

## SONOGRAPHY TO PREDICT CONVERSION IN LAPAROSCOPIC CHOLECYSTECTOMY

**Gazwan M Khadim\* & Zaki A Al-Faddagh@**

\*MB,ChB, Al-Mawani General Hospital, Basrah. @CABS, Professor, Department of Surgery, Basrah College of Medicine, Basrah University, Al-Mawani General Hospital.

### Abstract

Laparoscopic cholecystectomy has become the gold standard in the treatment of symptomatic cholelithiasis. Several preoperative variables have been identified as risk factors that are helpful in predicting the probability of conversion to laparotomy for safe and successful removal of the gallbladder.

*This study aimed* to look for the various sonographic findings and to make a predictive index for patients who are candidates for laparoscopic cholecystectomy, operative difficulties and conversion to open cholecystectomy.

This is a prospective study conducted in the Department of Surgery of Al-Mawani General Hospital, Al-Mousawi Private Hospital in Basrah, Iraq, between May 2005 and October 2008. Abdominal Sonography performed in 105 consecutive patients before laparoscopic cholecystectomy (the sonographic signs are: gallbladder wall thickness, pericholecystic fluid, sonographic Murphy's sign, shrunken gallbladder, number and size of gallstones). Patients excluded are those with history of jaundice, abnormal liver function test, upper abdominal surgery, co-morbid illnesses, extreme obesity, dilated intrahepatic or extrahepatic biliary ducts or those with CBD stones.

The surgeon re-evaluates the results of ultrasound with the results obtained during surgery.

One hundred and five patients included in the study, 103 patients with gallstones, the other 2 patients having polyps. Ultrasound was accurate 100% in detecting gallstones and polyps, 99 patients (94.3%) have their cholecystectomies via the laparoscope, 75 patient (75.8%) from them show easy procedure, while 24 patients (24.2%) suffered from difficulties.

Six patients (5.7%) needed conversion to open cholecystectomy to complete the operation safely.

*In conclusion*, there are many sonographic signs that we can be depend on them to give us an idea about the possibility of conversion to open cholecystectomy, the most specific one is pericholecystic fluid. Secondly gallbladder wall thickness more than 3mm, thirdly, sonographic Murphy's sign, fourthly, shrunken gallbladder, fifthly single gall stone. The other signs are of less specificity like size and multiplicity of gall stones.

### Introduction

Laparoscopic cholecystectomy provides a safe and effective treatment for most patients with symptomatic gallstones<sup>1</sup>. Laparoscopic cholecystectomy first performed by Erich MF Che in 1985, has gained acceptance as the standard of care for patients requiring cholecystectomy<sup>2</sup>. Indeed, it appears to become the procedure of choice for many of these

patients. Laparoscopic surgery is popular with patients<sup>3</sup>, The absence of the conventional large incision is cosmetically appealing. The immediate post operative course is smoother, allowing for early discharge from the hospital and early return to work<sup>4</sup>. The procedure however is surgically demanding and introduces specific risks unique to the laparoscopic surgery that

are not present during the performance of open cholecystectomy<sup>5</sup>.

In the developmental stage of laparoscopic cholecystectomy it was considered 'unsafe' or 'technically difficult' to perform laparoscopic cholecystectomy for acute cholecystitis<sup>5</sup>. Since its advent in 1987, laparoscopic cholecystectomy (LC) has become the gold standard for symptomatic gall stones<sup>6</sup>. With increasing experience in laparoscopic surgery, a number of centers have reports the use of laparoscopic cholecystectomy for acute cholecystitis, suggesting that it is technically feasible but at the expense of a high conversion rate, which can be up to 20 per cent<sup>7</sup>. This technique has become increasingly popular and in some hospitals, 80 to 90 percent of all cholecystectomy performed by laparoscopic techniques<sup>8</sup>.

Laparoscopic cholecystectomy is not without complications. A clear relationship has been found between the experience of the surgeon and complications of laparoscopic procedure<sup>9</sup>. To avoid complications, it is important for the surgeon to pay careful attention to detail of anatomy and be ready to convert from laparoscopic to open abdominal surgery when indicated<sup>10</sup>.

