PREDICTION OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY BASED ON ULTRASONOGRAPHIC FINDINGS

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ABSTRACT

Objectives: The objective of the study is to the role of pre-operative ultrasonography (USG) abdomen to find difficulty in laparoscopic cholecystectomy.

Methods: It was a prospective observational study conducted in the Department of General Surgery, Government Medical College, Kottayam, for a period of 12 months after obtaining approval from the Institutional Review Board and Ethical Committee. A total of 94 patients who underwent elective laparoscopic cholecystectomy were randomly allotted and their pre-operative ultrasound was assessed. Pre-operative predictability of difficult laparoscopic cholecystectomy based on USG was studied.

Results: Out of 78 difficult laparoscopic cholecystectomies, 71 cases were predicted to have intra-operative difficulty with pre-operative ultrasound as per total time taken for surgery. Out of these 78 difficult cases, 68 cases were able to predict as per difficulty in dissecting GB from GB fossa. This gives a positive predictive value of 91%, which is in agreement with earlier studies. Conversion rate in our study was 9.6% of total and 11.5% of difficult cases. Those cases that were predicted pre-operatively with ultrasound to be easy were never converted to open.

Conclusion: Pre-operative USG can be used as a screening method for laparoscopic cholecystectomy as this is a valuable predictor of difficulty in laparoscopic cholecystectomy in most of the cases. It will help the surgeon to make an idea of potential difficulty that he/she can face during the intra-operative period. The most valuable assessment using the ultrasound is the gall bladder wall thickness, gall bladder contracted or not, common bile duct diameter, and stones impacted in the neck of GB.

Keywords: Ultrasound, laparoscopic cholecystectomy, GB wall thickness, CBD diameter, contracted GB.

INTRODUCTION

Cholelithiasis is the most common biliary pathology worldwide. Only 1–2% asymptomatic patients will develop symptoms requiring any surgical intervention; in that case also, cholecystectomy is one of the common operations performed by general surgeons [1]. The National Institute of Health Consensus Conference held in 1992 stated that "laparoscopic cholecystectomy is safe and also effective in most of cases [2,3]. However, it can be technically demanding and is not free of complications. Laparoscopic cholecystectomy has some inherent disadvantages [4]. Certain factors play a role in making the procedure of laparoscopic cholecystectomy difficult which can lead to conversion to open cholecystectomy directly or indirectly [5,6].

Pre-operative knowledge of certain factors which predict difficulties in surgery is of great importance for safety of patients. Ultrasonography (USG) is the first investigation for diagnosing cholelithiasis with sensitivity and specificity of >90% [7]. It is helpful to surgeons in early phase of learning curve for laparoscopic cholecystectomy. It also helps in a more effective and accurate pre-operative counseling, improved operating room scheduling and efficiency, and risk stratification which improves patient safety by minimizing time to conversion and better mental preparation of surgeons and acceptance by patients.

Pre-operative identification of difficult laparoscopic cholecystectomy [8] gives a space to arrange better technical and senior faculty services and also provides a provision for early referral services. The aim is to study the role of USG abdomen to find difficulty in laparoscopic cholecystectomy in the General Surgery Department of Government Medical College, Kottayam, for a time period of 12 months.

Methodology

Type of study	Prospective observational study
Period of study	12 months
Ethical permission number	4/2022

Study setting

All patients above 18 years suffering from cholelithiasis who are posted for laparoscopic cholecystectomy irrespective of their duration attending surgical outpatient clinic or casualty are going to take into the study based on the inclusion and exclusion criteria.

Sample size

Sample size (n) = sensitivity × (1-sensitivity)/d^2

D = absolute proportion

Based on the study done by Dr. Rajiv Nandan Sahai at Hindu Rao Hospital, Delhi, sensitivity of USG parameters in predicting difficulty in laparoscopic cholecystectomy is 37.5.

