

Prediction of the difficulties of Laparoscopic Cholecystectomy and the possibility of conversion to Open Cholecystectomy before surgery using Ultrasonographic criteria

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Abstract

Background: Various other pre-operative ultrasonographic parameters have been studied for predicting a difficult laparoscopic cholecystectomy. One of the most extensively studied parameters is gallbladder wall thickness. **Objective:** to predict the difficulties of LC and the possibility of conversion to OC before surgery using ultrasonographic criteria in our hospital **Materials and methods:** This study was carried out in the Department of General Surgery, Govt. Royapettah Hospital, attached to Govt. Kilpauk Medical College, Chennai for a period of duration of 7 months from February 2018 to August 2018. **Results:** Total number of cases in our study was 98. The mean gall bladder wall thickness in our study was found to be 3.19 mm. The maximum gall bladder wall thickness was 6 mm, whereas the minimum was found to be 1.8 mm. 20 patients had a gall bladder wall thickness of >4 mm. Moderate intra operative bleeding was seen in 4 patients. The remaining 94 patients only had mild bleeding. There were 20 (20.41%) patients with a duration of surgery >120 minutes. There were 23 (24.21%) patients with time to dissect gall bladder bed >20 minutes and 13 (13.68%) patients for whom it took >20 minutes to dissect Calots triangle in our study. **Conclusion:** Pre-operative ultrasonography is a good indicator of difficulties which may be faced intra operatively by the surgeon. Increase in gall bladder wall thickness, presence of impaction of stone at the neck of the gall bladder and aberrant morphology of the gall bladder and of the Calots triangle.

Keywords: Gall bladder, Cholecystectomy, laparoscopic cholecystectomy, Calots, Cholelithiasis.

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Introduction

Cholelithiasis, which is one of the most common digestive disorders encountered, was traditionally being dealt with by conventional or open cholecystectomy. With the introduction of laparoscopic cholecystectomy (LC), the surgical community witnessed a revolution in ideology and minimal access surgery gained tremendous popularity. In 1882, Karl Langenbuch performed the first open cholecystectomy for cholelithiasis. [1]

The gold standard operative procedure today for dealing with cholelithiasis has become LC. [2-4] Upwards of 80% of cholecystectomies are carried out laparoscopically nowadays. Earlier return of bowel function, less postoperative pain, improved cosmesis, shorter length of hospital stay, earlier return to full activity and decreased overall cost are known advantages of laparoscopic cholecystectomy. [5] Patients with bleeding diathesis and carcinoma gallbladder are the only major contraindications of treating gall stone disease with laparoscopic procedure. In 1987, 105 years later, the first LC was performed by Philippe Mouret in Lyon, France. [6] In 1990, 10% of cholecystectomies were performed laparoscopically in the U.S and by 1992, this percentage had risen to 90%. Never before had a

surgical revolution occurred so quickly. [6] According to recent studies, laparoscopic removal of gall bladder may be completed with morbidity and mortality comparable to or less than that of traditional open cholecystectomy when performed by an experienced laparoscopic surgeon. [7] Complications of LC are injuries to the (CBD) common bile duct, injury to bowel, bladder, aorta, iliac vessels and vena cava. These complications are more prone to happen if initial trocar is inserted blindly into the peritoneum. [8,9]. Limitations of laparoscopy are costly equipment and unavailability of such equipment. Ultrasonography remains the common screening test for cholecystitis and cholelithiasis because of the relative ease with which it can be performed, lack of ionizing radiation and ability to image the entire upper abdomen at the time of examination. Ultrasonography has been shown to have an accuracy of 96% in the diagnosis of gall bladder calculi. [10] The sensitivity with which ultrasonography can detect CBD calculi varies from 50% to 75%. [11] Thus, a few preoperative ultrasonographic factors may help in the prediction of difficulties during LC. Appropriate planning to avoid complications and difficulties intra operatively for the benefit of patient and surgeon may be accomplished by a proper appreciation of these variables. Improved patient counseling, safety and post operative expectations are also obvious benefits of this. The aim of this study is to predict the difficulties of LC and the possibility of conversion to OC before surgery using ultrasonographic criteria in our hospital.

