To Determine the Diagnostic Accuracy of Gallbladder Wall Thickness and Presence of Pericholecystic Fluid in Predicting the need for Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy in patients with Cholelithiasis

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ABSTRACT

Background: The prevalence of cholelithiasis is high and approximately every third woman and every fifth man are affected. Certain conditions preclude laparoscopic cholecystectomy leading surgeons to perform conventional open cholecystectomy. In this study we have determined that gallbladder (GB) wall thickening and pericholecystic fluid, on sonography are best predictors of conversion from laparoscopic cholecystectomy to open cholecystectomy in our population.
Aim: To determine the diagnostic accuracy of GB wall thickness >4mm and pericholecystic fluid in predicting the need for conversion of lap. Chole.to open cholecystectomy in patients with cholelithiasis.
Methods: The current cross sectional validation study was done at Radiology department, Military Hospital, Rawalpindi for the period of six months from June till December 2013. 249 patients were included in the study with an average age of 35 years.
Results: The sensitivity, specificity, positive and negative predictive value as well as accuracy of wall thickening >4 mm as an indicator of surgical conversion were 88.5%, 91.5%, 74.2%, 96.8% and 91.2% respectively and for pericholecystic fluid were of 57.7%, 97.0%, 83.3% 89.7% and 88.7% respectively. Out of 249 cases 52 were converted to open cholecystectomy with conversion rate of 20.9%.
Conclusion: Sonography should play a central role in surgical planning. Gallbladder wall thickening and pericholecystic fluid on sonography are the best predictors for converting a patient from laparoscopic cholecystectomy to open cholecystectomy.
Keywords: laparoscopic cholecystectomy, pericholecystic fluid, cholelithiasis

INTRODUCTION

Cholelithiasis has a high prevalence. Although cholelithiasis only becomes symptomatic in about 50% of pts, cholecystectomy is a common surgical procedure[1]. Inflammatory changes associated with cholelithiasis can complicate laproscopic cholecystectomy. The severity of acute inflammatory change influences the degree of surgical difficulty. Gallbladder wall thickening[2] and pericholecystic fluid are indicators of inflammation in patients with acute cholecystitis. A preoperative GB ultrasound, which documents a thick gallbladder wall (> or =3 mm) with calculi, is a clinical warning for a difficult laparoscopic cholecystectomy which may require conversion to an open cholecystectomy. In a study it was found that the rate of conversion was 60% in case of thickened GB wall while 12% in case of normal GB wall[3].

Pericholecystic fluid on sonography is also suggestive of inflammatory gallbladder change in patients with acute cholecystitis and was found to be associated with need for conversion. Sonography

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should play a central role in surgical planning[4].

Variable results have been reported in the past. The sensitivity, specificity, positive predictive value, and accuracy of wall thickening as an indicator of surgical conversion were 80%, 78.6%, 21.1%, and 78.7%, respectively and for pericholecystic fluid were 60%, 97.1%, 60% and 94.7% respectively. In a study, out of 234 cases 61 were converted to open cholecystectomy with conversion rate of 26.1% [5]. However in another study the specificity of wall thickness>4mm to predict conversion was 96.5% while its sensitivity was 69%. In the same study the specificity of pericholecystic fluid to predict conversion was 100% while its sensitivity was 10.3%[6].

Since studies in past have reported controversial results we have planned this study to determine how accurate are GB wall thickening and pericholecystic fluid on sonography for predicting conversion from laparoscopic cholecystectomy to open cholecystectomy in our population.

The objective of the study was to determine the diagnostic accuracy of GB wall thickness >4mm and pericholecystic fluid in predicting the need for

conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with cholelithiasis.

MATERIALS AND METHODS

After informed consent from the patients and approval from the ethical review committee, the cross-sectional validation study was conducted at radiology department of military hospital Rawalpindi for the period of six months. Sample size was 249 patients and sampling technique was non probability consecutive sampling. Patients undergoing laparoscopic cholecystectomy were included in the study with an average age of 35 years. Patients with suspected gallbladder perforation or empyema, diagnosed clinically by the surgeon and patients with co morbid illnesses like congestive heart failure, cirrhosis of liver, kidney disease were excluded from the study.

All patients who were admitted for elective laparoscopic cholecystectomy in surgical wards underwent ultrasonography within 72 hour prior to surgery. Ultrasound was performed by the same consultant radiologist in all patients. Toshiba NEMIO XG Ultrasound machine was used with 3.5 megahertz curvilinear transducer and then with 7 megahertz linear transducer. The gallbladder was scanned in multiple planes. Thickness of the gallbladder wall was measured orthogonally to the liver surface at the anterior wall adjacent to the liver. Measurements were obtained in axial and longitudinal sections relative to the gallbladder and perpendicular to the liver surface. The presence of pericholecystic fluid was noted.