Taking d = 5%

n = 0.375 × (1–0.375)/0.05 × 0.05 n = 93.75

Sample size (n) = 94

Hypothesis statement

Ultrasound abdomen can effectively predict the difficulty in laparoscopic cholecystectomy.

METHODS

After taking informed written consent, a detailed history will be taken and also will look into USG parameters.

Table 1: Total time taken for laparoscopic cholecystectomy versus total score

	Time taken for surgery		Total	Chi-square	p-value
	<90 min	>90 min			
<2					
Count	9	7	16	16.737	0.000
%	56.3	43.8	100.0		
≥2					
Count	7	71	78		
%	9.0	91.0	100.0		
Total					
Count	16	78	94		
%	17.0	83.0	100.0		

Total score <2 total score ≥2

Table 2: Time taken to dissect GB from GB fossa versus total score

	Time taken to dissect GB from GB fossa		Total	Chi-square	p-value
	<20 min	>20 min			
<2					
Count	10	6	16	16.397	0.000
%	62.5	37.5	100.0		
≥2					
Count	10	68	78		
%	12.8	87.2	100.0		
Total					
Count	20	74	94		
%	21.3	78.7	100.0		

Table 3: Conversion to open cholecystectomy versus total score

	Conversion to open		Total	Father's
	Absent	Present		Exact test
<2				
Count	16	0	16	0.171
% within ≥2	100.0	0	100.0	
≥2				
Count	69	9	78	
% within ≥2	88.5	11.5	100.0	
Total				
Count	85	9	94	
% within ≥2	90.4	9.6	100.0	

Four USG parameters were considered pre-operatively in all patients:
1. Gall bladder size - Normal/Distended or contracted (<2 cm in AP diameter)
2. Gall bladder wall thickness (<4 mm)
3. Gallstone mobility - mobile or impacted in the neck of the GB.
4. Common bile duct (CBD) diameter - <8 mm or >8 mm.

Cases were considered difficult pre-operatively, according to these findings were found on USG:
1. Contracted GB
2. GB wall thickness >4 mm
3. Gallstone impacted in the neck of the GB
4. CBD diameter >8 mm.

Intra-operative assessment during laparoscopic cholecystectomy:
1. Total time of operation (<90 min or >90 min). Time started from the insertion of Verses needle or insertion of the cannula (open technique) to the extraction of the gall bladder

Table 4: Contracted GB versus total score

Total score	Contracted GB		Total	Chi-square	p-value
	Absent	Present			
<2					
Count	9	7	16	24.984	0.000
%	56.3	43.8	100.0		
≥					
Count	4	74	78		
%	5.1	94.9	100.0		
Total					
Count	13	81	94		
%	13.8	86.2	100.0		

Table 5: GB wall thickness

Total score	GB wall thickness >4 mm		Total	Chi-square	p-value
	<4 mm	≥4 mm			
<2					
Count	12	4	16	29.473	0.000
%	75.5	25.0	100.0		
≥					
Count	8	70	78		
%	10.3	89.7	100.0		
Total					
Count	20	74	94		
%	21.3	78.7	100.0		

2. Time taken to dissect gall bladder from gall bladder fossa (<20 min or >20 min)
3. Conversion to open cholecystectomy.

If any of the following intra-operative assessment was found to be positive, the case was considered as difficult laparoscopic cholecystectomy:
1. Total time of operation >90 min
2. Time taken to dissect gall bladder from gall bladder fossa >20 min
3. Conversion to open cholecystectomy.

Data collection will be done and recorded according to pro forma. Statistical analysis will be done in ultrasound abdomen findings, 2 or more out of a total score of 4 is taken as predictor of difficult laparoscopic cholecystectomy.

Study tool
Study tool includes pro forma questionnaire form, ultrasound study of abdomen, and consent form.

Inclusion criteria
1. Age limit: All age group above 18 years
2. All subjects suffering from cholelithiasis posted for laparoscopic cholecystectomy irrespective of its duration.

