

Comparative Analysis of Preoperative Ultrasonography Reports with Intraoperative Surgical Findings in Cholelithiasis

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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to identify the ability of pre-operative Ultrasonography in predicting difficult Laparoscopic Cholecystectomy.**Methods:** This cross-sectional observational study was done in the Department of General Surgery, Patna Medical College and Hospital, Bihar, India for the duration of 2 years. 100 Patients diagnosed with gallbladder stones were included in this study. The study was approved by the institutional ethical approval committee. Verbal consent was obtained from each patient after full illustration of the aim and procedures related to the current study.**Results:** The age range of those patients was from 14 to 85 years and the mean was 42.28 ± 15.50 years. With respect to gender, there was 20 male patients accounting for (20%) and 80 female patients accounting for (80%); therefore, the male to female ratio was 1:4.26. Mean body mass index (BMI) was 26.24 ± 7.73 kg/m². Pre-operative USG findings such as gall bladder wall thickness >4 mm, gall bladder size ≥ 5 cm, impacted gall stones, CBD diameter ≥ 6 mm, size of the calculus ≥ 1 cm, and presence of pericholecystic fluid collection were significantly associated with difficult laparoscopic cholecystectomy. There was statistically significant difference between pre-operative USG score and difficult or non-difficult laparoscopic cholecystectomy. Higher the preoperative USG score, higher were the percentage of difficult laparoscopic cholecystectomy.**Conclusion:** This study has shown that pre-operative USG findings such as gall bladder wall thickness >4 mm, gall bladder size ≥ 5 cm, impacted gall stones, CBD diameter ≥ 6 mm, size of the calculus ≥ 1 cm, and presence of pericholecystic fluid collection were significantly associated with difficult laparoscopic cholecystectomy. Gall bladder wall thickness >4 mm was the most accurate predictor for a difficult laparoscopic cholecystectomy followed by pericholecystic fluid collection and impacted gall stones.**Keywords:** Acute cholecystitis, Gallstone disease, Intraoperative scoring.

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Introduction

One of the most prevalent Gastrointestinal Illness, Gallstones afflict 10% of individuals in Western world. [1] They are mostly asymptomatic, only 10% and 20% will become symptomatic within 5 and 20 years of diagnosis respectively. Cholelithiasis has worldwide scope, with estimated incidence of 1.39/100 person/year, varying little between populations. Predominates in females and in advanced age. [2,3] Henceforth, the average risk of developing symptomatic disease is little, and approaches 2.0-2.6% per year. [4,5] Patients with symptomatic gall stones may suffer with severe pain in the right upper abdomen, frequently accompanied by nausea and vomiting, that steadily worsens over the course from 30 mins to several hours. A patient may also feel referred pain (Boa's

Sign) below the right shoulder area or between the shoulder blades. Attacks almost always occur at night particularly after a fatty meal. [6] Laparoscopic cholecystectomy has rapidly become the procedure of choice for routine gallbladder removal and is currently the most commonly performed major abdominal procedure worldwide, [7] with mortality and morbidity of approximately 0.5% and 10%, respectively. [8] This procedure has advantages when compared to laparotomy, such as reducing the length of hospital stay, incidence and intensity of pain in the postoperative period, better aesthetic effects and minor surgical trauma. [9]

To confirm the preoperative diagnosis, abdominal ultrasonography (USG) is the most frequently used exam, being diagnostic method with relative low

cost, free of ionizing radiation, non-invasive and practical realization. sensitivity and specificity of 84% and 99%, being gold-standart for the diagnosis of extrahepatic biliary diseases, detecting gallstones of 1.5-2 mm in diameter. [10,11]

The accuracy of presence of pericholecystic fluid on ultrasonography, is another factor of difficult laparoscopic surgery. The presence of multiple stones within the gall bladder on ultrasonography is another indicator of difficult laparoscopic surgery.¹¹ Gall bladder wall thickness of more than 4 mm, stone impaction at GB neck, multiple stones and pericholecystic fluid on Ultrasonography are various factors that may point tow difficult Laparoscopic surgery.

The present study was done to identify the ability of pre-operative Ultrasonography in predicting difficult Laparoscopic Cholecystectomy.

Material & Methods

This cross sectional observational study was done in the Department of General Surgery, Patna Medical College and Hospital, Bihar, India for the duration of 2 years. 100 Patients diagnosed with gallbladder stones were included in this study. The study was approved by the institutional ethical approval committee. Verbal consent was obtained from each patient after full illustration of the aim and procedures related to the current study.

Inclusion Criteria

- Both male and female patients with equal to or more than 18 years of age who are diagnosed with Cholelithiasis by Ultrasound whole abdomen and undergoing Laparoscopic Cholecystectomy was included in the study.

Exclusion Criteria

- Patients with Common Bile Duct stone/s
- Patients who are willing only for Open Cholecystectomy.

