Relation between Gallbladder Wall Thickness, Assessed by Sonography, and Difficulties in Laparoscopic Cholecystectomy

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Abstract:

**Background:** Laparoscopic cholecystectomy is the standard treatment for symptomatic gallbladder disease. Preoperative prediction of a difficult laparoscopic cholecystectomy can help the surgeon to prepare better for intraoperative risk and the risk of conversion to open cholecystectomy.

**Objectives:** Evaluation of the influence of gallbladder wall thickness, assessed by sonography preoperatively, on the outcome of laparoscopic cholecystectomy and to evaluate any intra- or postoperative complications in relation to them.

**Patients and Methods:** This prospective clinical trial conducted in Department of Surgery, Al-yarmouk Teaching Hospital, between October 2010 and October 2012. Abdominal sonography performed in 122 consecutive patients before laparoscopic cholecystectomy. The surgeon re-verified sonographic findings in the operating room. Difficulty of laparoscopy was evaluated with multiple parameters related to the gall bladder wall thickness, so classified as easy or difficult laparoscopy or conversion.

**Results:** Out of 122 patients with cholecystolithiasis on sonography, we encountered straightforward laparoscopic cholecystectomy in 87 patients (71.31%), difficult laparoscopic cholecystectomy in 27 (22.13%) and the procedure was converted to open cholecystectomy in 8 patients (6.55%). 47 patients (38.5%) had sonography revealing gallbladder wall thickness (>3 mm), and 75 patients (61.47%) had wall thickness <3 mm.

**Conclusions:** Gallbladder wall thickening is the most sensitive indicator of technical difficulties during laparoscopic cholecystectomy. Such difficulties may require conversion to Laparotomy.

**Key word:** Laparoscopic cholecystectomy, gallbladder wall thickness

Introduction:

Biliary diseases constitute a major portion of digestive tract disorders. Among these gall stone disease is the most common biliary pathology. 1 Gallstones are one of the major causes of morbidity in Western society. Prevalence of people with gallstones, whether symptomatic or asymptomatic, varies from 5 to 22%. There is a consensus that only patients with symptomatic gallstones need treatment. In previous studies that attempted to relate abdominal symptoms to the presence of gallstones, about one-third of stones were found to be symptomatic, meaning that 2-8% of Western populations would need treatment in their lifetime. 2 The main risk factor for gallbladder disease in Western countries is cholelithiasis. The main complications of cholelithiasis include: cholecystitis, cholecdocholithiasis, cholangitis, and biliary pancreatitis. In addition, cholelithiasis plays the role as the major risk factor for the development of gallbladder cancer. 1 For more than a century, classical conventional cholecystectomy has been the method of choice in the surgical management of gallbladder diseases. 3 In Iraq, operations of gallbladder represent a considerable fraction of total operations conducted in hospitals. This indicates that the disease is relatively important in Iraq. 4

Philip Mouret, in France, firstly introduced laparoscopic cholecystectomy in 1987, since then minimal invasive surgery still evolving. It has rapidly replaced open cholecystectomy (OC) as the standard treatment. 5 Laparoscopic cholecystectomy (LC) is considered the treatment of choice for cholelithiasis. It has advantages over traditional open cholecystectomy in terms of minimal post-operative pain, shorter hospital stay, better cosmeses, earlier recovery and early oral intake. 6

The selection of the patient who will undergo laparoscopic surgery is important, and the most frequently used method other than the clinical evaluation, is radiological examination (ultrasonography). 2 Ultrasonography is the initial imaging method for diagnostic approach and evaluation of the biliary system, as it is widely available, non-invasive, safe, innocuous and non-expensive. This method allows the detailed real-time study of the gallbladder, besides the evaluation of other findings that contribute to the final diagnosis. 7 Ultrasonography has been able to reliably detect gallstones in greater than 90% of symptomatic patients and the measurement of the thickness of the gallbladder wall by ultrasound is accurate.

