An Analytical Study on the Relationship Between Preoperative Ultrasound Findings and Intraoperative Challenges in Elective Laparoscopic Cholecystectomy

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KEYWORDS

Laparoscopic cholecystectomy, Preoperative ultrasound, Intraoperative difficulties, Gallbladder wall thickness, Common bile duct, Cholelithiasis

ABSTRACT:

INTRODUCTION: Cancer is a major health problem in many countries including India. Since Cancer Registries are incomplete in India, only a few epidemiological studies have been done so far. The objective was to determine to examine the various factors influencing the incidence of gastric carcinoma

Stomach cancer remains a major cause of cancer-related deaths worldwide, with a low 5-year survival rate (<30%) due to late diagnosis. Adenocarcinoma, the most common type, is linked to **Helicobacter pylori** infection. Though India has a relatively low incidence, urbanization and dietary shifts are contributing to its rise. Early detection in Japan has improved survival rates, unlike most regions. Surgical removal is the only effective treatment, but recurrence remains a challenge. Efforts are ongoing to develop adjuvant therapies for better outcomes.

AIM: The study aims to improve the prediction of intraoperative complications during lap cholecystectomy by comprehending and using preoperative USG data and criteria.

OBJECTIVES:

- To establish a relationship between intraoperative challenges and preoperative gall bladder ultrasonography results.The aim of this study is to evaluate the sensitivity and specificity of preoperative USG findings related to the gall bladder and to forecast the
- likelihood of a conversion to Laparoscopic cholecystectomy in order to do an open cholecystectomy as soon as feasible during surgery.

MATERIALS AND METHODS

This prospective analytical study was conducted in the General Surgery Department at KARPAGA VINAYAGA INSTITUTE OF MEDICAL SCIENCE, Chengalpettu, from September 2022 to July 2024. Fifty-seven patients undergoing elective laparoscopic cholecystectomy were assessed using preoperative ultrasound for parameters like gallbladder wall thickness, pericholecystic fluid, stone characteristics, and CBD size. Intraoperative challenges, including bleeding, bile leakage, operative time, and dissection difficulty, were documented. Statistical analysis was performed using unpaired t-tests and chi-square tests, with significance set at $p < 0.05$. The study aimed to correlate preoperative ultrasound findings with surgical complexity.

SL.No.	CRITERIA
1	Gall Bladder size
2	Number of stone
3	Size of stone
4	Pericholecystic fluid
5	Aberrant Anatomy (double gall bladder, intrahepatic gall bladder)
6	Gas in gall bladder wall
7	CBD size
8	GB wall thickness
9	Stone impaction at the neck of GB

Prior to surgery, the following ultrasonographic parameters were considered:

SL.No.	CRITERIA
1	Total duration of surgery from the insertion of working ports to the extraction of gall bladder as measured by stop watch.
2	Total time taken to dissect the Calot's Triangle as measured by stop watch
3	Total time taken to dissect the gall bladder from the gall bladder bed as measured by stop watch
4	Tear of gall bladder & spillage of bile and stone during extraction
5	Intra operative blood loss in mL
6	Time taken for Extraction of gall bladder

List of variables Studied Based on USG findings

• Gall bladder wall thickness
• Pericholecystic fluid
• Gall bladder size
• Size of gall stone
• Number of gall stone
• Location of gall stone
• Common bile duct size
• Vascularity around calot's triangle
• Abberant anatomy

Based on intra-operative difficulties

 Total duration of surgery from the insertion of working ports to the extraction of gall bladder
 Total time taken to dissect the Calot's Triangle
 Total time taken to dissect the gall bladder from the gall bladder bed
 Tear of gall bladder & spillage of bile and stone
 Bleeding
 Extraction of gall bladder

Expected outcome:

• Better correlation of intraoperative difficulties with pre-clinical USG findings
• Reduced duration of surgery.
• Avoiding complications during the procedure.
• Better predictions of complication during the during and be prepared for it
• Reducing morbidity and mortality of the patient.
• Enhancement of patient education on the necessity and likelihood of undergoing an open cholecystectomy

Outcome variables

 Distribution of duration of surgery (in minutes) in study population
 The study population's dissection time distribution for the gall bladder bed (in minutes)
 The research population's dissection time distribution in minutes
 The research population's distribution of gall bladder extraction times
 The incidence of gallstones and bile spills among patients with and without gallbladder tears
 The surgical conclusions drawn by the operating surgeon on the study population
 The research population's gall bladder wall thickness distribution (in mm)
 Link between ultrasonographic parameters and intraoperative bleeding?
 Correlation between ultrasonographic parameters and surgical duration
 Correlation between ultrasonographic characteristics and the amount of time required to dissect the gall bladder bed:
 Using ultrasonographic parameters to determine how long it takes to dissect

Calot's triangle
 Correlation between ultrasonographic parameters and the amount of time required to extract the gall bladder
 Association of "Tear of gall bladder and spillage of stones and bile" with ultrasonographic parameters.

STATISTICAL ANALYSIS: We used proforma and input all of the data into an Excel spreadsheet. Mean, standard deviation, frequency, and percentage were used to summarise the data. Tables, figures, a bar chart, and a pie chart were used to display the summarised data. A chi-square test was used for categorical data and an unpaired t-test for summarised data to compare with mean difference. A p-value below 0.05 was deemed statistically significant for all purposes.