Materials & Methods

This study was carried out in the Department of General Surgery, Govt. Royapettah Hospital, attached to Govt. Kilpauk Medical College, Chennai for a period of duration of 7 months from February 2018 to August 2018. Study was a prospective analysis of

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symptomatic gall bladder stone and prediction of ultrasonographic finding and its correlations with intra operative findings.

The study observed that the sensitivity and specificity of ultrasonography for predicting difficulties in surgery was 70.83% and 91.84% respectively and sensitivity of ultrasound to predict the conversion to open procedure was 76.47%, specificity was 85.71%. The total number of laparoscopic cholecystectomies attempted was 146 out of which 48(32.9%) were difficult on surgery. Out of total 146 cases 34(23.3%) cases were converted to open procedure. Taking these values as reference, the minimum required sample size with desired precision of 17.5% and 5% level of significance is 97patients

Methodology

All patients have been evaluated pre-operatively by ultrasound of abdomen. The pre operative criteria which were taken into consideration are given below. These criteria were then matched against certain intra operative criteria which are also given below. Each pre operative criteria was compared against an intra operative criteria and individual p values were calculated for each of them. All patients are subjected to Laparoscopic cholecystectomy after routine investigations and informed consent. Patients were also informed about the possibility of conversion to open cholecystectomy. The pre operative & Intraoperative ultrasonographic criteria which were taken into consideration.

Table 1: Pre operative criteria

SL. NO	CRITERIA	SUB-CRITERIA
1	Gall Bladder size	Normal Distended Contracted
2	Number of stone	Single Multiple
3	Size of stone	Large(>1cm) Small (<1cm)
4	Pericholecystic fluid	Present Absent
5	Aberrant Anatomy(double gall bladder, intrahepatic gall bladder)	Presence Absence
6	Gas in gall bladder wall	Presence Absence
7	Mobility of liver	Mobile Immobile
8	CBD size	>8mm <8mm
9	GB wall thickness	<4mm >4mm
10	Stone impaction at the neck of GB	Yes No

Table 2: Intra operative criteria which were taken into consideration were

S. No	Criteria	Sub Criteria
1	Total duration of surgery from the insertion of Veress needle to the extraction of gall bladder	>120 mins < 120 mins
2	Total time taken to dissect the Calot's Triangle	>20 mins <20 mins
3	Total time taken to dissect the gall bladder from the gall bladder bed	>20 mins < 20mins
4	Tear of gall bladder & spillage of bile and stone	Present Absent
5	Bleeding	Mild Moderate(requiring fluid replacement in excess of usual) Severe(requiring transfusion of blood or blood products)
6	Extraction of gall bladder	Easy Difficult (If extraction of gall bladder requires extraction of port or decompression of gall bladder)
7	Conversion to Open cholecystectomy	

At the end of the surgery, the surgeon was asked to rate the difficulty of the surgery as Easy or Difficult.

Inclusion criteria: All Patients of symptomatic gall stone disease reporting to Royapettah General Hospital, Chennai.

Exclusion criteria: Wt >90 kg, H/O >3 previous abdominal surgery., CBD dilated >10mm, CBD stone. Previous CBD exploration, Pancreatitis, Denial of Consent and Jaundice/ deranged LFT.

Preoperative assessment: A detailed clinical history with special reference to duration of pain, it's periodicity, aggravating and relieving factors, and time since last attack has to be taken. The information is recorded in the Performa. A detailed physical examination has to be done and recorded in the Performa.

Investigations: CBC, Blood sugar (R), Serum creatinine, Blood urea nitrogen, Liver function test, Serum amylase, serum lipase, HIV, HBsAg, HCV, ECG, X-Ray chest (PA view), X-Ray Abdomen Erect

Pre-operative ultrasound Sonographic examination

Sonographic examinations were performed by a single consultant radiologist. All patients were examined in a fasting state with a 3.5 MHz

scanner according to standardized protocol.

Technique of laparoscopic cholecystectomy

This surgery is done under general anaesthesia with controlled ventilation and monitoring of end tidal carbon dioxide and pulse oximetry. Patient is placed in supine position with 15° head tilt and right up position. Catheterization is done. Pneumoperitoneum is created and ports are inserted

Gall bladder adhesions are separated. Dissection and skeletonisation of cystic duct and artery is done. The gall bladder is dissected off the liver bed and is removed.

