Preoperative Ultrasonography as a Predictor of Difficult Laparoscopic Cholecystectomy that Requires Conversion to Open Procedure

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ABSTRACT

Aim: The present study was conducted to see whether preoperative ultrasonography can be used as a predictor of difficult laparoscopic cholecystectomy or not. Methods: 50 patients of cholelithiasis, selected from surgical OPD of Rajindra Hospital Patiala, who fulfilled all inclusion and exclusion criteria for the study underwent elective cholecystectomy. Ultrasonography was done pre-operatively on all cases in the same setup and with same probe and patients underwent laparoscopic cholecystectomy in same setup. Results: A significant prediction was found between ultrasonographic parameters and conversion of the procedure to open cholecystectomy which proved that pre-operative ultrasonography is a good predictor of difficulty in laparoscopic cholecystectomy in majority of the cases and should be used as a screening procedure. Conclusion: Preoperative ultrasonography should be used as a screening procedure as it is a good predictor of difficulty in laparoscopic cholecystectomy in majority of the cases. It can help surgeon to get an idea of potential difficulty that he can face in the particular patient.

Keywords: Calot’s triangle, difficult laparoscopic cholecystectomy, predictive factors, spillage of bile and stones, ultrasonography predictor

INTRODUCTION

Mouret introduced laparoscopic cholecystectomy in 1987, which brought a radical change in the treatment of patients with gallstones. Although laparoscopic cholecystectomy has numerous advantages including reduced hospitalization, decreased morbidity, short recovery time, and better cosmesis, its increased risk of injury to common bile duct (CBD), duodenum, bowel, iliac vessels, and so on; high conversion rate in acute cholecystitis, and difficulty in management of simultaneous CBD stones.

Ultrasonography is the most common noninvasive, safe, and highly accurate screening test for cholecystitis and cholelithiasis. It can also help surgeons to get an idea of potential difficulty to be faced during surgery in that particular patient.
after overnight fasting to assess the following criteria which may predict difficult laparoscopic cholecystectomy:
1. Gallbladder wall thickness - more than 4 mm
2. Stone impacted at the neck of gallbladder
3. Contracted gallbladder
4. Common bile duct size - more than 6 mm.

All the patients underwent laparoscopic cholecystectomy and presence of any of following intra-operative observation was taken as difficult laparoscopic cholecystectomy:
1. Total duration of surgery from insertion of verres needle to the extraction of gallbladder-more than 90 min
2. Total time taken to dissect the Calot’s triangle-more than 20 min
3. Total time taken to dissect the gallbladder from the gallbladder bed-more than 20 min
4. Spillage of bile and stone
5. Tear of gallbladder.

RESULTS

The age group of the patients ranged from 18 to 65 years. The mean age was 38.16 years. Five patients were male, and 45 were female.

Forty-six patients had wall thickness <4 mm out of which 38 were easy, and eight were difficult cases. While four were having wall thickness, more than 4 mm and all these four were difficult. The accuracy was 84%.

Five patients had contracted gallbladder, and all these were difficult cases. Out of the remaining 45 patients, 38 were easy. The accuracy was 86%.

There were three patients in which stone was impacted at the neck of gallbladder. All the three were difficult. While of rest of the 47 patients where stone was mobile, only nine were difficult. The accuracy was 82%.

There was no patient with CBD diameter more than 6 mm. This could be because of the exclusion of the patients with CBD stones. Thirty-eight patients were easy, 12 were difficult. The accuracy was 76%.

The number of cases predicted to be difficult on ultrasonography were 12, out of which 11 were actually found difficult during surgery while one case was easy [Tables 1 and 2].

The total number of laparoscopic cholecystectomies attempted was 50 out of which 14 were difficult. Only one (2%) case was converted to open procedure. In the remaining 49 cases, the laparoscopic cholecystectomy was completed successfully (including the difficult cases which were not converted to open cholecystectomy).

Predictive values of various parameters

Predictive value of gallbladder wall thickness for difficult surgery
Of four patients with gallbladder wall thickness >4 mm, three turned out to be difficult intraoperatively. None of the cases were converted to open procedure. Positive predictive value was 75% while sensitivity was only 21.43%.

Predictive value of gallbladder contraction for difficult surgery
All five patients with contracted gallbladder were difficult laparoscopically, but none of the cases was converted to open procedure. Positive predictive value was 100% while sensitivity was only 35.31%.

Predictive value of impacted stone for difficult surgery
All the 3 patients with impacted stone at the neck of gallbladder turned out to be difficult laparoscopically. The positive predictive value was 100%. While sensitivity was only 21.43%. Out of 3 cases, 1 case had to be converted to open procedure, giving positive predictive value of 33.33% while sensitivity was 100%.

Accuracy percentages of all parameters
Accuracy of gallbladder wall thickness, mobility of stone, gallbladder size and CBD size is 84%, 82%, 86%, and 76% respectively.