RESULTS: The average age of patients was 48.5 years, with females accounting for 77.2% of the cases. Ultrasound findings revealed that 89.5% had a normal gallbladder size, 84.2% had multiple gallstones, and 21.1% had stones larger than 1 cm. Additionally, 10.5% had a common bile duct (CBD) diameter exceeding 8 mm, while 12.3% had impacted stones at the gallbladder neck, and 19.3% exhibited a gallbladder wall thickness greater than 4 mm. Significant associations were noted between abnormal anatomy, increased gallbladder wall thickness, and CBD dilation with prolonged surgical duration (>120 minutes). A gallbladder wall thickness over 4 mm was also linked to longer dissection times of Calot's triangle (>20 minutes). Bile spillage and gallbladder perforation occurred in 14% of cases, strongly correlating with impacted stones and thickened gallbladder walls.

Conclusion: Preoperative ultrasound serves as an effective tool for anticipating intraoperative challenges in laparoscopic cholecystectomy. Key ultrasound parameters, such as gallbladder wall thickness, common bile duct diameter, and stone characteristics, offer valuable insights into potential complications and the likelihood of conversion to open cholecystectomy. Integrating these findings into preoperative planning can improve surgical efficiency and patient care.

INTRODUCTION

Globally, stomach cancer is still the third leading cause of cancer-related death, even though its incidence is on the decline. A million new instances of stomach cancer were diagnosed in 2008, according to estimates. Case fatality ratios for these tumours ranged from 78% to 78% in Eastern Asia, Europe, and South America compared to 66% in the industrialised world. The 5-year survival rate for gastric cancer patients is less than 30% when diagnosed in nearly one-half of all patients.1 Various predisposing circumstances and etiological variables contribute to the development of gastric cancer. Most gastric cancers are adenocarcinomas, which can be further split into intestinal and diffuse histotypes based on their location in the stomach. Undifferentiated medullary, squamous, and adenosquamous melanoma are less common. By far, the most common form of stomach cancer, intestinal-type gastric cancer (which accounts for 50–70% of cases) is found in areas where Helicobacter pylori infection is prevalent.1 Adenocarcinoma of the stomach was a prominent cause of cancer-related death around the world in the 21st century. Adenocarcinoma is the second leading cause of cancer-related death in the world, after lung cancer. An estimated 4,50,000 people worldwide die each year as a result of stomach cancer, which is diagnosed in roughly 9,88,000 people each year. Due to dietary changes, food preparation, and other environmental factors, stomach cancer is more common in certain parts of the country than others. India has a fairly low incidence of stomach carcinoma, although it was one of the ten most common cancer locations in men and women in most major cities. Stomach cancer cases are on the rise in India, thanks to urbanisation, a healthier lifestyle, and a longer life expectancy. Dietary changes are one of the factors that have influenced the rate of disease occurrence. Due to thousands of years of religious and cultural diet teachings, India has a dietary variety that most other countries can only dream of. However, little is known about the function of Indian diet in causing or preventing stomach cancer, hence more focus is paid to particular diet characteristics such as vegetarianism, spices, and food additives.2 Other than in a few nations, the prognosis for stomach cancer patients is poor due to various variables. The lack of distinct symptoms and the low incidence of the disease have contributed to a delay in diagnosis, which has resulted in a late diagnosis. Since stomach cancer is prevalent in Japan, most patients are diagnosed at an earlier stage, which results in an increase of overall survival rates.3 Cancers below the esophagogastric junction account for most of the decline in stomach cancer incidence over the past few decades. Proximal stomach carcinomas are becoming more common, though. It is tough to treat these tumours because they are usually more aggressive.4 The only effective treatment for Gastric cancer is surgical intervention to remove the tumour both microscopically and macroscopically. Despite the fact

that majority of the patients have been successfully treated, the disease continues to recur, either in the same area or in a new location. There are currently efforts to create systemic and localised adjuvant medicines that can be administered before and after surgery. Reduce the content to 6 lines

AIMS AND OBJECTIVES

The study aims to improve the prediction of intraoperative complications during lap cholecystectomy by comprehending and using preoperative USG data and criteria.

Objectives

Primary Objective

To establish a relationship between intraoperative challenges and preoperative gall bladder ultrasonography results. The aim of this study is to evaluate the sensitivity and specificity of preoperative USG findings related to the gall bladder and to forecast the likelihood of a conversion to Laparoscopic cholecystectomy in order to do an open cholecystectomy as soon as feasible during surgery.

MATERIAL & METHOD

Setting: Patients planned for elective laparoscopic cholecystectomy in KARPAGA VINAYAGA INSTITUTE OF MEDICAL SCIENCE under general surgery department.

Study design: Prospective analytical investigation of ultrasonographic findings and their relationships to laparoscopic cholecystectomy intraoperative complications.

Study participants:

Inclusion criteria:

The KARPAGA VINAYAGA INSTITUTE OF MEDICAL SCIENCE, Chengalpettu General Surgery Department accepts patients above the age of 18 for elective laparoscopic cholecystectomy.

Exclusion criteria:

The KARPAGA VINAYAGA INSTITUTE OF MEDICAL SCIENCE, Chengalpettu General Surgery Department accepts patients above the age of 18 for elective laparoscopic cholecystectomy.

