

# A Difficult Laparoscopic Cholecystectomy That Requires Conversion to Open Procedure Can Be Predicted by Preoperative Ultrasonography

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## ABSTRACT

A prospective study was conducted from March 1999 to April 2000 that included 73 patients who underwent elective laparoscopic cholecystectomy for uncomplicated gallstone disease. The study was conducted at one surgical unit in the Department of Surgery and Department of Radio-diagnosis and one surgical unit in the Department of Surgery, Maulana Azad Medical College and the associated Lok Nayak Hospital, which is the largest referral hospital in northern India and is located in the capital of India. A preoperative ultrasound was performed just prior to surgery, and 4 ultrasonographic parameters were analyzed, namely gallbladder wall thickness, contracted gallbladder, impaction of gallstones at the neck of the gallbladder, and common bile duct stones. The surgical findings were objectively graded as difficult or easy laparoscopic cholecystectomy according to 5 operative parameters, namely total time taken for the surgery, time taken to dissect gallbladder bed, spillage of stones, tear of gallbladder during dissection, and conversion to the open procedure. Of the 73 cases, 17 (23.3%) were conversions to the open procedure. Of the 21 (28.76%) cases predicted to be difficult, 17 (23.3%) were technically difficult, of which 13 (17.8%) were converted to the open procedure. Of the 52 (71.23%) cases predicted to be easy on ultrasonography, only 7 (9.38%) were found to be difficult on surgery, of which only 4 (5.48%) had to be converted to the open procedure. Based on our results, we conclude that preoperative ultrasonography is of great value in selecting patients preoperatively for laparoscopic cholecystectomy and minimizing complications and conversion to the open procedure.

**Key Words:** Laparoscopic cholecystectomy, Conversion.

## INTRODUCTION

Laparoscopic cholecystectomy is a revolutionary change in the treatment of patients with gallbladder stones. Mouret<sup>1</sup> introduced laparoscopic cholecystectomy in 1987. It has rapidly replaced open cholecystectomy as the standard treatment. Advantages of laparoscopic cholecystectomy include reduced hospitalization, decreased morbidity, short recovery time, and better cosmesis.<sup>2-5</sup> In addition, studies evaluating physiologic and biochemical responses show minimal change in the above parameters.<sup>6</sup> However, compared with open cholecystectomy, the incidence of injuries to the bile duct seems to be increased.<sup>7,8</sup> 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 operating time available.<sup>2</sup> Patients with long-standing disease and previous bouts of cholecystitis or pancreatitis are at higher risk of experiencing a difficult procedure or conversion and may be at increased risk of bile duct injury or injury to the adjoining viscera.<sup>7</sup> It would be useful to have some reliable predictive factors for conversion or complications in laparoscopic cholecystectomy. Patients can be selected for laparoscopic cholecystectomy and high-risk procedures and possible complications so that patients can be mentally prepared and can adjust their expectations accordingly.<sup>3</sup>

## METHODS

The study was conducted in the Department of Surgery and Department of Radiodiagnosis, Maulana Azad Medical College and the associated Lok Nayak Hospital, New Delhi, India from March 1999 to April 2000 and included 73 patients. All patients with symptomatic gallstone disease were included in the study. Patients with common bile duct stones (CBD stones) or any other CBD pathology, jaundice, or abnormal liver function tests (LFT), acute cholecystitis, and patients who had undergone previous abdominal operations (upper abdominal) were excluded from the study. A detailed clinical history and physical examination were carried out. Complete hemogram, liver function tests, chest X-ray and other preanesthetic investigations were carried out before tak-