Positive predictive value of ultrasound is 91.67 and \( P = 0.048 \) and giving overall accuracy of 92% [Tables 1 and 2].

DISCUSSION

Laparoscopic cholecystectomy has now become the gold standard for the treatment of symptomatic gallstones. Laparoscopy can be difficult in distorted anatomy due to dense adhesions in the Calot’s triangle, empyema of gallbladder, contracted gallbladder, Mirrzi’s syndrome, previous upper abdominal operations, and acute cholecystitis. The conversion rate of various studies ranges from 1.5% to 35%.[10-13]

In the present study, four ultrasonographic parameters for predicting difficult laparoscopic cholecystectomy were analyzed in 50 patients.

### Table 1: Results based on USG criteria

<table>
<thead>
<tr>
<th>Total number of cases</th>
<th>Predicted to be difficult on USG</th>
<th>Actually found to be difficult intraoperatively</th>
<th>Not found to be difficult intraoperatively</th>
<th>Positive predictive value of USG (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>12</td>
<td>11</td>
<td>1</td>
<td>91.67</td>
</tr>
</tbody>
</table>

USG: Ultrasonography
Stone impaction at the neck is another parameter that shows a positive predictive value of 78.57% on surgery but none had to be converted to open procedure.

Of these parameters, only gallbladder wall thickness, CBD diameter, contraction of gallbladder and stone impaction show significance with the difficult laparoscopic cholecystectomy and conversion of laparoscopic cholecystectomy to open procedure.

Of the 12 cases predicted to be difficult on ultrasonography, 11 cases were difficult on surgery giving a positive predictive value of 91.67% for difficult Lap chole [Tables 1 and 2], which is in agreement with the earlier studies.[14]

Conversion rate in our study was 2% of total and 8.33% of the difficult cases. A strong significance was found between preoperative ultrasound and difficult lap cholecystectomy.

Dinkel et al.[15] 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.[15]

Lal et al. found that the positive predictive value of ultrasonography for predicting difficult laparoscopic cholecystectomy was 80.95%. And the positive predictive value for predicting conversion to open cholecystectomy was 61.90%.[8]

Singh and Ohri conducted a study in which out of 6147 cases, 1518 patients (21.5%) were identified as difficult cases.[50]

Yetkin et al. studied that out in 108 patients, 19 (17.33%) needed conversion to open cholecystectomy.[13]

Difficult dissection secondary to adhesions was the most common cause for the difficult laparoscopic cholecystectomy and conversion to open cholecystectomy in our study.

Gallbladder wall thickness is one of the ultrasonic parameter most extensively studied for the gallstone disease. In our study, we had taken that gallbladder wall thickness more than 4 mm were predicted to be difficult. Of the 50 cases, 4 had gallbladder wall thickness more than 4 mm. Out of 4, 3 cases were difficult on surgery but none had to be converted to open procedure.

Stone impaction at the neck is another parameter that shows a good predictive value. Of the 3 cases with the stone impaction at the neck all the 3 cases were difficult on surgery and 1 out of 3 was converted to open procedure.

The contracted gallbladder is another important predictive factor for difficult laparoscopic cholecystectomy. In our study, there were five cases with contracted gallbladder. All were difficult on surgery, and none was converted to open.

The positive predictive value of ultrasonography considering all the four parameters included together was 91.67%. The sensitivity of the prediction was 78.57% [Tables 1 and 2]. And the specificity of the ultrasonographic prediction was 97.22%.

The negative prediction value (prediction of easy laparoscopic cholecystectomy on ultrasonography) was 92.11% \( P = 0.048 \). The accuracy of all the parameters (gallbladder wall thickness, mobility of stone, gallbladder size, CBD size) was 84%, 82%, 86%, and 76% respectively.

The study showed that preoperative ultrasound can predict operative difficulty for laparoscopic cholecystectomy to a good extent.

**CONCLUSION**

Preoperative ultrasonography should be used as a screening procedure as it is a good predictor of difficulty in laparoscopic cholecystectomy in majority of the cases. It can help the surgeon to get an idea of potential difficulty that he can face in the particular patient. The most valuable assessment the ultrasound can give is gallbladder wall thickness, gallbladder size, CBD diameter and CBD stones and any abnormal anatomy of biliary tract if present.

Thick gallbladder wall is a finding, which may show that more adhesions may be found during surgery. Preoperative ultrasonography can also aid in recognition of cases where an open cholecystectomy should be considered, and the patient counseled preoperatively.

**REFERENCES**


<table>
<thead>
<tr>
<th>Total number of patients</th>
<th>Cases found to be difficult intraoperatively</th>
<th>Actually found to be difficult on USG</th>
<th>Sensitivity of prediction of USG (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>14</td>
<td>11</td>
<td>78.57</td>
</tr>
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</table>

USG: Ultrasonography
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8. Lal P, Agarwal PN, Malik VK, Chakravarti AL. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. JSLS 2002;6:59-63.


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