1. H/O > 3 PREVIOUS ABDOMINAL SURGERIES
2. CBD DILATED >10 MM
3. CBD STONES
4. PREVIOUS CBD EXPLORATION
5. PANCREATITIS

Study duration: Sep 2022 – April 2024

Sampling technique: Convenience sampling technique

Sample size(n): the sample size is 57. Calculated based on similar study by Chand et al., with the expected sensitivity of USG as 75.7% and the relative precision of 12%. The level of significance was taken as 5%. P= expected proportion, d= relative precision.

$$n \geq \frac{Z^2_{1-\frac{\alpha}{2}} P(1-P)}{d^2 P}$$

(Chand P, SinghR, SinghB, Singla RL, Yadav M Preoperative ultrasonography as a predictor of difficult laparoscopic cholecystectomy that requires conversion to open procedure. Niger J Surg 2015;21:102-5)[39]

METHODOLOGY

This study examines the correlation between preoperative ultrasound findings and intraoperative outcomes to assess surgical complexity and the potential need for open cholecystectomy. All patients underwent abdominal ultrasonography before surgery, with specific preoperative criteria evaluated and compared to intraoperative findings. Unique values were assigned to each criterion for systematic comparison. Following standard assessments and patient consent, laparoscopic cholecystectomy was performed, with patients being informed about the possibility of conversion to open cholecystectomy if necessary.

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- Pericholecystic fluid
- Gall bladder size
- Size of gall stone
- Number of gall stone
- Location of gall stone
- Common bile duct size
- Vascularity around calot's triangle
- Abberant anatomy

Based on intra-operative difficulties

 Total duration of surgery from the insertion of working ports to the

extraction of gall bladder
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 Using ultrasonographic parameters to determine how long it takes to dissect Calot's triangle
 Correlation between ultrasonographic parameters and the amount of time required to extract the gall bladder
 Association of "Tear of gall bladder and spillage of stones and bile" with ultrasonographic parameters.

STATISTICAL ANALYSIS
We used proforma and input all of the data into an Excel spreadsheet. Mean, standard deviation, frequency, and percentage were used to summarise the data.

RESULT
The average age of the 57 patients who met the inclusion criteria was 48.5 years old.

Table 1: Showing mean age of patients

	Mean	SD
Age (yr)	48.5	16.4

Table 2: Showing gender distribution of patient

		Count	Column N%
Gender	Female	44	77.2%
	Male	13	22.8%

In this research, female patients predominated with 77.2% compared to 22.8% of male patients.

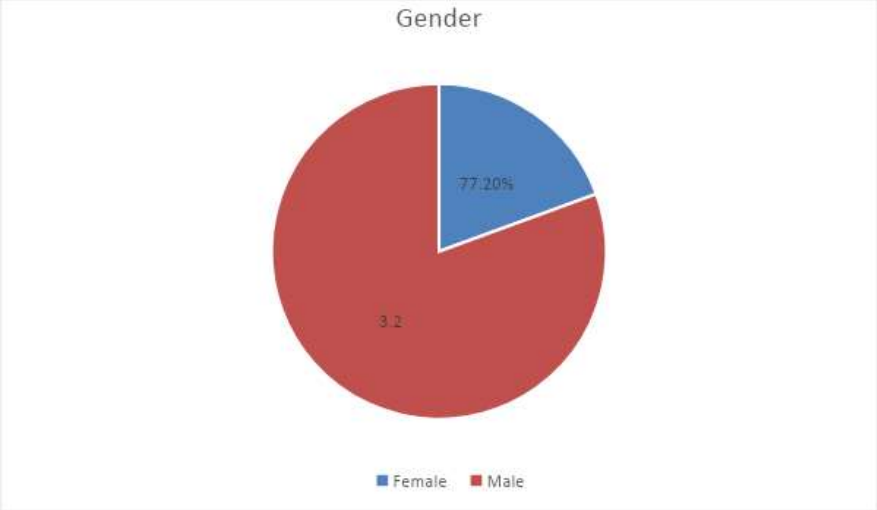

Figure 7: Showing gender distribution of patients

Table 3: Showing the ultrasound findings among patients

		Count	Column N %
Gall Bladder size	Contracted	2	3.5%
	Distended	4	7.0%
	Normal	51	89.5%
Number of stones	Multiple	48	84.2%
	Single	9	15.8%
Size of stone	<1cm	45	78.9%
	>1cm	12	21.1%
Pericholecystic fluid	Absent	51	89.5%
	Present	6	10.5%
Aberrant Anatomy	Absent	55	96.5%
	Present	2	3.5%
Gas in Gallbladder	Absent	49	86.0%
	Present	8	14.0%
Liver mobility	Absent	16	28.1%
	Present	41	71.9%
Common bile duct size	<8mm	44	77.2%
>8mm	>8mm	13	22.8%
Gallbladder wall thickness	<4mm	46	80.7%
>4mm	>4mm	11	19.3%
Stone impacted at GB	Absent	50	87.7%
neck	Present	7	12.3%

On ultrasound investigation, gall bladder size was normal in 89.5%, number of stones were multiple in 84.2%, with more than 1cm size was seen in 21.1%, pericholecystic fluid was present in 10.5%, with 3.5% aberrant anatomy, 14% with gas in gall bladder, 71.9% with presence of liver mobility, 22.8% with common bile duct size >8mm, 19.3% with GB wall thickness >4mm and stone impacted at GB neck was seen in 12.3% of the patients.