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to within one mm in 93% of patients. The thickness of wall of Gallbladder greater than three mm is suggestive of cholecystitis in some, but not all literature reports. Several clinical reports in the literature are in agreement concerning the relationship between preoperative ultrasound gallbladder wall thickness and the technical difficulty of an LC. 5 Certain condition preclude laparoscopic cholecystectomy and may lead surgeons to perform conventional open cholecystectomy, including pericholecystic adhesions and adhesions between the common bile duct, the cystic duct, and the cystic artery. 8 The success of any laparoscopic operation depends on both proper patient selection, and the technical skill and experience of the laparoscopist. The laparoscopic surgeon should carefully select the patients to maximize the chance of success. 9

Patients and Methods

This is a prospective clinical study that was conducted in the Department of Surgery at Al-Yarmouk Teaching Hospital, Iraq, between first of October 2010 and first of October 2012. One hundred twenty two (122) patients were included in this study. We collected the data from patients’ files including age, sex, history of illness and operative notes. Patients with features of chronic calculus cholecystitis, who were prepared for LC included in the study. All our patients are elective cases. We exclude:

1. Patients who had previous upper abdominal surgery.
2. Patients with features of acute cholecystitis (clinically and investigation).
3. Patients with extreme obesity (BMI > 30 Kg/m2).

All the patients evaluated by:
1. Hematological and biochemical investigations (like: CBP, ESR, blood sugar, renal function tests, liver function tests, bleeding profiles).
2. Sonography of biliary system, which was done by the same radiologist, after fasting of the patient at least eight hours. The wall of gallbladder was carefully evaluated and consider as thick when its thickness > 3 mm. These sonographic findings were re-verified by the surgeon in the operating room. All patients underwent LC which was done by senior general surgeon using closed method with 4 ports.

The difficulty of procedure was evaluated by one or more of the following:
1. Clarity of Calot’s triangle (transparency, peritoneal adhesion), length and width of cystic duct. Laparoscopic cholecystectomy considered easy when there is no or minimal adhesion involving the omentum, only attaches to the fundus and body of gallbladder, and easily separated. Difficult laparoscopic cholecystectomy when there is severe adhesion involving the Calot’s triangle.
2. Grasping and handling of gallbladder during procedure (perforation of gallbladder). Thick or fibrosed gall bladder wall which difficult to be grasped need more than 10 triles in grasping or lead to Tear of the gallbladder during grasping with spillage of bile and stones were considered a difficult laparoscopy.

3. Difficulty of dissection of gallbladder bed and bleeding from the bed. More than 20 minutes taken to dissect the gallbladder from the gallbladder bed or bleeding from the bed which obscure the field of dissection was considered a difficult laparoscopic cholecystectomy. In this study, the decision of conversion to open cholecystectomy is made when laparoscopy would expose the patient to unreasonably high surgical risks (like: i.e.: injury to CBD, vascular vicinity, stomach, duodenum and colon, or there was severe bleeding leading to tachycardia of greater than 100 beat/min with a greater than 10 mmHg drop in blood pressure).

Results:
The total number of patients included in our study was 122, of which 102 were females (83.6%) and 20 were males (16.4%). The average age was (37.42) years ranging from 17 to 70 years, female average age was (37.46) years ranging from 17 to 70 years, male average age was (37.25) years ranging from 18 to 70 years (Table 1, Figure 1 and 2).

Table 1: The age and gender distribution of patients.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Male</th>
<th></th>
<th>Female</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20</td>
<td>2</td>
<td>10.0</td>
<td>10</td>
<td>9.8</td>
</tr>
<tr>
<td>20—29</td>
<td>4</td>
<td>20.0</td>
<td>22</td>
<td>21.6</td>
</tr>
<tr>
<td>30—39</td>
<td>7</td>
<td>35.0</td>
<td>37</td>
<td>36.3</td>
</tr>
<tr>
<td>40—49</td>
<td>4</td>
<td>20.0</td>
<td>20</td>
<td>19.6</td>
</tr>
<tr>
<td>50—59</td>
<td>2</td>
<td>10.0</td>
<td>7</td>
<td>6.8</td>
</tr>
<tr>
<td>=&gt;60</td>
<td>1</td>
<td>5.0</td>
<td>6</td>
<td>5.9</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>16.4</td>
<td>102</td>
<td>83.6</td>
</tr>
</tbody>
</table>

