Original Article

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

Majeed H. Alamiri* MBChB , DGS, FICMS
Muthanna K . Adwan** MBChB

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.

Fac Med Baghdad
2015; Vol.57 , No.2
Received: Jan, 2015
Accepted:April,2015

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 straight forward 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 < 3mm .

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.1Gallstones 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.2The main risk factor for gallbladder disease in Western countries is cholelithiasis. The main complications of cholelethiasis include: cholecystitis, choledocholithiasis, cholangitis, and biliary pancreatitis. In addition, cholelithiasis plays the role as the major risk factor for the development of gallbladder cancer.1For 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 in1987, since then minimal invasive surgery still evolving. It has rapidly replaced open cholecystectomy (OC) as the standard treatment.5Laparoscopic 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 cosmoses, 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 (ultrason ography).2Ultrasonography 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.7Ultrasonography 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

*Al-Yarmouk Teaching Hospital
**Dept Of Surgery \ Al-Yarmouk Teaching Hospital
E-mail: mjdalamiri@yahoo.co.uk

to within one mm in 93% of patients. 5The 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 followings:

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.

Age (years)	Male		Female	
	No	%	No	%
<20	2	10.0	10	9.8
20—29	4	20.0	22	21.6
30—39	7	35.0	37	36.3
40—49	4	20.0	20	19.6
50—59	2	10.0	7	6.8
=>60	1	5.0	6	5.9
Total	20	16.4	102	83.6

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

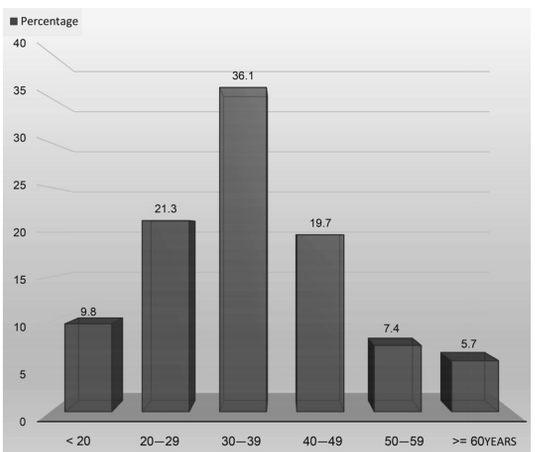

Figure 1 (histogram): The age distribution of patients

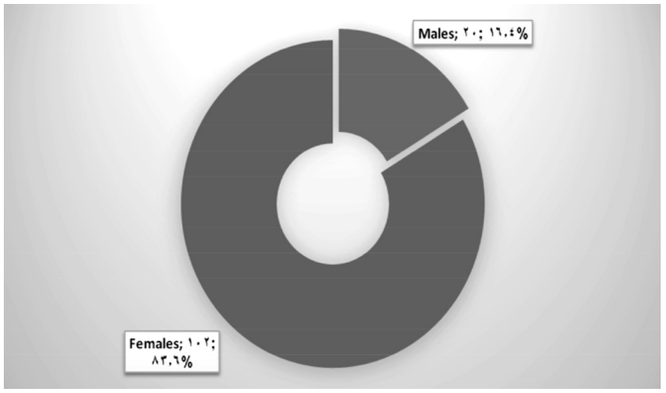

Figure 2 (piagram): Distribution of patients according to the gender (male to female ratio).

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 andthree patients(4%) converted to open procedure. The other 47 patients (38.52%) were having gallbladder wall thickness >3mm, (figure 3),

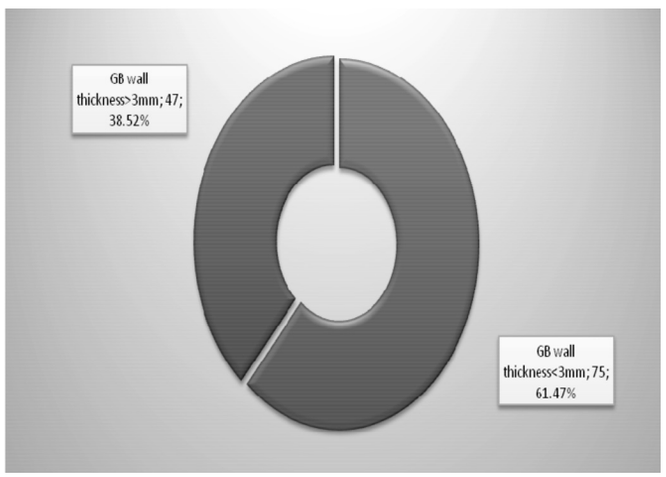

Figure 3 (piagram): Distribution of patients according to gallbladder wall thickness.