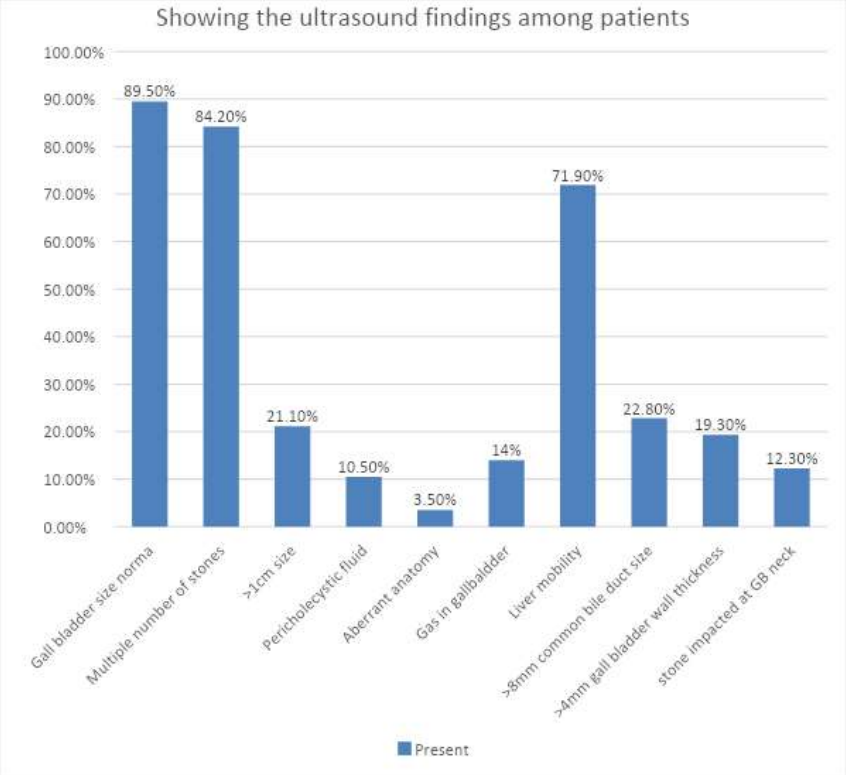

Figure 8: Showing the ultrasound findings among patients

Table 4: Showing the intraoperative findings among patients

		Count	Column N %
Surgery duration	<120min	44	77.2%
	>120min	13	22.8%
Calot triangle	<20min	50	87.7%
	>20min	7	12.3%
GB Bed	<20min	42	73.7%
	>20min	15	26.3%
Bile spill	Absent	49	86.0%
	Present	8	14.0%
Bleeding	1+	54	94.7%
	2+	3	5.3%
GBE Easy	Absent	11	19.3%
	Present	46	80.7%
GBE difficult	Absent	48	84.2%
	Present	9	15.8%
Conversion to open cholecystectomy	Absent	55	96.5%
	Present	2	3.5%

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.

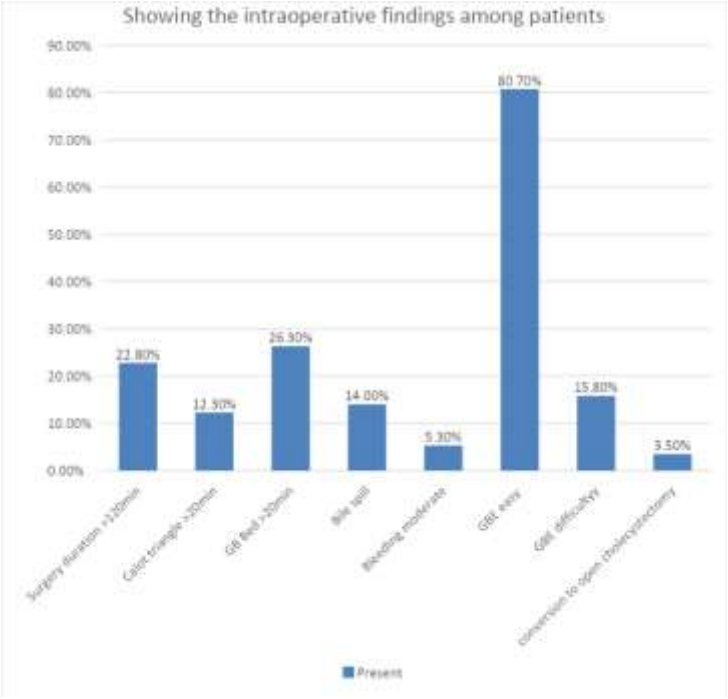

Figure 9: Showing the intraoperative findings among patients

Table 5: 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	<1cm	41	78.8%	4	80.0%	0.04 (0.95)
	>1cm	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 >8mm	<8mm	42	80.8%	2	40.0%	4.306 (0.01)*
	>8mm	10	19.2%	3	60.0%	
Gallbladder wall thickness >4mm	<4mm	44	84.6%	2	40.0%	6.83 (0.01)*
	>4mm	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%	

Among patients whose USG results were associated with postoperative haemorrhage, a correlation of >8 mm for the common bile duct and >4 mm for the gall bladder wall thickness was seen.

