ORIGINAL ARTICLE

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 lapariscopic 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

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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,[1-5] it has 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.[6-8]

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.[8]

On the basis of ultrasound findings, surgeons can select the cases appropriate for their skills aiming at reducing operative complications and minimizing the waste of operative time.[2]

Based on ultrasonographic findings, certain preoperative factors can reliably predict the chances of conversion to the open procedure and the danger of certain complications so that the surgeon and the patient are mentally prepared.[9]

This study was conducted to look for some predictive factors on ultrasonography of gallbladder that can give the surgeon some idea about the potential difficulty and complications that may be encountered during the course of laparoscopic cholecystectomy.

MATERIALS AND METHODS

Fifty patients with symptomatic cholelithiasis of both sexes and of all ages were included in the study. Patients with CBD stones, jaundice or abnormal liver function tests, with pregnancy, peritonitis or morbid obesity, acute cholecystitis, empyema of gallbladder, acute pancreatitis, cholangitis, portal hypertension, biliary-enteric fistula, carcinoma gallbladder; or patients who have undergone previous upper abdominal surgery, or patients who had any contraindication to laparoscopic surgery were excluded from the study. All the patients underwent ultrasonography

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

Total number of cases	Predicted to be difficult on USG	Actually found to be difficult intraoperatively	Not found to be difficult intraoperatively	Positive predictive value of USG (%)
50	12	11	1	91.67

USG: Ultrasonography

Table 2: Results based on operative findings

Total number of patients	Cases found to be difficult intraoperatively	Actually found to be difficult on USG	Sensitivity of prediction of USG (%)
50	14	11	78.57

USG: Ultrasonography

The various parameters in literature for predicting difficult laparoscopic cholecystectomy are: Gallstone size, gallbladder wall thickness, gallbladder volume, number of stones, common duct size, and stone impaction in the neck of gallbladder.[2]

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*.[9] 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.[16]

Yetkin *et al*. studied that out in 108 patients, 19 (17.33%) needed conversion to open cholecystectomy.[17]

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

1. Mouret P. How I developed laparoscopic cholecystectomy. Ann Acad Med Singapore 1996;25:744-7.
2. Daradkeh SS, Suwan Z, Abu-Khalaf M. Preoperative ultrasonography and prediction of technical difficulties during laparoscopic cholecystectomy. World J Surg 1998;22:75-7.
3. Corr P, Tate JJ, Lau WY, Dawson JW, Li AK. Preoperative ultrasound to predict technical difficulties and complications of laparoscopic cholecystectomy. Am J Surg 1994;168:54-6.
4. Chumillas MS, Ponce JL, Delgado F, Viciano V. Pulmonary function and complications after laparoscopic cholecystectomy. Eur J Surg 1998;164:433-7.
5. Vittimberga FJ Jr, Foley DP, Meyers WC, Callery MP. Laparoscopic surgery and the systemic immune response. Ann Surg 1998;227:326-34.
6. Strasberg SM, Hertl M, Soper NJ. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. J Am Coll

Surg 1995;180:101-25.

7. Fletcher DR, Hobbs MS, Tan P, Valinsky LJ, Hockey RL, Pikora TJ, *et al*. Complications of cholecystectomy: Risks of the laparoscopic approach and protective effects of operative cholangiography: A population-based study. Ann Surg 1999;229:449-57.
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.
9. Gadacz TR. Update on laparoscopic cholecystectomy, including a clinical pathway. Surg Clin North Am 2000;80:1127-49.
10. Chen RC, Liu MH, Tu HY, Chen WT, Wang CS, Chiang LC, *et al*. The value of ultrasound measurement of gallbladder wall thickness in predicting laparoscopic operability prior to cholecystectomy. Clin Radiol 1995;50:570-2.
11. Grace P, Quereshi A, Darzi A, McEntee G, Leahy A, Osborne H, *et al*. Laparoscopic cholecystectomy: A hundred consecutive cases. Ir Med J 1991;84:12-4.
12. Cuschieri A, Dubois F, Mouiel J, Mouret P, Becker H, Buess G, *et al*. The European experience with laparoscopic cholecystectomy. Am J Surg 1991;161:385-7.
13. Dubois F, Berthelot G, Levard H. Laparoscopic cholecystectomy: Historic perspective and personal experience. Surg Laparosc Endosc 1991;1:52-7.
14. Lo CM, Liu CL, Fan ST, Lai EC, Wong J. Prospective randomized study of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Ann Surg 1998;227:461-7.
15. Dinkel HP, Kraus S, Heimbucher J, Moll R, Knüpffer J, Gassel HJ, *et al*. Sonography for selecting candidates for laparoscopic cholecystectomy: A prospective study. AJR Am J Roentgenol 2000;174:1433-9.
16. Singh K, Ohri A. Laparoscopic cholecystectomy-is there a need to convert? J Minim Access Surg 2005;1:59-62.
17. Yetkin G, Uludag M, Citgez B, Akgun I, Karakoc S. Predictive factors for conversion of laparoscopic cholecystectomy in patients with acute cholecystitis. Bratisl Lek Listy 2009;110:688-91.

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