20 of them (42.55%) underwent easy laparoscopic cholecystectomy, 22patients (46.8%) underwent difficult laparoscopic cholecystectomy, and five(10.63%) patients converted to open procedure,(Table2 and Figure 4).

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

Gallbladder wall thickness	Easy laparoscopic surgery		Difficult laparoscopic surgery		Conversion to open		Total	
	No	%	No	%	No	%	No	%
=<3mm (n=75)	67	89.33	5	6.66	3	4.0	75	61.4
>3mm (n=47)	20	42.55	22	46.8	5	10.63	47	38.52
Total (122)	87	71.31	27	22.13	8	6.55	122	100

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

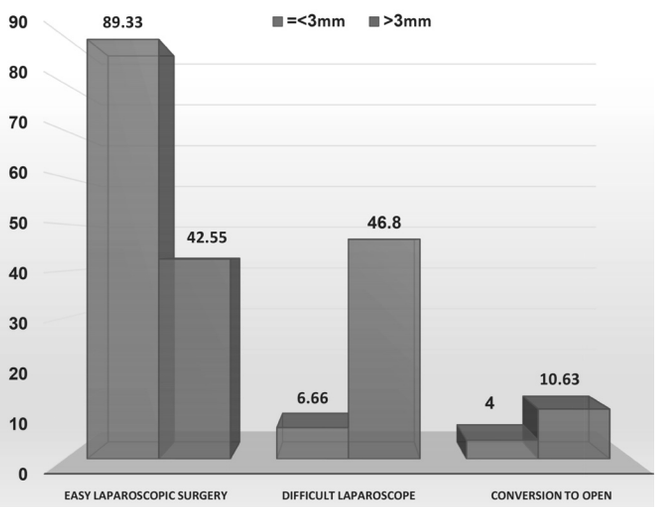

Figure 4 (histogram): The type of operation according to gallbladder wall thickness in 122 patients.

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 patints 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 3: The complication related to the gallbladder wall thickness

Gallbladder wall thickness	Intraoperative				Post-operative (Wound infection)	
	Perforation of gallbladder		Bleeding			
	No	%	No	%	No	%
=<3mm (n=75)	3	4.0	1	1.3	-	-
>3mm (n=47)	7	14.89	5	10.63	3	6.38
Total (122)	10	8.19	6	4.91	3	2.45

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

Table 4: Comparison with other studies

Study	No. of patients	Difficult	Converted
Our study	122 patients	27 (22.13%)	8 (6.55%)
Mumtaz K. Hanna et al	512	Not recorded	22 (4.3%)
Pawan etal	73 patients	24 (32.88%)	17 (23.28%)
Sharma SK et al	200 patients	35 (17.50%)	8 (4%)

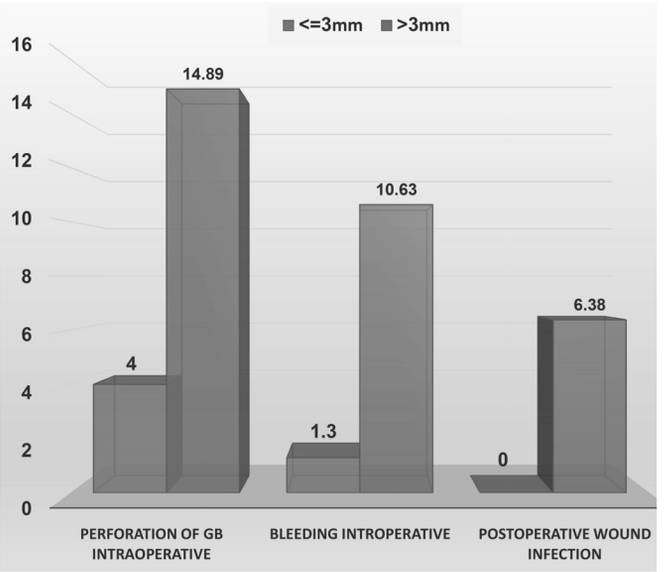

Figure5(Histogram): The complication related to the gallbladder wall thickness.