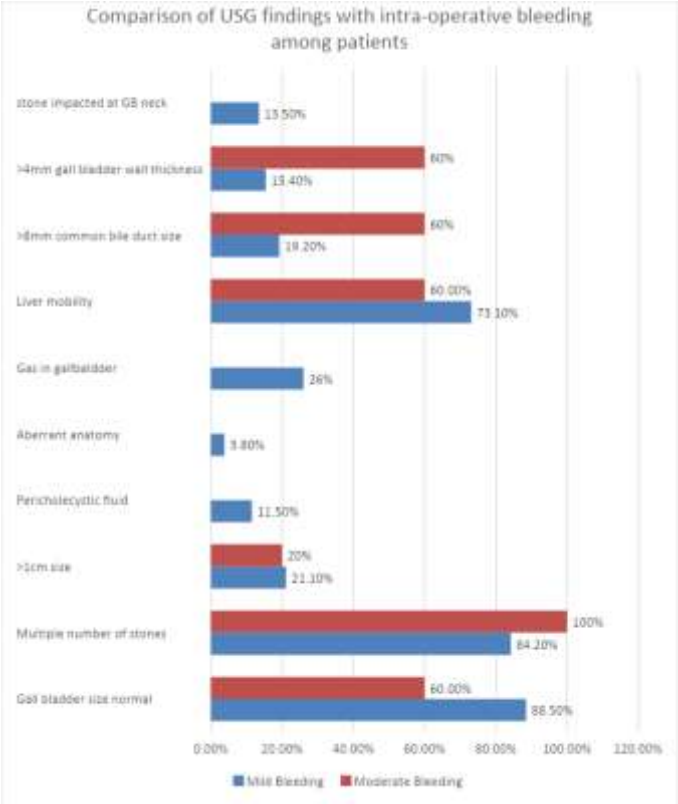

Figure 10: Comparison of USG findings with intra-operative bleeding among patients

Table 6: Comparison of USG findings with duration of surgery among patients

		Duration of surgery >120min				Chi-square (p-value)
		<120 min		>120min		
		Count	N %	Count	N %	
Gall Bladder size	Contracted	2	4.5%	2	15.4%	2.85
	Distended	4	9.1%	0	0.0%	(0.23)
	Normal	38	86.4%	11	84.6%	
Number of stones	Multiple	35	79.5%	13	100.0%	3.15
	Single	9	20.5%	0	0.0%	90.07)
Size of stone >1cm	<1cm	36	81.8%	9	69.2%	0.95
	>1cm	8	18.2%	4	30.8%	(0.32)
Pericholecystic fluid	Absent	40	90.9%	11	84.6%	0.422
	Present	4	9.1%	2	15.4%	(0.516)
Aberrant Anatomy	Absent	44	100.0%	11	84.6%	7.01
	Present	0	0.0%	2	15.4%	(0.001)*
Gas in Gallbladder	Absent	37	84.1%	12	92.3%	0.56
	Present	7	15.9%	1	7.7%	(0.45)
Liver mobility	Absent	12	27.3%	4	30.8%	0.061
	Present	32	72.7%	9	69.2%	(0.805)
Common bile duct size >8mm	<8mm	41	93.2%	3	23.1%	28.29
	>8mm	3	6.8%	10	76.9%	(0.01)*
Gallbladder wall thickness >4mm	<4mm	41	93.2%	5	38.5%	19.24
	>4mm	3	6.8%	8	61.5%	(0.01)*
Stone impacted at GB neck	Absent	40	90.9%	10	76.9%	1.82
	Present	4	9.1%	3	23.1%	(0.17)

There was a significantly greater frequency with the existence of aberrant architecture, >8mm size of the

common bile duct, and gall bladder wall thickness of >4mm when comparing the USG results with length of operation >120 minutes.

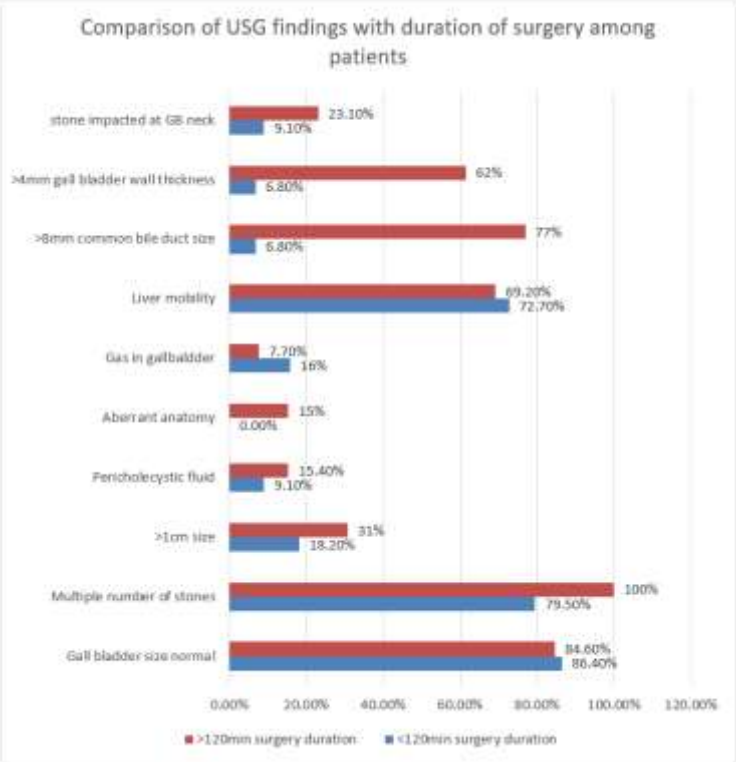

Figure 11: Comparison of USG findings with duration of surgery among patients

Table 7: 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 >1cm	<1cm	34	81.0%	11	73.3%	0.38 (0.534)
	>1cm	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 >8mm	<8mm	34	81.0%	10	66.7%	1.28 (0.258)
	>8mm	8	19.0%	5	33.3%	
Gallbladder wall thickness >4mm	<4mm	38	90.5%	8	53.3%	9.79 (0.02)*
	>4mm	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%	

There was an increased frequency of several gall stones and a wall thickness more than 4 mm when comparing the results of the USG with the dissection of the gall bladder, both of which required more than 20 minutes of bed time.