Haemostasis is ensured and the ports are closed after removing cannulae. The sheath is closed in 10 mm ports and then stitches applied. Sterile dressing is done.

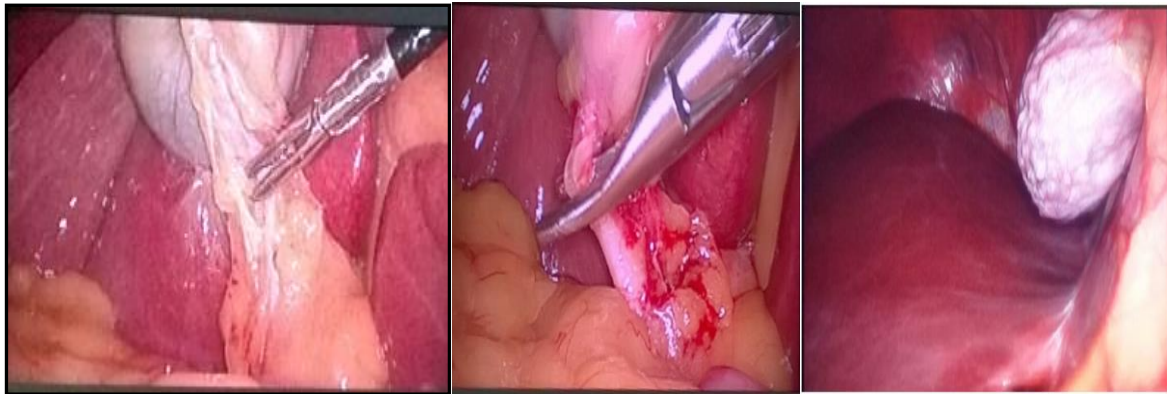


Fig 1: Calot's triangle dissection (laparoscopic view)
Results

Fig 2: Clipping of cystic duct (laparoscopic view)

Fig 3: Extraction of gall bladder (laparoscopic view)

Total number of cases in our study was 98. The mean age of patients was 49.08 yrs and the majority of patients were females (81.63%). The mean gall bladder wall thickness in our study was found to be 3.19 mm. The maximum gall bladder wall thickness was 6 mm, whereas the minimum was found to be 1.8 mm. 20 patients had a gall bladder wall thickness of >4 mm. Moderate intra operative bleeding was seen in 4 patients. The remaining 94 patients only had mild bleeding. None of our study subjects had severe bleeding. There were 20 (20.41%) patients with a duration of surgery >120 minutes. There were 23 (24.21%) patients with time to dissect gall bladder bed >20 minutes and 13 (13.68%) patients for whom it took >20 minutes to dissect Calot's triangle in our study. Extraction of gall bladder was

difficult in 15 (15.78%) cases. The total number of cases predicted to be difficult by ultrasonography was 44. LC was attempted on 98 patients out of which 14 were found to be difficult on surgery. Out of a total of 98 cases, 3 (3.06%) cases were converted to OC. The only major intra-operative complications that occurred in our study were tear of cystic artery, avulsion of cystic duct and tear of gall bladder leading to spillage of bile and stones. In our study, a statistically significant correlation was found between parameters such as increased gall bladder wall thickness, stone impaction at the neck of the gall bladder and aberrant anatomy with a difficult LC. 70% of patients with duration of surgery >120 minutes had gall bladder wall thickness >4 mm, according to the above figure. Association was found to be statistically significant (p value < .001).

Table 3: Association of Duration of surgery with ultrasonographic parameters

Duration of surgery (in mins) →		< 120		> 120		p-value
		n	%	n	%	
Gall bladder wall thickness (in mm)	< 4	72	92.31%	6	30.00%	0.001
	> 4	6	7.69%	14	70.00%	
Pericholecystic fluid		5	6.41%	4	20.00%	0.081
Gall bladder size	Normal	69	88.46%	17	85.00%	0.091
	Distended	6	7.69%	0	0.00%	
	Contracted	3	3.85%	3	15.00%	
Stone size (cm)	< 1	62	79.49%	15	75.00%	0.663
	> 1	16	20.51%	5	25.00%	
no. of stone	Single	11	14.10%	1	5.00%	0.267
	Multiple	67	85.90%	19	95.00%	
Stone impacted at gallbladder neck		4	5.13%	4	20.00%	0.030
Aberrant Anatomy		0	0.00%	2	10.00%	0.041

