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**Dr. Prasanna Panneerselvam**  
Post Graduate, Department of  
General Surgery, Aarupadai  
Veedu Medical College,  
Pondicherry, India

**Dr. S Madhivannan**  
Professor, Department of  
General Surgery, Aarupadai  
Veedu Medical College,  
Pondicherry, India

**Dr. Ravichandran**  
Head of Department,  
Department of General  
Surgery, Aarupadai Veedu  
Medical College, Pondicherry,  
India

**Corresponding Author:**  
**Dr. Prasanna Panneerselvam**  
Post Graduate, Department of  
General Surgery, Aarupadai  
Veedu Medical College,  
Pondicherry, India

# Association of pre-operative USG findings with intra-operative difficulties among patients undergoing elective laparoscopic cholecystectomy

**Dr. Prasanna Panneerselvam, Dr. S Madhivannan and Dr. Ravichandran**

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### Abstract

**Background:** Cholelithiasis is a prevalent alimentary tract disorder traditionally treated with open cholecystectomy. Advances in technology have favoured laparoscopic cholecystectomy (LC) as a minimally invasive alternative with fewer complications. Preoperative ultrasonography (USG) is crucial in diagnosing cholecystitis and cholelithiasis, and it offers significant insights into potential intraoperative challenges.

**Aim:** To evaluate the correlation between preoperative ultrasonographic findings and intraoperative difficulties in laparoscopic cholecystectomy, and assess the need for conversion to open cholecystectomy.

**Materials and Methods:** This prospective analytical study was conducted from September 2022 to July 2024 at AVMCH's Department of General Surgery. Fifty-seven patients planned for elective LC were included, based on specific inclusion criteria and excluding those with extensive surgical history or severe bile duct conditions. USG parameters such as gallbladder wall thickness, pericholecystic fluid, gallbladder size, and gallstone characteristics were analysed against intraoperative factors like surgery duration, dissection times, and complications.

**Results:** The mean patient age was 48.5 years, with a predominance of female patients (77.2%). Ultrasound indicated normal gallbladder size in 89.5%, multiple stones in 84.2%, and stones >1 cm in 21.1%. Intraoperatively, a duration >120 minutes correlated significantly with aberrant anatomy, a common bile duct (CBD) size >8 mm, and gallbladder wall thickness >4 mm. Dissection of Calot's triangle and gallbladder bed lasting >20 minutes was associated with gallbladder wall thickness >4 mm and multiple stones. Complications such as gallbladder tear and bile spillage (14%) were frequent in patients with a gallbladder wall thickness >4 mm and stones impacted at the gallbladder neck. Conversion to open cholecystectomy was necessary in 3.5% of cases.

**Conclusion:** Preoperative USG effectively predicts intraoperative difficulties in laparoscopic cholecystectomy. Indicators like gallbladder wall thickness, CBD size, and the presence of multiple or impacted stones provide critical information for surgical planning, potentially reducing complications and improving patient outcomes.

**Keywords:** Cholelithiasis, laparoscopic cholecystectomy, preoperative ultrasonography, intraoperative difficulties, surgical complications, gallbladder wall thickness

### Introduction

Cholelithiasis is one of the most common alimentary canal illnesses. It is commonly treated with an open cholecystectomy. However, with the newest advancements in technology, laparoscopic cholecystectomy has enabled minimally invasive surgery with low intraoperative and postoperative problems<sup>[1]</sup>. USG is the most accurate mode of examination for diagnosing cholecystitis and cholelithiasis (96%). It has a sensitivity of 50-75% in detecting CBD calculi<sup>[2-4]</sup>. So, before planning surgery, the USG results and criteria are utilized to analyze the potential challenges that a surgeon may encounter during a Laparoscopic cholecystectomy operation, as well as the possibility of converting the procedure to an open cholecystectomy on the table.