The incidence of conversion is less in centers where LC is attempted in a selected group of patients<sup>11</sup>. This conversion is neither a failure nor a complication, but an attempt to avoid complications. It would be useful to have some reliable predictive factors for conversion in LC so that patients may be informed appropriately and they have a chance to make arrangements regarding their work and family<sup>12</sup>. Similarly, the surgeon may schedule the time and team for surgery. Studies have shown that there are higher incidence of post-operative complications and longer hospital stay in converted patients when compared with both the laparoscopic and

the open cholecystectomy group<sup>13</sup>. Scoring systems are designed in some studies for better understanding and for easy prediction of conversion<sup>13</sup>. The risk factors had been reviewed recently.

Recent series state that presence of previous upper abdominal surgery with obesity had a substantial effect on conversion<sup>14</sup>. However, the presence of inflammation alone or in combination with obesity and/or previous (especially upper) abdominal surgery is the main factor that influences the adverse outcomes of LC<sup>15</sup>. Number and duration of attacks of acute cholecystitis seen to be a risk factor in prediction of difficulties and conversion<sup>16</sup>.

Many sonographic signs (gallbladder wall thickness, pericholecystic fluid, sonographic Murphy's sign, shrunken gallbladder, number and size of gallstones) showing an idea about prediction of difficulties in LC or conversion to laparotomy<sup>17</sup>.

Diagnosis of a contracted gallbladder (shrunken gallbladder) was made when the organ measured less than 2 cm in diameter on repeated examinations (under fasting conditions).

Sonographic Murphy's sign corresponds to a painful one finger palpation of the gallbladder during inspiration when it touched by the probe of the ultrasound.

This study aimed to look for the various sonographic findings and to make a predictive index which patient candidates for laparoscopic cholecystectomy, operative difficulties and conversion to open cholecystectomy.

## Patients and method

A prospective clinical study has been done in the Department of Surgery in Al-Mawani general hospital and Al-Mousawi private hospital in Basrah, Iraq, between (may2005 and October 2008). One hundred five patients were included in this study, 103 patients having symptomatic cholecystolithiasis

while the other 2 patients having gallbladder wall polyp.

The sample included in this study were those consecutive patients according to a checklist after exclusion of those with history of jaundice, abnormal liver function test (especially those with elevated level of bilirubin and alkaline phosphatase), dilated biliary ducts, CBD stone, previous upper abdominal surgeries, extreme obesity, Patients with co morbid illnesses like Ischemic heart disease, hypertension, diabetes mellitus.

All our patients are elective cases, Patients were interviewed according to a standardized questionnaire; patients were asked about their symptoms and all other relevant medical history. Physical examination findings notified. Sonography was performed by one radiologist in a period ranging from 2 hours to 7 days away from time of surgery by (Logiq P5, Japan), using 3.5-MHz and 5-MHz curved array probes. After fasting, patients were examined in the supine and the left decubitus positions.

we recorded specific data about the gallbladder like; gallbladder wall thickness; the size of gallbladder; diameter of the intrahepatic and extrahepatic bile ducts; and presence, number, and location of stones in the gallbladder, cystic duct, intrahepatic bile ducts, and common bile duct; polyps of gallbladder wall; sonographic Murphy's sign and pericholecystic fluid; shrunken gallbladder.

We meticulously checked for the presence of pericholecystic fluid—small fluid collections or thin layers of fluid in or around the gallbladder wall or in the liver bed. The term "pericholecystic fluid" is different than ascites or diffuse peritoneal fluid, both of which were not encountered in our patients.

An evaluation sheet on which we recorded history data, physical examination notes, laboratory data and sonographic data was sent to the

operating room with each patient. Intraoperative technical difficulties were defined by a preparation time (the time after insertion of the ports needed to identify all structures in Calot's triangle and to ligate the cystic duct and the cystic artery) of more than 30 min, bleeding obscured the operative field, unable to clear anatomy or pericholecystic adhesions or perforation of gallbladder.

The decision to convert to open surgery was made by the surgeon on a patient-by-patient basis. Our policy is to change to open laparotomy when laparoscopy would expose the patient to unreasonably high surgical risks.