* P>0.05 (Not significant using Pearson Chi-square test at 0.05)

Figure 1 (histogram): The age distribution of patients.
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In all patients, the preoperative diagnosis of gall stones was correctly made on sonography. Initially, all patients underwent laparoscopy. Out of 122 patients with gall stones on sonography, we encountered 75 patients, (61.47%)with gallbladder wall thickness ≤3 mm, 67 patients of them(89.33%) underwent easy laparoscopic surgery, five patients(6.66%) underwent difficult laparoscopic surgery and three patients(4%) converted to open procedure. The other 47 patients (38.52%) were having gallbladder wall thickness >3mm, (figure 3), (Table 2).

Figure 2 (piagram): Distribution of patients according to the gender (male to female ratio).

Figure 3 (piagram): Distribution of patients according to gallbladder wall thickness.

Among 75 Patients with wall thickness≤3mm, three patient (4%) have perforation of gallbladder and one patient (1.3%) has sinus bleeding from the liver bed, (these four patients underwent difficult laparoscopy), and no post-operative complication recorded apart from mild abdominal pain mostly at the wound sites and occasional postoperative vomiting. Regarding those 47 patients with wall thickness>3mm, perforation of gallbladder happened intra-operatively in seven patients(14.89%), four of which during dissection of gallbladder from its bed, while the other three during extraction of the gallbladder from the epigastric port. Intraoperative bleeding was recorded in five patients (10.36%).In regard to these 12 patients 10 patients underwent difficult laparoscopy, while two of them whos severe bleeding had been occurred; were converted to open cholecystectomy. Postoperative wound infection occurs in three patients (6.38%), (Table 3, figure 5).

Table 2: The type of operation according to gallbladder wall thickness in 122 patients.

<table>
<thead>
<tr>
<th>Gallbladder wall thickness</th>
<th>Easy laparoscopic surgery</th>
<th>Difficult laparoscopic surgery</th>
<th>Conversion to open</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤&lt;3mm (n=75)</td>
<td>67</td>
<td>5</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>&gt;3mm (n=47)</td>
<td>20</td>
<td>22</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>Total (122)</td>
<td>87</td>
<td>27</td>
<td>8</td>
<td>122</td>
</tr>
</tbody>
</table>

* P=0.0001 (Significant using Pearson Chi-square test at 0.05 level)

Figure 4 (histogram): The type of operation according to gallbladder wall thickness in 122 patients.

20 of them (42.55%) underwent easy laparoscopic cholecystectomy, 22 patients (46.8%) underwent difficult laparoscopic cholecystectomy, and five(10.63%) patients converted to open procedure, (Table 2 and Figure 4).

In regard to these 12 patients 10 patients underwent difficult laparoscopy, while two of them whos severe bleeding had been occurred; were converted to open cholecystectomy. Postoperative wound infection occurs in three patients (6.38%), (Table 3, figure 5).

Figure 4 (histogram): The type of operation according to gallbladder wall thickness in 122 patients.
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Table 3: The complication related to the gallbladder wall thickness

<table>
<thead>
<tr>
<th>Gallbladder wall thickness</th>
<th>Intraoperative</th>
<th>Post-operative (Wound infection)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perforation of gallbladder</td>
<td>Bleeding</td>
</tr>
<tr>
<td>=&lt;3mm (n=75)</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>4.0</td>
</tr>
<tr>
<td>&gt;3mm (n=47)</td>
<td>7</td>
<td>14.89</td>
</tr>
<tr>
<td>Total (122)</td>
<td>10</td>
<td>8.19</td>
</tr>
</tbody>
</table>

* P=0.001 (Significant using Pearson Chi-square test at 0.05 level)