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ing the patient for surgery. Preoperative ultrasonography was performed on the morning of the surgery. Four ultrasonographic parameters were studied, namely gallbladder wall thickness (more than 4-mm thick gallbladder wall thickness was predicted to be a difficult laparoscopic cholecystectomy); gallstone mobility (gallstone impacted at the neck of the gallbladder was taken to be a difficult laparoscopic cholecystectomy); gallbladder size, that is whether gallbladder is contracted or not (contracted gallbladder was predicted to be a difficult laparoscopic cholecystectomy); common bile duct diameter (CBD size more than 6 mm was predicted to be a difficult laparoscopic cholecystectomy). The laparoscopic surgery was performed by surgeons at our institution experienced in laparoscopic surgery; therefore, the learning curve statistics do not apply to this study. The operating surgeon was blinded to these findings. The operative findings were objectively graded as difficult or easy laparoscopic cholecystectomy according to the following criteria: more than 90 minutes taken for laparoscopic cholecystectomy from insertion of the Veress needle or trocar (in open method of port insertion) until the extraction of the gallbladder, was considered a difficult laparoscopic cholecystectomy. Tear of the gallbladder during dissection with spillage of bile and stones was considered a difficult laparoscopic cholecystectomy. More than 20 minutes taken to dissect the gallbladder from the gallbladder bed was considered a difficult laparoscopic cholecystectomy. More than 20 minutes taken to dissect Calot's triangle was considered a difficult laparoscopic cholecystectomy. Any laparoscopic cholecystectomy converted to the open procedure was considered a difficult laparoscopic cholecystectomy.

## RESULTS

A total of 73 laparoscopic cholecystectomies were performed from March 1999 to April 2000. The mean age of the patients was 35 years, and most patients were 25 to 30 years of age. Of 73 patients, only 2 were males. Of 73 cases, 17 (23.3%) had to be converted to open cholecystectomy (**Table 1**). Ten cases were converted due to either dense adhesions at Calot's triangle or the surrounding structures. One case was converted due to the presence of carcinoma of the gallbladder. Two cases were converted due to a tear of the cystic artery during dissection. One case was converted due to the presence of empyema of the gallbladder. Three cases were converted due to the presence of a sessile gallbladder hence

the inability to apply clips. Forty-nine (67.12%) laparoscopic cholecystectomies were performed without any difficulty.

The mean gallbladder wall thickness in our study was 2.8 mm. The maximum gallbladder wall thickness was 6 mm, and the minimum was 1.8 mm. Ten (13.6%) patients had gallbladder wall thickness more than 4 mm of which 9 cases were found to be difficult on surgery, and of these 9 cases 7 were converted to the open procedure.

Eleven (15.07%) patients had gallstones impacted at the neck of the gallbladder or Hartman's pouch. The rest of the 62 cases (84.9%) had mobile gallstones. The patients with a gallbladder full of stones with no mobility of the stones due to the gallbladder being totally packed with stones were considered stone impacted at the neck of gallbladder in addition to solitary stone impaction.

Of 11 patients (15.07%) with contracted gallbladders, 8 laparoscopic cholecystectomies were surgically difficult, and 5 were converted to the open procedure.

Of a total of 3 patients (4.10%) whose common bile duct diameter was more than 6 mm, surgeries for all 3 were difficult, and 2 were converted to the open procedure.

The total number of cases predicted to be difficult on ultrasonography was 21 (28.76%), of which 17 (23.3%) were difficult. Of 17 (23.3%) cases that were difficult on surgery, 13 (17.8%) had to be converted to open cholecystectomy.

The cases predicted to be easy on ultrasonography were 52 (71.23%) of which 45 (61.64%) were actually easy, and 7 (9.58%) turned out to be difficult. Of 7 cases, 4 (5.48%) had to be converted to open cholecystectomy.

The positive predictive value of ultrasonography for predicting difficult laparoscopic cholecystectomy is 80.95%, and the positive predictive value for predicting conversion to open cholecystectomy is 61.90%. The multiple regressions for various ultrasonographic parameters are shown in **Tables 2 and 3**. The patients with common bile duct dilatation were not enough to be statistically significant.