The surgeon must properly inform the patient of this option and obtains the consent for both laparoscopic cholecystectomy and open procedure.

The operating surgeon correlates the data of the patient with intraoperative findings immediately after surgery.

All gallbladders sent for histopathological examination after surgery.

Many statistical measures (sensitivity, specificity and p value) done for the results of each sonographic sign in relation with the scenario of laparoscopic cholecystectomy to reveal its significance in prediction of difficulties and conversion to laparotomy.

## Results

The total number of patients included in this study was 105, from them 103 cases having cholelithiasis, the other 2 cases underwent cholecystectomy due to gallbladder polyps.

Ninety nine cases (94.3%) complete their surgeries via laparoscope, 75 of them (75.8%) were straightforward, while the last 24 cases (24.2%) get some difficulties in form of long procedure time, difficulties to assess the anatomy, failure to separate pericholecystic adhesions adequately, moderate to severe

bleeding obscuring the operative field or perforation of gallbladder.

Six patients (5.7%) converted to open cholecystectomy when laparoscopy would expose the patient to unreasonably high surgical risks (diagram 1). In four patients,

laparoscopic cholecystectomy was switched to laparotomy because of dense pericholecystic adhesions that could not be effectively removed, bleeding and time consumed procedure, and rigid gallbladder in the other 2 cases.

**Diagram 1: Percentage of open and laparoscopic cholecystectomy.**



The time needed for laparoscopic cholecystectomy in our study ranging between (19-49 minutes) in an average time (31 minutes).

The time needed to decide the conversion to laparotomy (if occur) ranging between (25-29) minutes in an average time (27minutes).

This study classified the result of surgery in this study according to sex as following (Table I). There is a higher percentage of difficulties in surgeries of male group (52.9%) in compare with (17%) in female group. Also males having conversion rate reaching (11.8%) in compare with (4.5%) in females

**Table I: Relation between sex and result of laparoscopic cholecystectomy.**

| Total | Open Cholecystectomy | Difficult laparoscopic cholecystectomy | Laparoscopic Easy cholecystectomy | Sex    |
|-------|----------------------|--|-----------------------------------|--------|
| 88    | 4(4.5%)              | 15(17%)                                | 69(78.5%)                         | Female |
| 17    | 2(11.8%)             | 9(52.9%)                               | 6(35.3%)                          | Male   |

The surgical outcomes in this study according to age group shown in( table II) The highest age group facing difficulties those between (50-60 years)

in a percentages of (30.8%) while the highest conversion rate (14.4%) occurs in those above 60 years.

**Table II: Relation between age group and fate of laparoscopic cholecystectomy.**

| Total | Open Cholecystectomy | Difficult lap. Chole. | Laparoscopic Easy cholecystectomy | Age      |
|-------|----------------------|-----------------------|-----------------------------------|----------|
| 1     | 0                    | 0                     | 1(100%)                           | <20 year |

|    |          |          |           |            |
|----|----------|----------|-----------|------------|
| 21 | 0        | 2(9.5%)  | 19(90.5%) | 20-30 year |
| 30 | 2(6.7%)  | 7(23.3%) | 21(67%)   | 30-40 year |
| 33 | 2(6%)    | 9(27.3%) | 22(66.7%) | 40-50 year |
| 13 | 1(7.7%)  | 4(30.8%) | 8(61.5%)  | 50-60 year |
| 7  | 1(14.4%) | 2(28.6%) | 4(57%)    | >60 year   |

Gallbladder wall thickness was an important predictor of difficulties and conversion during laparoscopic cholecystectomy and difficulty in detaching the gallbladder from its bed in the liver. When gallbladder wall thickness was less than or equal to 3mm

(87 patients), 68 patients (78.2%) underwent easy laparoscopic cholecystectomy, laparoscopy was difficult in 17 of 87 patients (19.5%), while conversion occurs in 2 cases (2.3%). (diagram 2).