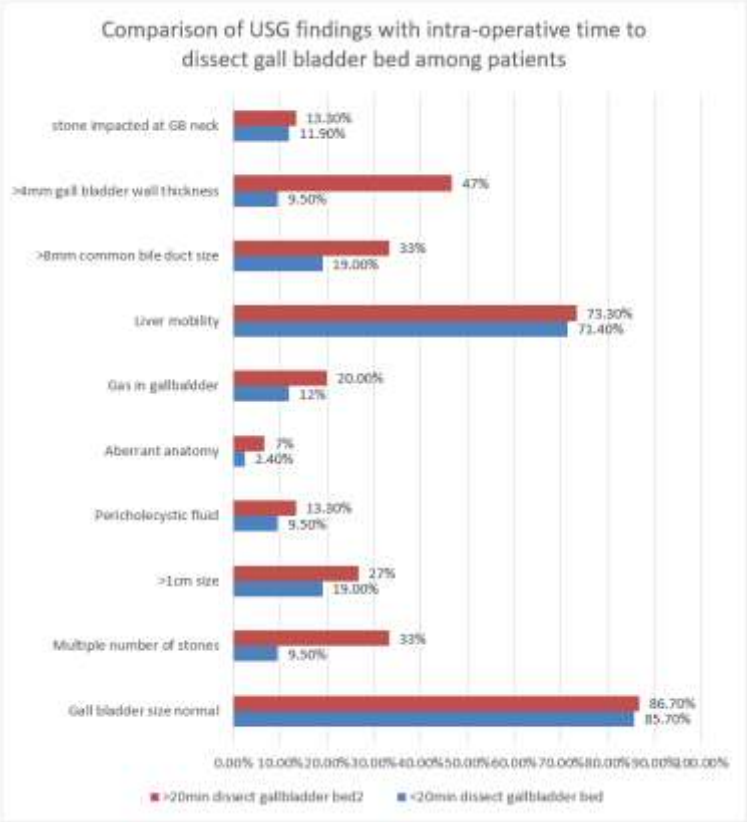

Figure 12: Comparison of USG findings with intra operative time to dissect gall bladder bed among patients

Table 8: 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 >1cm	<1cm	41	82.0%	4	57.1%	2.28 (0.131)
	>1cm	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 >8mm	<8mm	40	80.0%	4	57.1%	1.822 (0.177)
	>8mm	10	20.0%	3	42.9%	
Gallbladder wall thickness >4mm	<4mm	44	88.0%	2	28.6%	13.92 (0.01)*
	>4mm	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 Chalot triangle dissection time of more than 20 min was seen with significant higher incidence in if gall bladder wall thickness was >4

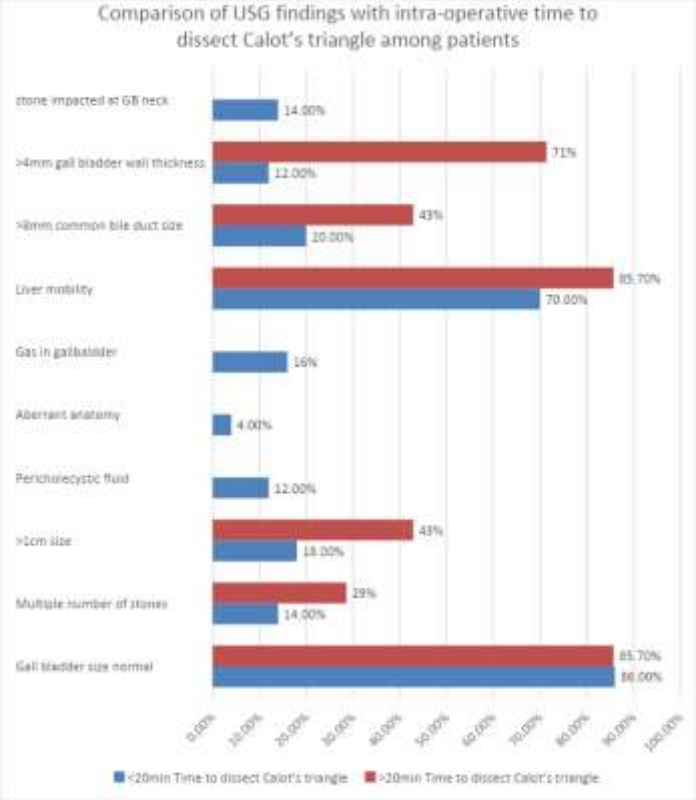

Figure 13: Comparison of USG findings with intra operative time to dissect Calot's triangle among patients

Table 9: 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	<1cm	7	63.6%	38	82.6%	1.93 (0.16)
	>1cm	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	<8mm	5	45.5%	39	84.8%	7.79 (0.01)*
	>8mm	6	54.5%	7	15.2%	
Gallbladder wall thickness >4mm	<4mm	6	54.5%	40	87.0%	5.98 (0.01)*
	>4mm	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%	

Significant difficulty was seen when the common bile duct size was >8mm and in individuals with gall bladder wall thickness of >4mm, when comparing the USG results with gall bladder extraction.