Intraoperative conversion of laparoscopic cholecystectomy to open cholecystectomy occurs most commonly in cases of friable gall bladder, dense vascular region generating bleeding on manipulation obscuring the view, inadequate exposure of calot's triangle, and oedematous gall bladder<sup>[2]</sup>. Chance of this conversion from laparoscopic to open cholecystectomy can be estimated if the surgeon has reliable pre operative predictive factors. So in this study correlation of the USG findings and its criteria with intraoperative difficulties is being

studied. Hence present study aimed to understand and utilize the pre operative USG findings and criteria for better prediction of intra operative difficulties during lap cholecystectomy

**Materials & Methods**

In a prospective analytical study conducted at AVMCH under the Department of General Surgery, patients scheduled for elective laparoscopic cholecystectomy were evaluated using preoperative ultrasonography to predict intraoperative difficulties and the potential need for open cholecystectomy. The study included 57 patients aged 18 years and older, excluding those with specific criteria such as a history of more than three previous abdominal surgeries, common bile duct dilation >10mm, CBD stone, previous CBD exploration, or pancreatitis. Various parameters from preoperative ultrasound, including gall bladder wall thickness, pericholecystic fluid, gall bladder size, gall stone characteristics, common bile duct size, vascularity around Calot’s triangle, and aberrant anatomy, were correlated with intraoperative findings such as total surgery duration, time to dissect Calot’s triangle and gall bladder bed, complications like gall bladder tear and bile spillage, bleeding, and gall bladder extraction time.

The expected outcomes focused on better predicting surgical difficulties, reducing operative time and complications, improving patient counseling regarding potential conversions, and ultimately lowering morbidity and mortality rates.

Statistical analysis involved summarizing data using mean, standard deviation, frequency, and percentage, with comparisons made using unpaired t-tests for continuous variables and chi-square tests for categorical variables, considering a significance level of  $p < 0.05$ .

**Result**

In present study total of 57 patients fulfilling inclusion criteria are included with mean age of patients 48.5yrs. Among included patients, 77.2% were female patients and 22.8% were male patients, with female preponderance in present study

At surgical findings, it was found to be with total surgery duration of >120 min in 22.8%, 12.3% with >20min to dissect calot triangle, 26.3% with >20min requirement for dissect GB bed. Bladder tear and bile spill was seen in 14% of patients, moderate bleeding (2+) was seen in 5.3%, extraction was easy in 80.7% of the patients and 3.5% required for the conversion.

**Table 1:** Comparison of USG findings with intra-operative bleeding among patients

		Bleeding				Chi-square (p-value)
		Mild		Moderate		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	2	3.8%	2	40.0%	9.31 (0.01)
	Distended	4	7.7%	0	0.0%	
	Normal	46	88.5%	3	60.0%	
Number of stones	Multiple	43	82.7%	5	100.0%	1.02 (0.31)
	Single	9	17.3%	0	0.0%	
Size of stone	<1 cm	41	78.8%	4	80.0%	0.04 (0.95)
	>1 cm	11	21.2%	1	20.0%	
Pericholecystic fluid	Absent	46	88.5%	5	100.0%	0.64 (0.422)
	Present	6	11.5%	0	0.0%	
Aberrant Anatomy	Absent	50	96.2%	5	100.0%	0.199 (0.655)
	Present	2	3.8%	0	0.0%	
Gas in Gallbladder	Absent	44	84.6%	5	100.0%	0.89 (0.344)
	Present	8	15.4%	0	0.0%	
Liver mobility	Absent	14	26.9%	2	40.0%	0.38 (0.534)
	Present	38	73.1%	3	60.0%	
Common bile duct size >8 mm	<8 mm	42	80.8%	2	40.0%	4.306 (0.01)*
	>8 mm	10	19.2%	3	60.0%	
Gallbladder wall thickness >4 mm	<4 mm	44	84.6%	2	40.0%	6.83 (0.01)*
	>4 mm	8	15.4%	3	60.0%	
Stone impacted at GB neck	Absent	45	86.5%	5	100.0%	0.76 (0.38)
	Present	7	13.5%	0	0.0%	

On assessment of the USG findings with bleeding during surgery, there was significant relation of size of common

bile duct >8 mm and gall bladder wall thickness of >4mm among the patients.

**Table 2:** Comparison of USG findings with duration of surgery among patients

		Duration of surgery >120min				Chi-square (p-value)
		<120 min		>120 min		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	2	4.5%	2	15.4%	2.85 (0.23)
	Distended	4	9.1%	0	0.0%	
	Normal	38	86.4%	11	84.6%	
Number of stones	Multiple	35	79.5%	13	100.0%	3.15 90.07)
	Single	9	20.5%	0	0.0%	
Size of stone > 1 cm	<1cm	36	81.8%	9	69.2%	0.95 (0.32)
	>1cm	8	18.2%	4	30.8%	