Gas in GB Wall		10	12.82%	1	5.00%	0.452
Common Bile Duct Size (in mm)	< 8	73	93.58%	5	25%	< 0.001
	>8	5	6.42%	15	75%	
Liver	+	60	76.92%	14	70.00%	0.520
Mobility	-	18	23.08%	6	30.00%	
Prediction by ultrasonography	Simple	50	64.10%	4	20.00%	0.001
	Difficult	28	35.90%	16	80.00%	

A statistically significant association was observed between time to dissect Calot’s triangle and:

- i Gall Bladder wall thickness (p-value< 0.001). ii. Pericholecystic fluid (p-value 0.025).

A statistically significant association was seen between “Time to dissect calot’s triangle” and prediction by ultrasonography (p-value 0.007) and CBD size (p-value 0.001)

A statistically significant association was observed between “extraction of gall bladder” and gall bladder wall thickness (p-value 0.001).

A statistically significant association was observed between “extraction of gall bladder” and Size of stone (p-value 0.022).

A statistically significant association was observed between “Extraction of gall bladder” and Prediction of difficulty by ultrasonography (p-value 0.023).

Table 4: Association of Extraction of Gall Bladder with ultrasonographic parameters

Extraction of Gall Bladder		Simple		Difficult		p-value
		n	%	n	%	
Gall bladder wall thickness (in mm)	< 4	69	87.34%	8	50.00%	0.001
	> 4	10	12.66%	8	50.00%	
Pericholecystic fluid		6	7.59%	3	18.75%	0.174
Gall bladder size	Normal	72	91.14%	12	75.00%	0.176
	Distended	4	5.06%	2	12.50%	
	Contracted	3	3.80%	2	12.50%	
Stone size (cm)	< 1	65	82.28%	9	56.25%	0.022
	> 1	14	17.72%	7	43.75%	
no. of stone	Single	10	12.66%	2	12.50%	1.000
	Multiple	69	87.34%	14	87.50%	
stone impacted at G B neck		5	6.33%	2	12.50%	0.335
Aberrant Anatomy		0	0.00%	0	0.00%	-
Gas in Gb Wall		8	10.13%	2	12.50%	0.674
Common Bile Duct Size (in mm)	<8	68	85%	10	66.66%	\0.089
	>8	12	15%	5	33.34%	
Liver	+	60	75%	12	80%	0.678
Mobility	-	20	25%	3	20%	
Prediction by ultrasonography	Simple	49	62.03%	5	31.25%	0.023
	Difficult	30	37.97%	11	68.75%	

A statistically significant association was found between “tear of gall bladder and bile and stone spillage” with gall bladder wall thickness (p-value 0.003).No statistically significant associations were found from the above figure.

A statistically significant association was found between “tear of gall bladder and spillage of bile and stones” and prediction by ultrasonography (p-value 0.011)

Table 5: Association of “Tear of gall bladder and spillage of stones and bile” with ultrasonographic parameters

Tear of gall bladder and spillage of stones and bile →		No		Yes		p-value
		n	%	n	%	
Gall bladder wall thickness (in mm)	< 4	73	83.91%	5	45.45%	0.003
	> 4	14	16.09%	6	54.55%	
Pericholecystic fluid		9	10.34%	0	0.00%	0.592
Gall bladder size	Normal	77	88.51%	9	81.82%	0.153
	Distended	6	6.90%	0	0.00%	
	Contracted	4	4.60%	2	18.18%	
Stone size (cm)	< 1	67	77.01%	10	90.91%	0.448
	> 1	20	22.99%	1	9.09%	
no. of stone	Single	11	12.64%	1	9.09%	1.000
	Multiple	76	87.36%	10	90.91%	
Stone impacted at gallbladder neck		7	8.05%	1	9.09%	1.000
Aberrant Anatomy		2	2.30%	0	0.00%	1.000
Gas in GB Wall		10	11.49%	1	9.09%	1.000
Common Bile Duct Size(in mm)	<8	69	80.23%	8	66.66%	0.283
	>8	17	19.77%	4	33.34%	
Liver Mobility	+	68	78.16%	6	54.54%	0.086
	-	19	21.84%	5	45.46%	
Prediction by ultrasonography	Simple	52	59.77%	2	18.18%	0.011
	Difficult	35	40.23%	9	81.82%	

A statistically significant association was found between “operative inference by surgeon” and gall bladder wall thickness (p-value 0.001).