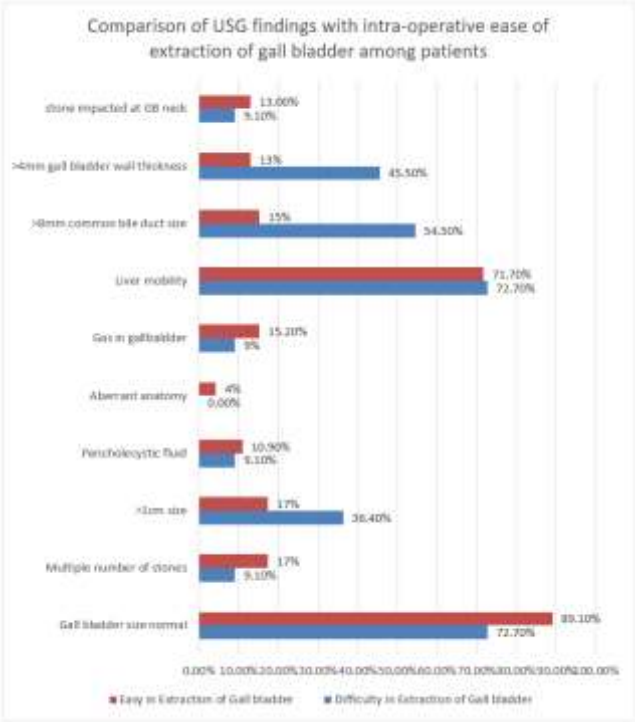

Figure 14: Comparison of USG findings with intra-operative ease of extraction of gall bladder among patients

Table 10: 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 >1cm	<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%	

In situations where the gall bladder wall thickness was more than 4 mm or when the stone had an effect at the

GB neck, the USG results were significantly associated with bile leakage and stone.

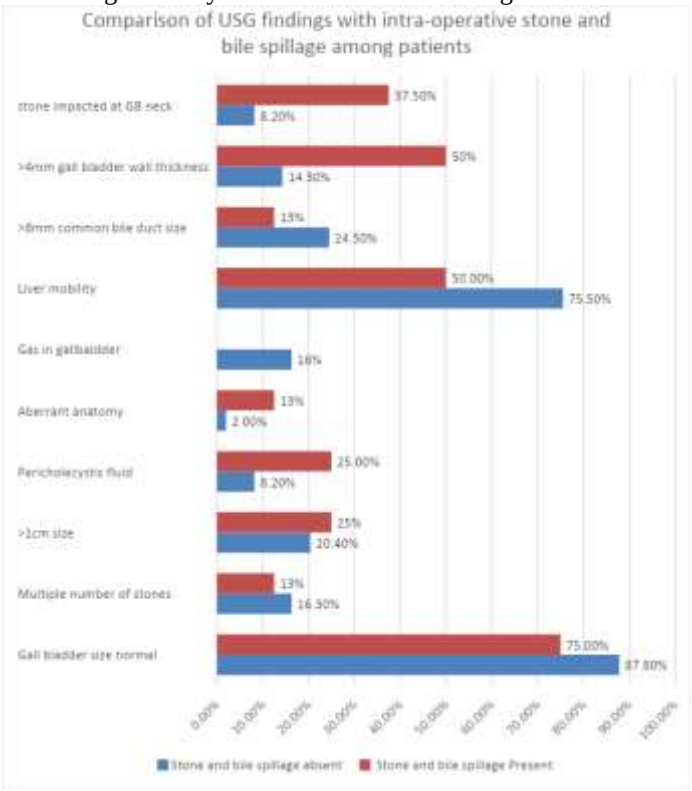

Figure 15: Comparison of USG findings with intra-operative stone and bile spillage among patients

DISCUSSION

Laparoscopic cholecystectomy is the preferred treatment for gallbladder diseases, particularly symptomatic cholelithiasis, due to its advantages over open surgery, such as reduced postoperative pain, shorter hospital stays, and faster recovery. However, certain intraoperative challenges may arise, especially in cases with complex gallbladder pathology or anatomical variations.

Preoperative ultrasonography (USG) plays a crucial role in assessing gallbladder conditions by evaluating factors such as gallbladder wall thickness, common bile duct (CBD) size, presence of gallstones, and pericholecystic fluid. These USG findings aid in surgical planning by predicting potential complications, including prolonged operative time, difficult dissection, increased bleeding, and the possibility of conversion to open surgery.

This study investigates the relationship between preoperative USG findings and intraoperative complications in patients undergoing elective laparoscopic cholecystectomy. Among the 57 patients analyzed, 77.2% were female, with an average age of 48.5 years. USG findings revealed that 89.5% had a normal gallbladder size, 84.2% had multiple stones, 21.1% had stones larger than 1 cm, and 19.3% had a gallbladder wall thickness greater than 4 mm. A CBD size exceeding 8 mm was observed in 22.8% of cases, while 12.3% had impacted stones at the gallbladder neck.