Following pre-operative ultrasonographic parameters were studied:

- Gallbladder (GB) wall thickness (≤4mm or >4mm wall thickness)

- Gallstone mobility (gallstone mobile or impacted at neck)
- Gallbladder size (gallbladder contracted with transverse diameter <5cm or distended with transverse diameter ≥5cm).⁹
- Common bile duct (CBD) diameter (diameter<6mm or ≥6mm).¹⁰
- Size of calculus: Small <1cm or large ≥1cm and number of calculi (single or multiple)
- Presence of pericholecystic fluid collection.

Above ultrasonographic parameters were given score of 0 or 1 based on findings being negative or positive respectively. Total score was calculated considering all six ultrasonographic parameters. Thus, a total score of a minimum of 0 and a maximum of 6 was found. Total score was correlated to intraoperative difficulty of surgery. A cut off score was calculated for prediction of a difficult laparoscopic cholecystectomy. Operative findings were objectively graded as difficult laparoscopic cholecystectomy if any one of following difficulties was encountered:

- Presence of dense peri gall bladder adhesions.
- Difficulty in dissection of the Calot triangle or a frozen Calot triangle.
- Tear of the gallbladder during dissection with spillage of bile and stones.
- Bleeding that hindered visual field.
- Abnormal anatomy of biliary tree.
- Buried or intrahepatic gall bladder.

Statistical Analysis

This is an observational study and the results are represented in percentage forms. Quantitative data was presented as mean + SD. Chi square test was used for data analyzing wherever applicable. P value <0.05 was considered significant. Data was analysed by statistical package for social sciences (SPSS) version v24.0.

Results

Table 1: Demographic details

Characteristic	Value
Age (years)	
Mean ±SD	42.28± 15.50
Range	14-85
Gender	
Male, n (%)	20 (20 %)
Female, n (%)	80 (80%)
BMI (kg/m2)	26.24 ± 7.73

The age range of those patients was from 14 to 85 years and the mean was 42.28 ± 15.50 years. With respect to gender, there was 20 male patients accounting for (20%) and 80 female patients accounting for (80%); therefore the male to female ratio was 1:4.26. Mean body mass index (BMI) was 26.24 ± 7.73 kg/m².

Table 2: Pre-operative ultrasonographic findings and incidence of difficult laparoscopic cholecystectomy

Ultrasonographic Parameters	Findings	Laparoscopic cholecystectomy			
		Not difficult	Difficult	Total	P Value
GB wall thickness	≤4 mm	50 (78.12)	14 (21.88)	64	0.001
	>4 mm	10 (27.77)	26 (72.23)	36	
GB size	<5 cm	54 (81.81)	12 (18.19)	66	0.005
	>5 cm	6 (17.64)	28 (82.36)	34	
Gall stone mobility	Mobile	55 (61.11)	35 (38.89)	90	0.001
	Impacted	5 (50)	5 (50)	10	
CBD diameter	<6 mm	70 (82.35)	15 (17.65)	85	0.001
	>6 mm	0	15 (100)	15	
Size of calculus	<1 cm	60 (75)	20 (25)	80	0.001
	>1 cm	4 (20)	16 (80)	20	
Pericholecystic fluid collection	No	60 (75)	20 (25)	80	0.001
	Yes	2 (10)	18 (90)	20	

Pre-operative USG findings such as gall bladder wall thickness >4 mm, gall bladder size ≥5cm, impacted gall stones, CBD diameter ≥6mm, size of the calculus ≥1cm, and presence of pericholecystic fluid collection were significantly associated with difficult laparoscopic cholecystectomy.

Table 3: Diagnostic accuracy of pre-operative USG findings for predicting the difficult surgery

Ultrasonographic findings	Diagnostic accuracy				
	Sensitivity	Specificity	PPV	NPV	Accuracy (95% CI)
GB wall thickness (>4mm)	64.0	96.4	92.7	84.6	86.7 (78.1 - 95.3)
GB size (≥5cm)	70.0	67.3	51.9	82.8	68.3 (56.6 - 80.1)
Gall stone mobility (Impacted)	40.0	100.0	100.0	75.5	80.0 (69.9 - 90.1)
CBD diameter (≥6mm)	30.0	100.0	100.0	74.6	76.7 (65.9 - 87.4)
Size of calculus (≥1cm)	40.0	92.8	72.8	75.5	75.0 (64.0 - 85.9)
Pericholecystic fluid collection	50.0	97.4	90.9	79.3	81.7 (71.9 - 91.5)

Gall bladder wall thickness > 4 mm was the most accurate predictor for a difficult laparoscopic cholecystectomy followed by pericholecystic fluid collection and impacted gall stones. Median pre-operative USG score was 0.72 and 3.00 for non-difficult and difficult laparoscopic cholecystectomy respectively which was statistically significant (p = 0.001).

Table 4: Pre-operative USG score and difficult laparoscopic cholecystectomy

Pre-operative USG score	Laparoscopic cholecystectomy			P value
	Non-difficult	Difficult	Total	
	N (%)	N (%)	N (%)	
0-1	55 (78.57)	15 (21.43)	70	0.001
2-3	3 (30)	7 (70)	10	
≥4	2 (10)	18 (90)	20	
Total	60 (60)	40 (40)	100(100.0)	

There was statistically significant difference between pre-operative USG score and difficult or non-difficult laparoscopic cholecystectomy. Higher the preoperative USG score, higher were the percentage of difficult laparoscopic cholecystectomy.