Pericholecystic fluid	Absent	40	90.9%	11	84.6%	0.422 (0.516)
	Present	4	9.1%	2	15.4%	
Aberrant Anatomy	Absent	44	100.0%	11	84.6%	7.01 (0.001)*
	Present	0	0.0%	2	15.4%	
Gas in Gallbladder	Absent	37	84.1%	12	92.3%	0.56 (0.45)
	Present	7	15.9%	1	7.7%	
Liver mobility	Absent	12	27.3%	4	30.8%	0.061 (0.805)
	Present	32	72.7%	9	69.2%	
Common bile duct size >8 mm	<8 mm	41	93.2%	3	23.1%	28.29 (0.01)*
	>8 mm	3	6.8%	10	76.9%	
Gallbladder wall thickness >4 mm	<4 mm	41	93.2%	5	38.5%	19.24 (0.01)*
	>4 mm	3	6.8%	8	61.5%	
Stone impacted at GB neck	Absent	40	90.9%	10	76.9%	1.82 (0.17)
	Present	4	9.1%	3	23.1%	

On comparison of the USG findings with duration of surgery >120min, there was significant higher incidence with presence of aberrant anatomy, >8mm size of common bile duct and gall bladder wall thickness of >4mm.

**Table 3:** Comparison of USG findings with intra-operative time to dissect gall bladder bed among patients

		Dissect gall bladder bed				Chi-square (p-value)
		<20 min		>20 min		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	3	7.1%	1	6.7%	0.08 (0.996)
	Distended	3	7.1%	1	6.7%	
	Normal	36	85.7%	13	86.7%	
Number of stones	Multiple	38	90.5%	10	66.7%	4.71 (0.03)*
	Single	4	9.5%	5	33.3%	
Size of stone >1 cm	<1 cm	34	81.0%	11	73.3%	0.38 (0.534)
	>1 cm	8	19.0%	4	26.7%	
Pericholecystic fluid	Absent	38	90.5%	13	86.7%	0.17 (0.680)
	Present	4	9.5%	2	13.3%	
Aberrant Anatomy	Absent	41	97.6%	14	93.3%	0.600 (0.439)
	Present	1	2.4%	1	6.7%	
Gas in Gallbladder	Absent	37	88.1%	12	80.0%	0.6 (0.43)
	Present	5	11.9%	3	20.0%	
Liver mobility	Absent	12	28.6%	4	26.7%	0.02 (0.88)
	Present	30	71.4%	11	73.3%	
Common bile duct size >8 mm	<8 mm	34	81.0%	10	66.7%	1.28 (0.258)
	>8 mm	8	19.0%	5	33.3%	
Gallbladder wall thickness >4 mm	<4 mm	38	90.5%	8	53.3%	9.79 (0.02)*
	>4 mm	4	9.5%	7	46.7%	
Stone impacted at GB neck	Absent	37	88.1%	13	86.7%	0.02 (0.885)
	Present	5	11.9%	2	13.3%	

On comparison of the USG findings with the dissect of gall bladder bed time more than 20 min was seen with higher incidence with multiple gall stones and if the gall bladder wall thickness was more than 4mm.

**Table 4:** Comparison of USG findings with intra-operative time to dissect Calot's triangle among patients

		Time to dissect Calot's triangle				Chi-square (p-value)
		<20 min		>20 min		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	4	8.0%	0	0.0%	1.16 (0.56)
	Distended	3	6.0%	1	14.3%	
	Normal	43	86.0%	6	85.7%	
Number of stones	Multiple	43	86.0%	5	71.4%	0.98 (0.32)
	Single	7	14.0%	2	28.6%	
Size of stone >1 cm	<1 cm	41	82.0%	4	57.1%	2.28 (0.131)
	>1 cm	9	18.0%	3	42.9%	
Pericholecystic fluid	Absent	44	88.0%	7	100.0%	0.93 (0.33)
	Present	6	12.0%	0	0.0%	
Aberrant Anatomy	Absent	48	96.0%	7	100.0%	0.29 (0.59)
	Present	2	4.0%	0	0.0%	
Gas in Gallbladder	Absent	42	84.0%	7	100.0%	1.30 (0.25)
	Present	8	16.0%	0	0.0%	
Liver mobility	Absent	15	30.0%	1	14.3%	0.751 (0.385)
	Present	35	70.0%	6	85.7%	

Common bile duct size >8 mm	<8 mm	40	80.0%	4	57.1%	1.822 (0.177)
	>8 mm	10	20.0%	3	42.9%	
Gallbladder wall thickness >4 mm	<4 mm	44	88.0%	2	28.6%	13.92 (0.01)*
	>4 mm	6	12.0%	5	71.4%	
Stone impacted at GB neck	Absent	43	86.0%	7	100.0%	1.11 (0.291)
	Present	7	14.0%	0	0.0%	

On comparison of the USG findings with Calot’s triangle dissection time of more than 20 min was seen with significant higher incidence in if gall bladder wall thickness was >4.