Exclusion criteria
1. Patients with acute cholecystitis
2. Evidence of concomitant choledocholithiasis
3. Previous history of upper abdominal surgery
4. Abnormal liver function test.

Data management and statistical analysis
Data will be entered in MS Excel and will analyze with SPSS. Quantitative parameters will be expressed in mean ± SD. Statistical analysis will be done with appropriate test. The level of significance will be a $p<0.05$ and high level of significance would correspond to a $p<0.01$.

RESULTS

Out of 78 difficult laparoscopic cholecystectomies, 71 cases were predicted to have intra operative difficulty with preoperative ultrasound as per total time taken for surgery.

Out of these 78 difficult cases, 68 cases were able to predict as per difficulty in dissecting GB from GB fossa.

This gives a positive predictive value of 91%, which is in agreement with earlier studies.

Conversion rate in our study was 9.6% of total and 11.5% of difficult cases. Those cases which was predicted pre operatively with ultrasound to be easy was never converted to open.

DISCUSSION

Laparoscopic cholecystectomy is the gold standard of symptomatic cholelithiasis. Laparoscopy can be difficult in some cases [9], and this is usually due to altered anatomy due to dense adhesions in the calot's triangle, empyema of gall bladder, contracted GB, previous upper abdominal surgeries, contracted GB, and acute cholecystitis. The conversion rate of various studies ranges from 1.5% to 3.5%.

In the present study, four ultrasonographic parameters are used to predict the difficulty in laparoscopic cholecystectomy which was analyzed in total 94 patients.

The various parameters used in literature for predicting the difficult laparoscopic cholecystectomy are [10] gallstone size, gall bladder wall thickness, gall bladder volume, number of stones, CBD size, and stone impaction in the neck of gall bladder.

Of these, in this study, GB wall thickness, contracted GB, CBD diameter, and stone impacted in the neck of gall bladder are used. These parameters show significance with difficult laparoscopic cholecystectomy. This study shows less significance in predicting the conversion of procedure to open with these parameters, but those cases that were predicted pre-operatively easy were never converted to open.

Out of 78 difficult laparoscopic cholecystectomies, 71 cases were predicted to have intra-operative difficulty with pre-operative ultrasound as per total time taken for surgery.

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Dinkel *et al.* studied that sensitivity, specificity, positive predictive value, and accuracy of wall thickening as an indicator of technical difficulties were 66.7%, 94.1%, 84.2%, and 85.3%, respectively.

Lal *et al.* found that the positive predictive value of USG for predicting difficult laparoscopic cholecystectomy was 80.95%. Moreover, the positive predictive value for predicting conversion to open cholecystectomy was 61.90% [11].

Gall bladder wall thickness is one of the ultrasonographic parameters extensively studied for cholelithiasis. In our study, we took that gall bladder wall thickness more than 4 mm was predicted to be difficult.

Out of 74 cases with thickened GB, 70 were difficult laparoscopic cholecystectomy.

Contracted GB is another important parameter that is a predictive factor for difficult cholecystectomy. In our study, out of total 81 cases with contracted GB, 74 were difficult.

The study showed that pre-operative ultrasound can predict the difficulty in laparoscopic cholecystectomy to a good extent.

CONCLUSION

Pre-operative USG can be used as a screening method for laparoscopic cholecystectomy as this is a valuable predictor of difficulty in laparoscopic cholecystectomy in most of the cases. It will help the surgeon to make an idea of potential difficulty that he/she can face during the intra-operative period. The most valuable assessment using the ultrasound is gall bladder wall thickness, gall bladder contracted or not, CBD diameter, and stones impacted in the neck of GB.

Thick gall bladder wall is a finding, which may show that more adhesions may be found during surgery.

Pre-operative USG can also aid in the recognition of cases where an open cholecystectomy should be considered, and the patient counseled pre-operatively.

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