## DISCUSSION

Laparoscopic cholecystectomy has become the gold standard for the treatment of symptomatic gallstones, but the procedure is technically more demanding than the classical

**Table 1.**  
Summarizing the Results.

Total Number of Patients	Total Patients With Easy Laparoscopic Cholecystectomy	Total Number of Patients With Difficult Laparoscopic Cholecystectomy	Total Number of Patients Converted to the Open Procedure
73	49 (67.12%)	24 (32.88%)	17 (23.28%)

**Table 2.**  
Multiple Regression Tables for Difficult Laparoscopic Cholecystectomy.

Variable	Correlation ( r )	( r2 )	Significance ( t )	P Value	Positive Predictive Value (%)	Sensitivity
Gallbladder wall thickness	.484465	.234706	4.666348	.000014	90	37.5
Contracted gallbladder	.357317	.127676	3.223624	.001913	72.73	33.3
Stone impacted at the neck of gallbladder	.520343	.270757	5.134323	.000002	90.91	41.67
Combined ultrasono-graphic prediction	.650358	.422966	7.214078	.000000	80.95	70.83

**Table 3.**  
Multiple Regression Tables for the Conversion to Open Procedure.

Variable	Correlation ( r )	( r2 )	Significance ( t )	P Value	Positive predictive value	Sensitivity (%)
Gallbladder wall thickness	.440317	.193879	4.132328	.000097	70	41.18
Impaction of stone in the neck of gallbladder	.402100	.161685	3.700495	.000421	63.64	41.17
Contracted gallbladder	.220907	.048800	1.908546	.060364	45.45	41.67
Combined ultrasonographic prediction	.580620	.337119	6.009017	.000000	61.90	76.47

open cholecystectomy. Greater chances of damage to the common bile duct and surrounding viscera exist. The aim of our study was to evaluate some preoperative factors, which can reliably predict the chances of conversion to the open procedure and the complications during laparoscopic cholecystectomy. Also, it may benefit patients because they can be informed of the possibility of complications and conversion to the open procedure. The patient can be mentally prepared and can adjust his or her expectations accordingly. In addition, the surgeon can directly perform the classical open cholecystectomy in the patients with presumed difficult surgery thus saving operating time and the conversion rate. The conversion rate was high in our group of patients, which could be attributed to the multiple attacks of acute cholecystitis suffered by our group of patients before reporting to the hospital, as is the trend generally in India.

The risk of organ injury was minimized in our study by using open trocar placement (a Hasson cannula was used). Patients with previous lower abdominal surgeries were also included in our study.

Lots of studies have been published in the Western literature on the predictive use of ultrasonography, but little data exist about Indian patients.

In our study, we found a good correlation between gallbladder wall thickness with conversion to the open procedure and adhesions in accord with reports in other studies.<sup>2,6,9-12</sup> In 1 study, however, the opposite is reported.<sup>13</sup>

Our study shows that stone impaction at the gallbladder neck and certain complications are a good predictor of conversion to the open procedure, which is contrary to the findings in other studies in which stone impaction is shown to have a moderate correlation.<sup>2,10</sup> The main difficulty with stone impacted at the neck or Hartman's pouch is that it hinders holding of the gallbladder during dissection, and also due to impacted stone, the gallbladder is distended with mucus forming the mucocele of the gallbladder, which is even more difficult to hold. In these cases, the gallbladder was emptied of its contents by aspirating the contents making the gallbladder more manageable.

The contracted gallbladder is a corollary to the thickened gallbladder wall as we had excluded the patients with acute cholecystitis. The thickened and contracted gallbladder was difficult to dissect because it had dense adhesions with the surrounding structures and in Calot's triangle.

Common bile duct size also has a good correlation with conversion to the open procedure and difficulty in surgery, in accordance with findings from previous studies.<sup>2,3</sup>

In our study, ultrasonography was not a good predictor of hemorrhage from the cystic artery tear. Both cases in which the cystic artery was torn were predicted to be easy on ultrasonography. The tear occurred due to technical error.

No complications, such as common bile duct injury or injury to adjacent viscera, occurred in our study.

From this study, we conclude that preoperative ultrasonography is a good predictor of difficulty in laparoscopic cholecystectomy in the majority of cases and should be used as a screening procedure. It can help surgeons to get an idea of the potential difficulty to be faced in that particular patient. The most valuable assessment the ultrasound can provide is gallbladder wall thickness, gallbladder size, common bile duct diameter, common bile duct stones, and any abnormal anatomy of the biliary tract, if present.

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