**Table 5:** Comparison of USG findings with intra-operative ease of extraction of gall bladder among patients

		Extraction of Gall bladder				Chi-square (p-value)
		Difficult		Easy		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	2	18.2%	2	4.3%	2.78 (0.249)
	Distended	1	9.1%	3	6.5%	
	Normal	8	72.7%	41	89.1%	
Number of stones	Multiple	10	90.9%	38	82.6%	0.46 (0.49)
	Single	1	9.1%	8	17.4%	
Size of stone >1cm	<1 cm	7	63.6%	38	82.6%	1.93 (0.16)
	>1 cm	4	36.4%	8	17.4%	
Pericholecystic fluid	Absent	10	90.9%	41	89.1%	0.03 (0.876)
	Present	1	9.1%	5	10.9%	
Aberrant Anatomy	Absent	11	100.0%	44	95.7%	0.49 (0.48)
	Present	0	0.0%	2	4.3%	
Gass in Gallbladder	Absent	10	90.9%	39	84.8%	0.27 (0.59)
	Present	1	9.1%	7	15.2%	
Liver mobility	Absent	3	27.3%	13	28.3%	0.04 (0.948)
	Present	8	72.7%	33	71.7%	
Common bile duct size >8mm	<8 mm	5	45.5%	39	84.8%	7.79 (0.01)*
	>8 mm	6	54.5%	7	15.2%	
Gallbladder wall thickness >4mm	<4 mm	6	54.5%	40	87.0%	5.98 (0.01)*
	>4 mm	5	45.5%	6	13.0%	
Stone impacted at GB neck	Absent	10	90.9%	40	87.0%	0.129 (0.720)
	Present	1	9.1%	6	13.0%	

On comparison of the USG findings with extraction of gall bladder, significant difficulty was present when the common bile duct size was >8 mm and also in patients with gall bladder wall thickness of >4 mm.

**Table 6:** Comparison of USG findings with intra-operative stone and bile spillage among patients

		Stone and bile spillage				Chi-square (p-value)
		Absent		Present		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	3	6.1%	1	12.5%	0.92 (0.62)
	Distended	3	6.1%	1	12.5%	
	Normal	43	87.8%	6	75.0%	
Number of stones	Multiple	41	83.7%	7	87.5%	0.076 (0.78)
	Single	8	16.3%	1	12.5%	
Size of stone >1 cm	<1cm	39	79.6%	6	75.0%	0.87 (0.76)
	>1cm	10	20.4%	2	25.0%	
Pericholecystic fluid	Absent	45	91.8%	6	75.0%	2.07 (0.15)
	Present	4	8.2%	2	25.0%	
Aberrant Anatomy	Absent	48	98.0%	7	87.5%	2.22 (0.136)
	Present	1	2.0%	1	12.5%	
Gass in Gallbladder	Absent	41	83.7%	8	100.0%	1.51 (0.218)
	Present	8	16.3%	0	0.0%	
Liver mobility	Absent	12	24.5%	4	50.0%	2.217 (0.127)
	Present	37	75.5%	4	50.0%	
Common bile duct size >8mm	<8mm	37	75.5%	7	87.5%	0.563 (0.454)
	>8mm	12	24.5%	1	12.5%	
Gallbladder wall thickness >4mm	<4mm	42	85.7%	4	50.0%	0.562(0.01)*
	>4mm	7	14.3%	4	50.0%	
Stone impacted at GB neck	Absent	45	91.8%	5	62.5%	5.49 (0.01)*
	Present	4	8.2%	3	37.5%	

On comparison of the USG findings with stone and bile spillage, there was significant higher incidence in cases with gall bladder wall thickness of  $>4$  mm and when stone impacted at GB neck.

## Discussion

Laparoscopic cholecystectomy is a popular and less invasive technique for treating gallbladder disorders, particularly symptomatic cholelithiasis. It has several advantages over open surgery, such as less postoperative discomfort, shorter hospital stays, and faster recovery durations. However, the treatment might still provide considerable intraoperative complications, especially in individuals with severe gallbladder disease or anatomical differences. In this study of 57 patients undergoing elective laparoscopic cholecystectomy, pre-operative ultrasound findings provided valuable insights into predicting intra-operative difficulties. The mean patient age was 48.5 years, with a notable female predominance (77.2%).

