversion in laparoscopic cholecystectomy. *OA Minim Invasive Surg*. 2013;1(1):1-2.
7. Beksac K, Turhan N, Karaagaoglu E, Abbasoglu O. Risk factors for conversion of laparoscopic cholecystectomy to open surgery: a new predictive statistical model. *J Laparoendosc Adv Surg Tech A*. 2016;26(9):693–696.
8. Simopoulos C, Botaitis S, Polychronidis A, Tripsianis G, Karayiannakis AJ. Risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy. *Surg Endosc*. 2005;19(7):905–909.
9. Warchałowski Ł, Łuszczki E, Bartosiewicz A, Dereń K, Warchałowska M, Oleksy Ł, et al. The analysis of risk factors in the conversion from laparoscopic to open cholecystectomy. *Int J Environ Res Public Health*. 2020;17(20):7571. doi: 10.3390/ijerph17207571.
10. Tang B, Cuschieri A. Conversions during laparoscopic cholecystectomy: risk factors and effects on patient outcome. *J Gastrointest Surg*. 2006;10(7):1081–1091.
11. Al Thabit RA, Aljuboory MA, Al-Helfy SH. Ultrasound findings in predicting difficult laparoscopic cholecystectomy. *GSC Adv Res Rev*. 2024;18(3):173–181.
12. Shapey IM, Sultan M. Machine learning for prediction of postoperative complications after hepato-biliary and pancreatic surgery. *Artif Intell Surg*. 2023;3(1):1–3.
13. Veličković, J.V., 2019. The Predictive Performance of the Possum Scoring System and Early Indicators of Peripheral Perfusion for Complications After Major Abdominal Surgery (Doctoral dissertation, University of Belgrade, Serbia).
14. Kanaan SA, Murayama KM, Merriam LT, Dawes LG, Prystowsky JB, Rege RV, Joehl RJ. Risk factors for conversion of laparoscopic to open cholecystectomy. *J Surg Res*. 2002;106(1):20-24. doi:10.1006/jsre.2002.6393.
15. Korayem IM, Bessa SS. Preoperative predictors of difficult early laparoscopic cholecystectomy among patients with acute calculous cholecystitis in Egypt. *BMC Surg*. 2024;24(1):329.
16. Cianci P, Restini E. Management of cholelithiasis with choledocholithiasis: Endoscopic and surgical approaches. *World Journal of Gastroenterology*. 2021;27(28):4536-4554.
17. Komar MH, Imanuddin KA. Predicting Conversion to Open Cholecystectomy: A Validation Study of the Difficult Laparoscopic Cholecystectomy Scoring System. *Bioscientia Medicina: Journal of Biomedicine and Translational Research*. 2024;8(12):5593-606.
18. Hu ASY, Menon R, Gunnarsson R, De Costa A. Risk factors for conversion of laparoscopic cholecystectomy to open surgery: a systematic literature review of 30 studies. *Am J Surg*. 2017;214(5):920-930. doi: 10.1016/j.amjsurg.2017.07.29.
19. Tan JH, Bessa SS. A retrospective cohort study identifying risk factors and using a CLOC score to predict conversion from laparoscopic to open cholecystectomy. *Asiatic Surg J*. 2024;3(1):- . doi:10.21037/asj-24-41.
20. Apfel CC, Heidrich FM, Jukar-Rao S, Jalota L, Hornuss C, Whelan RP, Zhang K, Cakmakaya OS. Evidence-based analysis of risk factors for postoperative nausea and vomiting. *Br J Anaesth*. 2012;109(5):742–753.
21. Siddiqui MA, Rizvi SA, Sartaj S, Ahmad I, Rizvi SW. A standardized ultrasound scoring system for preoperative prediction of difficult laparoscopic cholecystectomy. *Journal of Medical Ultrasound*. 2017;25(4):227–231.
22. Yaqub U, Tariq G, Ali S, Nazeer U, Khan MA. Frequency and factors leading to conversion of laparoscopic cholecystectomy to open cholecystectomy in a tertiary care hospital. *Pak Armed Forces Med J*. 2020;70(2):491–495.