**Diagram 2: The fate of laparoscopic cholecystectomy in those with gallbladder wall thickness 3mm or less.**



In 18 patients with a gallbladder wall thickness greater than 3mm, we encounter a surgical difficulties in 7 patients (38.9%), conversion occurs in

four patients (22.2%), the other 7 patients (38.9%) with easy laparoscopic cholecystectomy. (diagram 3).

**Diagram 3: The fate of laparoscopic cholecystectomy in those with gallbladder wall thickness more than 3mm.**



The specificity of wall thickness to predict conversion 85.9% in those more than 3mm while its sensitivity was 66.7% and it's p value 0.0005. We notify the relation between numbers of attacks

of acute cholecystitis previously as an indicator of difficulties in laparoscopic cholecystectomy with those having wall thickness greater than 3 mm (table III).

**Table III: Relation between outcome of surgery in those with gallbladder wall thickness more than 3mm and number of attacks of cholecystitis.**

| Number of attacks | Easy Laparoscopic cholecystectomy | Difficult laparoscopic cholecystectomy | Open cholecystectomy | Total |
|-------------------|-----------------------------------|--|----------------------|-------|
| One               | 7(38.9%)                          | 4(22.2%)                               | 2(11.1%)             | 13    |
| Two               | 0                                 | 2(11.1%)                               | 0                    | 2     |
| Three and more    | 0                                 | 1(5.6%)                                | 2(11.1%)             | 3     |

  

| Number of attacks | Easy Laparoscopic cholecystectomy | Difficult lap. cholecystectomy | Open cholecystectomy | Total   |
|-------------------|-----------------------------------|--------------------------------|----------------------|---------|
| One               | 19(79.2%)                         | 5(20.8%)                       | 0                    | 0       |
| Two               | 23(74.2%)                         | 7(22.6%)                       | 1(3.2%)              | 1(3.2%) |
| Three and more    | 26(81.1%)                         | 5(15.6%)                       | 1(3.2%)              | 1(3.3%) |

The relation between numbers of attacks of acute cholecystitis previously and fate of LC in those having wall thickness

equal or less than 3 mm are shown in (Table IV).

**Table IV: Relation between outcome of surgery in those with gallbladder wall thickness equal or less than 3mm and number of attacks of cholecystitis**

In 3 patients with pericholecystic fluid, laparotomy was required in 2 of them (66.6%), the last 1 (33.3%) done with difficulties. While those 102 without this sign, get easy laparoscopy in 75 patient

(72.6%), difficulties occurred in 23 patient (23.5%), 4 patients (3.9%) converted to laparotomy. (diagram 4).

**Diagram 4: Fate of laparoscopic cholecystectomy in relation with pericholecystic fluid.**



The specificity of pericholecystic fluid to predict conversion was 98.9% while its sensitivity was 33.3% and its p value 0.0008. In 15 patients, a sonographic Murphy's sign was present, In 12 of them (80%) laparoscopy was difficult, 2 patients (13.3%) converted to open

laparotomy. The last one (7.6%) done easily. While in 90 patients with negative sonographic Murphy's we have 4 cases (4.4%) converted to open cholecystectomy, difficulties occurs in 12 patients (13.3%), the last 74 patients (82.3%) doing laparoscopies easily. (diagram 5).

**Diagram 5: Percentages of surgical outcome in laparoscopic cholecystectomy in relation with sonographic Murphy's sign.**



The specificity of sonographic Murphy's sign to predict conversion was 92.5% while its sensitivity was 33.3% and its p value 0.43.

In 2 patients (100%) having no gallstones there is no problem in completing the procedures safely.

While we have 32 patients with single gallstones, 24 of them (75%) passed in easy laparoscopic procedure, difficulties occurred in 6 cases (18.8%), while 2 of them (6.2%) converted to laparotomy.

71 patients with multiple gallstones, laparoscopy done without difficulties in 49 patients (69.%), in the other hands we suffered difficulties in 18 patient (25.3%), the last 4 patients (5.7%) converted to open cholecystectomy, (diagram 6).



### Diagram 6: Fate of laparoscopic cholecystectomy in relation with the number of gallstone.

The specificity of single gallstone to predict conversion was 69.7% while its sensitivity was 33.3% and its p value 0.93.