In study by Chand P *et al.*, the mean age of the patients was found to be 38.16yrs with 90% female and 10% male with female preponderance [5]. Another study by Togale V *et al.*, the majority were more than 50yrs of age and 80% were female with female preponderance in the study [6].

Ultrasound imaging revealed several pertinent characteristics: a normal gallbladder size in 89.5%, multiple stones in 84.2% of cases, stones larger than 1 cm in 21.1%, pericholecystic fluid in 10.5%, aberrant anatomy in 3.5%, gas in the gallbladder in 14%, liver mobility in 71.9%, a common bile duct (CBD) size  $>8$  mm in 22.8%, gallbladder wall thickness  $>4$  mm in 19.3%, and stones impacted at the gallbladder neck in 12.3%.

In Chand P *et al.*, a study involving 50 patients found that gallbladder wall thickness less than 4 mm predicted easy procedures in 38 out of 46 cases, with eight facing difficulties. All four patients with wall thickness greater than 4 mm encountered difficulties, yielding an 84% accuracy in predicting procedure difficulty based on wall thickness. Contraction of the gallbladder led to difficulties in all five cases, while among 45 patients without contraction, 38 procedures were easy, resulting in an 86% accuracy. Three patients with gallstones impacted at the neck experienced difficult procedures, compared to nine out of 47 patients with mobile stones, providing an 82% accuracy in predicting difficulty based on stone mobility.

Intra-operative findings correlated with these ultrasound parameters highlighted several challenges. Notably, a surgery duration exceeding 120 minutes was significantly associated with aberrant anatomy, a CBD size  $>8$  mm, and a gallbladder wall thickness  $>4$  mm. Difficulty in dissecting Calot's triangle for more than 20 minutes was significantly associated with a gallbladder wall thickness  $>4$  mm. Similarly, a longer dissection time of the gallbladder bed was more likely in patients with multiple gallstones and a gallbladder wall thickness  $>4$  mm.

Saad K *et al.* identified several factors associated with procedural difficulty, including hospitalization, previous supraumbilical surgeries, prior acute cholecystitis, and episodes of jaundice, previous endoscopic biliary clearance, increased gallbladder wall thickness, and the presence of pericholecystic fluid collection [7]. Daly A *et al.*'s research found that 28% of anticipated challenging cases were verified as difficult, including 20 cases categorized as difficult, 2 as exceptionally difficult, and 6 as unexpectedly

easy. Among those predicted to be exceptionally difficult (5% of cases), one was confirmed as such, one was straightforward, one was challenging, and three were highly difficult. The study established a strong statistical association between preoperative predictions and the actual difficulty encountered during laparoscopic cholecystectomy. The preoperative scoring system exhibited both statistical significance and clinical reliability in forecasting surgical outcomes [8].

Complications such as gallbladder tear and bile spillage, observed in 14% of cases, were significantly more frequent in patients with a gallbladder wall thickness  $>4$  mm and stones impacted at the gallbladder neck. Difficulty in gallbladder extraction was notably higher in cases with a CBD size  $>8$  mm and a gallbladder wall thickness  $>4$  mm. Santharaj *et al.* emphasized that preoperative scoring of patients could preempt intraoperative challenges by predicting the likelihood of conversion to open cholecystectomy, enabling patients to be informed about this possibility before surgery [9].

In a study by Bhandari TR *et al.*, difficult laparoscopic cholecystectomy (LC) was observed in 15.4% of cases, with an overall conversion rate of 8.9%. Logistic multivariable regression identified male gender, a history of acute cholecystitis, gallbladder wall thickness ( $\geq 4$ -5 mm), fibrotic gallbladder, and adhesions at Calot's triangle as independent predictors of difficult LC. These factors, including male gender, prior acute cholecystitis, thicker gallbladder walls, gallbladder fibrosis, and adhesions at Calot's triangle, are significant indicators of challenging LC. Awareness of these predictors can assist in treatment planning and resource allocation for effectively managing complex cases [10].

Factors contributing to the elevated conversion rate in non-acute cases include dense adhesions and an oedematous gall bladder, which hinder exposure of Calot's triangle. Poor exposure may also result from dense, highly vascular adhesions, leading to bleeding and further compromising visualization. It's essential to note that most common bile duct injuries occur in scenarios where visualization is inadequate.