The intraoperative findings demonstrated a strong correlation with preoperative USG parameters. Cases with a CBD size greater than 8 mm and gallbladder wall thickness exceeding 4 mm were associated with increased bleeding, prolonged surgical duration beyond 120 minutes, and difficulties in gallbladder extraction. Dissecting Calot's triangle for more than 20 minutes was significantly linked to a gallbladder wall thickness over 4 mm. Additionally, multiple stones and thickened gallbladder walls contributed to prolonged gallbladder bed dissection. Gallbladder tears and bile leakage were more frequent in patients with impacted stones and increased wall thickness.

Several studies support these findings, highlighting the predictive value of USG in assessing surgical difficulty. Research by Chand P et al. and Togale V et al. emphasized the role of gallbladder wall thickness and stone mobility in predicting intraoperative challenges. Similar studies by Daly A et al. and Bhandari TR et al. confirmed that male gender, history of acute cholecystitis, fibrotic gallbladder, and adhesions at Calot's triangle increased the complexity of laparoscopic cholecystectomy.

Factors such as prior hospitalizations, history of supraumbilical surgeries, acute cholecystitis, and pericholecystic fluid were associated with greater operative difficulty, as observed in studies by Saad K et al. and Santharaj et al. The likelihood of conversion to open surgery was found to be higher in patients with older age, diabetes, elevated inflammatory markers, and gallbladder gangrene, as reported by Terho P et al.
This study reinforces the importance of preoperative USG in predicting surgical complexity and optimizing patient management. Identifying high-risk cases allows for better preoperative counseling, surgical planning, and resource allocation, ultimately improving patient outcomes and reducing intraoperative complications.

SUMMARY

With a mean age of 48.5 years, 57 patients who met the inclusion criteria were included in the current research.
● Among included patients, 77.2% were female patients and 22.8% were male
patients, with female preponderance in present study.
● Ultrasound examination revealed the following: 89.5% of patients had normal gall bladder size, 84.2% had multiple stones, 21.1% had stones larger than 1 cm, 10.5% had pericholecystic fluid, 3.5% had abnormal anatomy, 14% had gall bladder gas, 71.9% had liver mobility, 22.8% had common bile duct sizes greater than 8 mm, 19.3% had GB wall thickness greater than 4 mm, and 12.3% had stones impacted at the GB neck.
● 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.
● Among patients whose USG results were associated with postoperative haemorrhage, a correlation of >8 mm for the common bile duct and >4 mm for the gall bladder wall thickness was seen.
● There was a significantly greater frequency with the existence of aberrant architecture, >8mm size of the common bile duct, and gall bladder wall thickness of >4mm when comparing the USG results with length of operation >120 minutes.
On comparison of the USG findings with the dissect of gall bladder bed time more than 20min was seen with higher incidence with multiple gall stones and if the gall bladder wall thickness was more than 4mm.
● On comparison of the USG findings with Calot triangle dissection time of more than 20 min was seen with significant higher incidence in if gall bladder wall thickness was >4.
● Significant difficulty was seen when the common bile duct size was >8mm and in individuals with gall bladder wall thickness of >4mm, when comparing the USG results with gall bladder extraction.
● Cases with gall bladder wall thickness >4 mm and when stone impacted at GB neck had a significantly greater incidence when comparing the USG results with stone and bile spilling.

CONCLUSION

In this study involving 57 patients undergoing elective laparoscopic cholecystectomy, preoperative ultrasound played a crucial role in predicting intraoperative challenges. The average patient age was 48.5 years, with a predominance of females (77.2%). Key ultrasound findings included a normal gallbladder size in 89.5% of cases, multiple stones in 84.2%, stones larger than 1 cm in 21.1%, pericholecystic fluid in 10.5%, aberrant anatomy in 3.5%, gallbladder gas in 14%, liver mobility in 71.9%, a common bile duct (CBD) size greater than 8 mm in 22.8%, gallbladder wall thickness exceeding 4 mm in 19.3%, and impacted stones at the gallbladder neck in 12.3% of cases.
The correlation between intraoperative findings and these ultrasound parameters revealed several surgical challenges. Notably, procedures lasting over 120 minutes were significantly linked to anatomical abnormalities, a CBD size greater than 8 mm, and increased gallbladder wall thickness. Additionally, difficulty in dissecting Calot's triangle for more than 20 minutes was strongly associated with a gallbladder wall thickness exceeding 4 mm. Similarly, cases with multiple stones and a thicker gallbladder wall were more likely to require prolonged dissection of the gallbladder bed.
Complications, including gallbladder tears and bile leakage, were notably more frequent in patients with a gallbladder wall thickness greater than 4 mm and impacted stones at the gallbladder neck, occurring in 14% of cases. Furthermore, gallbladder extraction was significantly more challenging in cases where the CBD measured over 8 mm and the gallbladder wall was thickened beyond 4 mm.
These findings underscore the importance of preoperative ultrasound in anticipating intraoperative difficulties in laparoscopic cholecystectomy. Key ultrasonographic indicators such as CBD size, gallbladder wall thickness, and the presence of multiple or impacted stones serve as valuable tools for surgical planning. The study highlights the critical role of detailed preoperative imaging in refining the surgical approach, minimizing complications, and enhancing patient outcomes.

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