A statistically significant association was found between “operative inference by surgeon” and stone impacted at gall bladder neck (p-value 0.043) and aberrant anatomy (p-value 0.020)

A statistically significant association was found between “operative inference by surgeon” and:

i. CBD size (p-value 0.024).

ii. Liver mobility (p-value 0.005)

iii. Prediction by ultrasonography (p-value 0.008)

Discussion

In this study, various parameters in pre operative ultrasonography were considered and correlated with intra operative findings and operative inference. On the basis of our study, it was seen that intra operative bleeding had a statistically significant association with gall bladder wall with thickness (p-value 0.006) and size of the gall bladder (p value < 0.001). Based on the findings by Nachnani et al in his study, it was found that bleeding occurred more often in patients with gall bladder wall thickness exceeding 3 mm. [12] Out of a total of 98 patients, up to 80% had a duration of surgery less than 120 mins. A statistically significant association was seen

between duration of surgery and increase in gall bladder thickness (p value < 0.001), with impaction of stone at the neck of the gall bladder (p value 0.030), with the presence of aberrant anatomy, Phrygian cap (p value 0.041), CBD size (p value < 0.001) and with prediction by ultrasonography (p value 0.001). Thick walled gall bladder and distended gall bladder were significant factors which were seen to increase the operating time according to Sahu et al [13] According to the findings of European surgeons, thickened gall bladder was associated with prolonged operative duration. [14] In our study, dissection of the gall bladder bed took < 20 mins in 76% of our subjects. A statistically significant association was seen between time taken to dissect the gall bladder bed and thickness of the wall of the gall bladder (p value < 0.001), with gall bladder size (p value 0.008), with gas in the gall bladder wall (p value 0.046) and with prediction by ultrasonography (p value 0.014). According to the study of Nachnani et al it was found that dissection of gall bladder bed was more often difficult in patients with gall bladder wall thickness exceeding 3 mm (p < 0.05). [12] Similar results were seen by O.Kaya et al (p < 0.05). [15] Time taken to dissect Calot's triangle was under 20 mins in 86% of our subjects. A statistically significant association was observed between time taken to dissect Calots and gall bladder wall

thickness(p value <0.001), with presence of pericholecystic fluid(p value 0.025), with CBD size (p value 0.001), and with prediction by ultrasonography(p value 0.007). A significant co relation was found between ultrasound prediction and difficulty during dissection of calot's triangle by Santambrogio et al [14]

In our study, extraction of the gall bladder was seen to be difficulty in 16% of the subjects. A statistically significant association was observed between time taken to extract the gall bladder and gall bladder wall thickness (p value 0.001), with size of the stones(p value 0.022) and with prediction by ultrasonography(p value 0.023). Difficulty in extraction of the gall bladder specimen was seen in patients with a calculus size greater than 1 cm by Nachnani et al [12]

In our study, tear of the gall bladder and spillage of bile and stones was seen in 11% of our subjects. A statistically significant association was observed between occurrence of tear in the gall bladder and spillage of bile and stones and gall bladder wall thickness(p value 0.003), and with prediction by ultrasonography(p value 0.011). In our study spillage of stone and bile was managed laparoscopically. Frazee R.C. et al observed that spillage of stones was a cause for conversion. [13]

In our study, 3 patients were converted to open cholecystectomy. No statistically significance was found for this. Conversion to OC in our study was 3.06% which turned out to be similar to the rates in other international studies. The conversion rate according to various studies in different parts of the world were Waseem et al.(4%), Kuldip et al (1.66%), [16, 17]

Conclusion

At the conclusion of this study, it can be stated with confidence that pre operative ultrasonography is a good indicator of difficulties which may be faced intra operatively by the surgeon. Increase in gall bladder wall thickness, presence of impaction of stone at the neck of the gall bladder and aberrant morphology of the gall bladder and of the Calots triangle. It also helps us to plan out the surgery in advance and take consent and appraise the patient of the possible necessity for open cholecystectomy.

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