Table 5: Pre-operative USG score and conversion of laparoscopic cholecystectomy to open cholecystectomy

Pre-operative score	USG	Conversion to open cholecystectomy			P value
		Not required	Required	Total	
		N (%)	N (%)	N (%)	
0-1		70 (100)	0 (0.0)	70	0.001
2-3		8 (80)	2 (20)	10	
≥4		7 (35)	13 (65)	20	
Total		85(85)	15(15)	100 (100)	

There was statistically significant difference between pre-operative USG score and conversion of laparoscopic cholecystectomy to open cholecystectomy. Higher the preoperative USG score, higher were the percentage of conversion to open cholecystectomy. Minor surgical wound infections occurred in two patients which were managed conservatively with oral antibiotics.

Discussion

Gallstones constitute a significant health problem in developed societies, affecting 10% to 15% of the adult population, meaning 20 to 25 million Americans have (or will have) gallstones. [12] With an estimated 1.8 million ambulatory care visits each year, gallstone disease is a leading cause for hospital admissions related to gastrointestinal problems. These numbers are likely an underestimate because laparoscopic cholecystectomy is often performed as a day procedure and thus not captured by hospital statistics that require overnight admission. Fortunately, case fatality rates have steadily diminished from over 5,000 deaths in 1950, falling >50% between the years 1979 and 2004. This decline represents the greatest decrease for any digestive disease. [13] Gallstone disease per se also carries inherent risks.

The age range of those patients was from 14 to 85 years and the mean was 42.28 ± 15.50 years. With respect to gender, there was 20 male patients accounting for (20%) and 80 female patients accounting for (80%); therefore the male to female ratio was 1:4.26. Mean body mass index (BMI) was 26.24 ± 7.73 kg/m². Pre-operative USG findings such as gall bladder wall thickness >4 mm, gall bladder size ≥ 5 cm, impacted gall stones, CBD diameter ≥ 6 mm, size of the calculus ≥ 1 cm, and presence of pericholecystic fluid collection were significantly associated with difficult laparoscopic cholecystectomy. In present study, there was a significant correlation between gallbladder wall thickness more than 4mm and difficulty faced in laparoscopic cholecystectomy which is comparable to other studies except one study in which, the opposite has been reported. [14-20] A correlation between the common bile duct diameter and difficulty in laparoscopic cholecystectomy and also conversion to open procedure was observed in our

study which was comparable to other studies. [14,21] Daradkeh et al and Lal et al also reported in their respective studies that both gall bladder wall thickness and common bile duct diameter were the best ultrasonographic parameters to predict difficulty of laparoscopic cholecystectomy. [14,17]

Gall bladder wall thickness > 4 mm was the most accurate predictor for a difficult laparoscopic cholecystectomy followed by pericholecystic fluid collection and impacted gall stones. Median pre-operative USG score was 0.72 and 3.00 for non-difficult and difficult laparoscopic cholecystectomy respectively which was statistically significant ($p = 0.001$). There was statistically significant difference between pre-operative USG score and difficult or non-difficult laparoscopic cholecystectomy. Higher the preoperative USG score, higher were the percentage of difficult laparoscopic cholecystectomy. Many studies have reported statistical significance between the size of stones and conversion of laparoscopic cholecystectomy to open cholecystectomy. [22,23] Authors found the same in present study, but Jansen et al stated that stone size >20 mm was associated with increased risk of conversion. [16]

There was statistically significant difference between pre-operative USG score and conversion of laparoscopic cholecystectomy to open cholecystectomy. Higher the preoperative USG score, higher were the percentage of conversion to open cholecystectomy. Minor surgical wound infections occurred in two patients which were managed conservatively with oral antibiotics. Many studies have attempted to form a scoring system to predict difficult laparoscopic cholecystectomy, but most of them are complex, use large number of determining factors, and they are difficult to use in day-to-day practice. [24-27] Many of these scoring systems cannot be applied pre-operatively. [25] The score formulated in present study can be applied pre-operatively. It is a simple and purely ultrasonological score with six parameters which were highly predictive of a difficult laparoscopic surgery.

Conclusion

This study has shown that pre-operative USG findings such as gall bladder wall thickness >4 mm, gall bladder size ≥ 5 cm, impacted gall stones, CBD

diameter ≥ 6 mm, size of the calculus ≥ 1 cm, and presence of pericholecystic fluid collection were significantly associated with difficult laparoscopic cholecystectomy. Gall bladder wall thickness >4 mm was the most accurate predictor for a difficult laparoscopic cholecystectomy followed by pericholecystic fluid collection and impacted gall stones. Higher the pre-operative USG score, higher were the percentage of difficult laparoscopic cholecystectomy and conversion to open cholecystectomy. From these observations, authors conclude that pre-operative ultrasonography in the form of the formulated score is a good predictor of difficulty in laparoscopic cholecystectomy.

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