Another study by Ali M *et al.*, the conversion rate was found to be 3.8% [11]. In a subsequent study by Terho P *et al.*, laparoscopic cholecystectomy resulted in a conversion to open surgery for 22.5% of patients. Factors such as elevated C-reactive protein levels, age over 65, diabetes, gallbladder gangrene, and abscess were identified as increasing the likelihood of conversion [12].

Significant correlations were identified between USG findings and surgical challenges: increased bleeding was linked to CBD size  $>8$  mm and gallbladder wall thickness  $>4$  mm. Extended surgery durations ( $>120$  minutes) were more common with aberrant anatomy, CBD size  $>8$  mm, and gallbladder wall thickness  $>4$  mm. Longer dissection times for the gallbladder bed and Calot's triangle were associated with multiple stones and a gallbladder wall thickness  $>4$  mm. Extraction difficulties and a higher incidence of stone and bile spillage were also significantly correlated with CBD size  $>8$  mm and a gallbladder wall thickness  $>4$  mm, emphasizing the predictive value of these USG parameters for surgical complexity.

## Conclusion

The results underscore the importance of preoperative ultrasound in predicting intraoperative challenges during

laparoscopic cholecystectomy. Ultrasound parameters such as gallbladder wall thickness, CBD size, and the presence of multiple or impacted stones at the neck are crucial for anticipating surgical complexities and guiding treatment decisions. This highlights the significance of comprehensive preoperative imaging to optimize surgical planning and enhance patient outcomes.

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## Reference

1. Botaitis S, Pitiakoudis M, Perente S, Tripsianis G, Polychronidis A, Simopoulos C. Laparoscopic cholecystectomy in acute cholecystitis: an analysis of the risk factors. *South African Journal of Surgery*. 2012;50(3):62-68.
2. Gupta N, Ranjan G, Arora MP, Goswami B, Chaudhary P, Kapur A, *et al.* Validation of a scoring system to predict difficult laparoscopic cholecystectomy. *International Journal of Surgery*. 2013;11(9):1002-1006.
3. Hwang H, Marsh I, Doyle J. Does ultrasonography accurately diagnose acute cholecystitis? Improving diagnostic accuracy based on a review at a regional hospital. *Canadian Journal of Surgery*. 2014;57(3):162-168.
4. Pinto A, Reginelli A, Cagini L, Coppolino F, Stabile Ianora AA, Bracale R, *et al.* Accuracy of ultrasonography in the diagnosis of acute calculous cholecystitis: review of the literature. *Critical Ultrasound Journal*, 2013, 5-1(1).
5. Chand P, Singh R, Singh B, Singla RL, Yadav M. Preoperative ultrasonography as a predictor of difficult laparoscopic cholecystectomy that requires conversion to open procedure. *Nigerian Journal of Surgery*. 2015;21(2):102-105.
6. Veerank N, Togale MD. Validation of a scoring system to predict difficult laparoscopic cholecystectomy: a one-year cross-sectional study. *Journal of West African College of Surgeons*. 2018;8(1):23-39.
7. Saad MR, Kabbash M, Yassen A, Suleiman KAT, Elzayat I. Preoperative predictive factors of difficult laparoscopic cholecystectomy. *Egyptian Journal of Surgery*. 2024;43(1):11-16.
8. Daly A, Elnagar R, Shoulah A, Rezk M. Preoperative prediction of difficult laparoscopic cholecystectomy using a scoring system. *Benha Journal of Applied Sciences*. 2020;5(2):39-45.
9. Santharaj S, Marahanumaiah S. Pre-operative predictors of difficult laparoscopic cholecystectomy: A comparative study between two scoring systems. *International Surgery Journal*. 2022;9(5):960-965.
10. Bhandari TR, Khan SA, Jha JL. Prediction of difficult laparoscopic cholecystectomy: An observational study. *Annals of Medicine and Surgery*. 2021;72:103060.
11. Ali MA, Uddin MM, Ahmad MN, Jawed S. Study of a preoperative scoring system to predict difficult laparoscopic cholecystectomy. *Journal of Surgery and Surgical Research*. 2021;7:32-36.
12. Terho PM, Leppäniemi AK, Mentula PJ. Laparoscopic

cholecystectomy for acute calculous cholecystitis: a retrospective study assessing risk factors for conversion and complications. *World Journal of Emergency Surgery*. 2016;11(1):54-59.

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