In 47 patients with gallstones less than or equal to 1cm, we found 3 patients (6.4%) converted to open cholecystectomy, 9 patients (19.1%) having some difficulties, the last 35

patient (74.5%) underwent easy laparoscopy.

56 patient with gallstone more than 1 cm, laparoscopy done for 38 patient (67.9%) without difficulties, 15 patient (26.8%) gets difficulties while laparotomy happen in 3 cases (5.3%). (diagram 7).

### Diagram 7: Fate of laparoscopic cholecystectomy in relation with the size of gallstones



The specificity of gallstone with size more than 1cm to predict conversion was 58.7% while its sensitivity was 50% and its p value 0.996.

Shrunken gallbladder sign found in 23 patients, 2 of them (8.8%) converted to laparotomy, difficulties occurs in 6 cases

(26%) the other 15 cases (65.2%) done without difficulties. while those 82 patients who do not having this sign suffered from conversion in 4 cases (4.8%), difficulties occurs in 18 patients (21.9%), the other 60 cases (73.2%) having easy laparoscopy. (diagram 8).

### Diagram 8: The fate of laparoscopic cholecystectomy in relation with sign of shrunken gallbladder.



The specificity of shrunken gallbladder to predict conversion was 78.8% while its sensitivity was 33.3% and its p value 0.4.

The histopathological examination reports for the 103 patients with cholecystolithiasis reveal signs of chronic cholecystitis in 89 cases (86.4%), the other 14 cases (13.6%) shows signs of acute cholecystitis .while

those 2 cases with polyps reveal cholesterol and hypertrophic polyps. The most difficulties (43%) and conversion (28.5%) occurs in those with sign of acute cholecystitis in histopathological examination. The relation between histopathological examination and outcome of surgery showed in (Table V)

#### Table V: Relation between histopathological examination and outcome of surgery.

|                                      |           |
|--------------------------------------|-----------|
| Open cholecystectomy                 |           |
| Difficult laparoscopic cholecystitis | 4(28.5%)  |
| Easy Laparoscopic cholecystectomy    | 6(43%)    |
| Histopathologic finding              | 4(28.5%)  |
| Acute cholecystitis                  | 2(2.3%)   |
|                                      | 18(20.2%) |
|                                      | 69(77.5%) |
| Chronic cholecystitis                | 0         |
|                                      | 0         |
|                                      | 2(100%)   |
| Polyp                                |           |

#### Discussion













Gall bladder wall thickness has been identified as a risk factor for conversion in almost all the studies. The critical thickness of gall bladder associated with conversion varies from study to study. It was 3mm<sup>6,9</sup>, 4mm<sup>8</sup>, and 6mm<sup>17</sup> in different studies.

Hans-Peter, found' When gallbladder wall thickness was less than or equal to 3 mm<sup>19</sup>, surgical preparation was difficult in (14%) of patients, compared with (84%) of patients with a wall thickness greater than 3 mm ( $p < 0.01$ ). Sensitivity of wall thickness if more than 3mm was 66.7%, and its specificity was 94.1%.

Ultrasonographic study analyzed the gall bladder wall thickness was strongly associated with conversion on univariate analysis, contradicting the belief that this is a weak predictor<sup>12</sup>.

In the other hand, we have the relation between the number of attacks of cholecystitis in those with gallbladder wall thickness more than 3mm to be of value in the conversion process, that occur in 2 cases (11.1%) after the first attack due to rigidity of gallbladder wall and adhesions ,and in other 2 cases (11.1%) at the third attack and more that's due to significant adhesion between gallbladder wall and its bed in the liver together with presence pericholecystic adhesions. Kiviluoto T<sup>20</sup> reported in a study of 300 patients assessing 24 variables for conversion that patients with history of acute cholecystitis within the last 3 weeks were at increased risk of conversion.

In many studies, there was significantly more risk of conversion in patients with previous history of acute cholecystitis ( $p < 0.001$ )<sup>1,2,6,23</sup> Association of total duration of symptoms with conversion has also been evaluated. Alponat et al<sup>21</sup> did not notice association of conversion with duration of symptoms in both univariate and multivariate analysis. In this study we can't estimate the relation between duration of previous attacks and