Laparoscopic surgery was performed by the same team for all patients. After the surgery the results i.e. either successful laparoscopic or converted to open cholecystectomy were noted.

Data was entered and analyzed by using SPSS 12.0. Frequencies and percentages were presented for qualitative variables like gender, gallbladder wall thickness >4mm and presence of pericholecystic fluid. The results of ultrasonography were compared to calculate sensitivity, specificity, PPV and NPV with results of laparoscopic surgery. Diagnostic accuracy was presented as the frequency of correct results which was calculated by adding the true positives and true negatives.

RESULTS

A total of 249 patients undergoing laparoscopic cholecystectomy were included in this study. The average age of the patients was 35.83±8.49 years (95%CI: 34.77 to 36.89) (Fig. 1). Out of 249 cases, 188(75.5%) were female and 61(24.5%) were male with male to female ratio 1:3 (Fig. 2).

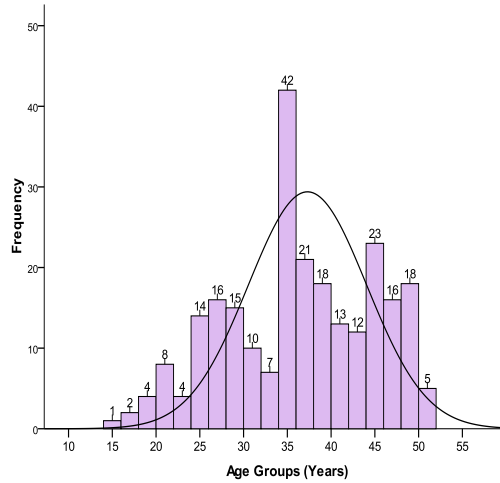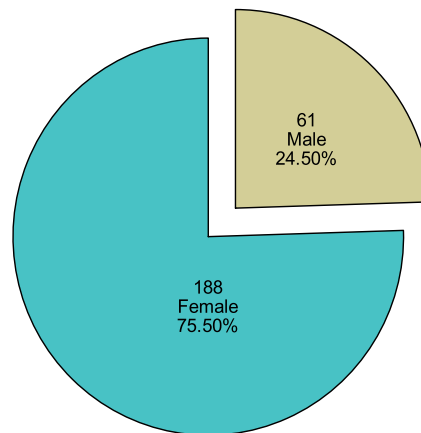Fig. 1: Age distribution of the patients (n= 249)

Fig. 2: Gender distribution of the patients (n= 249)

Gall bladder wall thickness above 4mm and presence of pericholecystic fluid were an important predicting factor for difficult laparoscopic cholecystectomy. 46 out of 62 patients with wall thickness >4mm were converted to open cholecystectomy and 30 out of 36 cases were converted to open cholecystectomy due to pericholecystic fluid.

The sensitivity, specificity, positive and negative predictive value as well as accuracy of wall thickening >4 mm as an indicator of surgical conversion were 88.5%, 91.5%, 74.2%, 96.8% and 91.2% respectively as presented in table 1 and for pericholecystic fluid were 57.7%, 97.0%, 83.3% 89.7% and 88.7% respectively as presented in table 2 . In a study out of 249 cases 52 were converted to

open cholecystectomy hence the conversion rate was 20.9%. Accuracy of wall thickness >4mm predicting difficult laparoscopic cholecystectomy was 95.1% in male cases and 89.9% for female cases.

Accuracy of presence of pericholecystic fluid predicting difficult laparoscopic cholecystectomy was 90.1% in male cases and 88.3% for female cases.

Table 1: Accuracy of gb wall thickness >4mm in predicting the need for conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with cholelithiasis

Gallbladder Wall Thickness	Results of Surgery		Total
	Converted to open Cholecystectomy	Completed Lap. Cholecystectomy	
>4 mm	46 (TP)	16 (FP)	62(24.9%)
≤4 mm	6(FN)	181(TN)	187(75.1%)
Total	52(20.9%)	197(79.1%)	249

Sensitivity: 88.5% Specificity: 91.9%,   PPV: 74.2%,   NPV: 96.8%,   Accuracy: 91.2%

Table 2: Accuracy of presence of pericholecystic fluid in predicting the need for conversion of laparoscopic cholecystectomy to open cholecystectomy in patients with cholelithiasis