Table 4: Comparison with other studies

<table>
<thead>
<tr>
<th>Study</th>
<th>No. of patients</th>
<th>Difficult</th>
<th>Converted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our study</td>
<td>122 patients</td>
<td>27 (22.13%)</td>
<td>8 (6.55%)</td>
</tr>
<tr>
<td>Mumtaz K. Hanna et al</td>
<td>512 patients</td>
<td>Not recorded</td>
<td>22 (4.3%)</td>
</tr>
<tr>
<td>Pawan et al</td>
<td>73 patients</td>
<td>24 (32.88%)</td>
<td>17 (23.28%)</td>
</tr>
<tr>
<td>Sharma SK et al</td>
<td>200 patients</td>
<td>35 (17.50%)</td>
<td>8 (4%)</td>
</tr>
</tbody>
</table>

Figure 5 (Histogram): The complication related to the gallbladder wall thickness.

The procedure was converted to open cholecystectomy in three patients (4%) from those 75 patients with gallbladder wall thickness ≤3mm, because of severe adhesion. With regard to other 47 patients with gallbladder wall thickness >3mm, five patients (10.63%) had converted to open cholecystectomy, three of them due to severe adhesion, while other two patients had severe bleeding from the liver bed, so difficult to be dissected laparoscopically. So we had encountered six patient converted to open due to adhesions, three patients from each group, the p value was 0.554 non significant.

Discussion:

Laparoscopic cholecystectomy has become the gold standard for the treatment of symptomatic gall stone.10 Gallbladder wall thickness on preoperative Ultrasound represents the presence of inflammation or fibrosis due to previous attacks of cholecystitis.5 Conversion from a LC to an OC is an intraoperative decision by the laparoscopic surgeon when visualization and identification of the operative anatomy is impaired by increased vascularity from the inflammatory response, dense adhesions, edema, fibrosis, or abnormal anatomy, such as short cystic duct or an intrahepatic gallbladder.6 It would be useful in advance to know which ones would require conversion so that experienced laparoscopic surgeon could be scheduled to minimize conversion rate.11 In this study gallbladder wall thickness significantly determines the difficulty during surgery. We found that increase gallbladder wall thickness (>3mm) on preoperative ultrasound which encountered in 47 patients (38.52%) in comparison to second group with thin gallbladder wall thickness (<3mm) 75 patients (61.47%) was associated with increase operative difficulty (46.80%), that mean 7 times increment the second group (6.66%), and our conversion rate to open surgery was (10.63%) in thick wall group, that mean 2 times increment the second group (4.0%). And in total number 122 patients we found increase operative difficulty was 22.13% and our conversion rate to open surgery was 6.55%, which is within the range reported by several other studies. Our center of laparoscopy newly instituted with newly developed experience, our study had been done in relatively short period we had no enough time to reach a perfect study. A study by Mumtaz K. Hanna et al, found that 512 patients (37.92%) from 1350 patients had increased gallbladder wall thickness >3 mm, 22 patients (4.3%) of them converted to open cholecystectomy. They encountered lower rate of conversion than our study because the operations had been done at better centers with good facilities available there, they are more expert than us with old hand in the laparoscopy. While a study by Pawan et al, found that 24 patients (32.88%) out of 73 patients had difficult on laparoscopic surgery, and 17 of them (23.28%) were converted to open surgery. The conversion rate was high in this study, which could be attributed to the multiple attacks of acute cholecystitis their patients suffered before reporting to the hospital, as is the trend generally in India. Also, they encountered some cases of carcinoma of the gallbladder and empyema of the gallbladder in their study, so they had higher rate in difficulties and conversion than our study. Last study by Sharma SK et al, found that, 35 patients (17.5%) out of 200 patients had difficult laparoscopy, 8 patients (4%) had converted to open cholecystectomy and this result showed no significant difference with our study.11 In our study, we found a good correlation between gallbladder wall thickness with difficult laparoscopic procedure and conversion to the
open procedure. Gallbladder wall thickness of more than three millimeter was significantly associated with a difficult surgical procedure. In our study we did not encounter serious injury during LC like injury to CBD, adjacent viscera or significant vessels.

Author Contributions
Majeed H. Alamiri: study conception, study design, and critical revision data collecton, Muthanna K. Advan: acquisition of data analysis and interpretation of data

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