Pericholecystic fluid	Results of Surgery		Total
	Converted to open Cholecystectomy	Completed Lap. Cholecystectomy	
Present	30 (TP)	6 (FP)	36(14.5%)
Absent	22 (FN)	191 (TN)	213(85.5%)
Total	52(20.9%)	197(79.1%)	249

Sensitivity: 57.7%,   Specificity: 97%,   PPV: 83.3%%,   NPV: 89.7%%,   Accuracy: 88.7%

DISCUSSION

Conversion from laparoscopic to open cholecystectomy is required when safe completion of the laparoscopic procedure cannot be ensured. The identification of parameters predicting conversion improves preoperative patient counselling, provides for better perioperative planning, optimizes operating room efficiency, and helps to avoid laparoscopic associated complications by performing an open operation when appropriate. Preoperative diagnostic procedures should support the decision process for the adequate treatment of patients with gallstone disease. Sonography is a valuable tool to help surgeons detect gallbladder stones, estimate patients' surgical risks, and suggest whether further workup of the bile duct is required. This study corroborates the well-established high accuracy of sonography for cholecystolithiasis. Multiple studies have evaluated the ability of transabdominal ultrasound to detect gallstones, though it is important to recognize that precise estimates of sensitivity and specificity are difficult to determine since surgical confirmation of a negative sonogram is unlikely. A systematic review estimated that the sensitivity was 84 percent (95% confidence interval [CI] 76 to 99%) and specificity was 99 percent (95% CI 97 to 100%)[7].

When compared with other cross-sectional imaging modalities and cholecystography, ultrasound has the highest sensitivity[8,9]. Modern sonographic equipment is able to detect stones as small as 1.5 to 2 mm in diameter [8]. However smaller stones may be missed, and the sensitivity falls to 50 to 60 percent for stones less than 3 mm in diameter[10,11,12].

In our study the average age of the patients undergoing laparoscopic cholecystectomy was 35.83±8.49 years. This observation was validated in the Sirmione study in which the incidence between the ages of 35 and 69 years was four times higher than that in younger subjects[13].

In our study out of 249 cases, 75.5% were female and 24.5% were male showing male to female ratio 1:3 which is supported by few other studies showing higher prevalence of gallstones in women in all age group[14,15].

Cystic duct stones are difficult to directly visualize[16]. In most patients, the presence of cystic duct stones can be derived only from indirect signs, such as when gallbladder hydrops occlude the cystic duct. An important question is whether it is possible to assess local operability prospectively. In our study, the conversion rate to open surgery of 20% was similar to other studies[17,18,19]. A study by Fuchs et al[20] found that laparoscopy may even be advantageous for patients who are difficult to operate on. Although conversion to laparotomy alone does not worsen patient's outcome, several reasons support the preoperative assessment of the feasibility of laparoscopy.

Our findings suggest that patients with excessive gallbladder wall thickening and symptoms of cholelithiasis tend to have technical difficulties during laparoscopic cholecystectomy. In gallstone disease, the histopathologic substrate for sonographic thickening of the gallbladder most frequently is acute or chronic pericholecystic inflammatory change. Jantsch et al[21] reported that a thickened gallbladder wall of more than 4 mm

frequently indicates acute cholecystitis. In 84% of the patients with gallbladder wall thickening > 4 mm in that study, surgeons encountered surgical difficulties.

In our study, a gallbladder wall thickness of > 4 mm was significantly associated with difficult surgical preparation and with the histopathologic report of chronic or acute inflammation. The inflamed gallbladder wall becomes friable and the enlarged vessels are more likely to break. Inflammation may also lead to bleeding that compromises orientation and the visual exposure at surgery, forcing surgeons to change the operative access. In patients with chronic inflammation, pericholecystic adhesions frequently impede the detachment of the gallbladder from its bed. In gallstone disease, the most frequent histopathologic substrate for sonographic thickening of the gallbladder is pericholecystic inflammatory change[22].

In our study accuracy of presence of pericholecystic fluid predicting difficult laparoscopic cholecystectomy was 90.1% in male cases and 88.3% for female cases. The finding of fluid in the gallbladder bed was significantly correlated to the necessity of conventional cholecystectomy. In comparison, gallbladder wall thickening was more sensitive and pericholecystic fluid more specific a parameter of technical difficulties and conversion.

CONCLUSION

Meticulous preoperative diagnostic technique is mandatory to provide information for a rational selection of the most effective treatment for cholelithiasis and to avoid intraoperative difficulty and surprise. Therefore, sonography should play a central role. Gallbladder wall thickening and pericholecystic fluid on sonography are the best predictors for converting a patient from laparoscopic cholecystectomy to open cholecystectomy.

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