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.5Conversion 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.6It 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 al12, 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. 12They 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 al10, 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. 10The 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 al11, 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. Adwan: acquisition of data analysis and interpretation of data

References

1. *Margret Oddsdottir, Thai H. Pham and John G. Hunter. Gall bladder and extrahepatic bilirary system: F. Charles Brunicardi, Dana K. Andersen, Timothy R. Billiar et al. Schwartz's principles of surgery. USA, 9th edition. 2010; 1142.*

2. *Serkan Sengul, Suleyman Cetinkunar, Egemen Ciftci et al. Evaluation of Potential Intraoperative Technical Difficulties with Ultrasonography before Laparoscopic Cholecystectomy, European Journal of Surgical Siences. 2012; 3(1): 15-21.*

3. *Haitham. H. Al-Najafi, Muthanna Al. Al-Sharbaty, Adil M. Al-ibadi. Safety of elective Lapraroscopic cholecystectomy in the hands of Postgraduate trainees. The Iraqi postgraduate medical journal. 2013; 1: 137-45.*

4. *AL-Jawadi A. Ibrahim IR. Risk markers in cholelithiasis. Ann. Coll. Med. Mosul: 2004; 30(2):71-6.*

5. *Syed Amjad Ali Rizvi, Syed Asmat Ali, Sadik Akhtar et al: Forecast of difficult Laparoscopic cholecystectomy by Sonography: An added advantage. Biomedical Research 2012; 23(3): 425-9*

6. *Mohamed aslam, Shashank Chauhan, Tariq Mansoor et al: Prediction of conversion of laparoscopic to open cholecystectomy by ultrasonography. J. Med and Allied Health Sciences. 2012; 1(1): 25-9.*

7. *Aldo Benjamim Rodrigues Barbosa, Luis Ronan Marquez Ferreira de Souza; Rogério Silva Pereira et al: Gallbladder wall thickening at ultrasonography: how to interpret it? Radiol Bras 2011; Nov./Dec. 6:*

8. *Hans-Peter Dinkel, Simon Kraus, Jonhannes Heimbucher et al. Sonography for Selecting Candidates for laparoscopic Cholecystectomy A Prospective Study. AJR 2000; 174:1433-9.*

9. *Gallstones and Laparoscopic Cholecystectomy. National Institutes of Health Consensus Development Conference Statement. 1992; September: 14-6*

10. *Pawan Lal, PN Agarwal, Vinod Kumar Malik et al: A Difficult Laparoscopic Cholecystectomy That Requires Conversion to Open Procedure Can Be Predicted by Preoperative Ultrasonography, journal of the society of laparoendoscopic surgeons. 2002; Jan-Mar: 6(1): 59–63.*

11. *Sharma SK, Thapa PB, Pandey et al: Predicting difficulties during laparoscopic cholecystectomy by preoperative ultrasound. Kathmandu University Medical Journal. 2007; 1: 8-11*

12. *Mumtaz K. Hanna, Mohammed K. Mohammed, Layth N. Hindosh: Predictability of conversion from laparoscopic to open cholecystectomy: retrospective analysis of risk factors. The Iraqi postgraduated medical journal. 2010;1:25-30.*

13. *Schlarger A,Khalaileh A, Shussman N, Elazary R. Current methods of retraction in SIMI and NOTES cholecystectomy. Surg Endosc. 2010;24:1542-6.*

14. *Podolsky ER, Rottman SJ, Curcillo PG. Single port access cholecystectomy:Two year follow-up.JSLS.2009;13:528-35.*

15. *Piskun G, Rajpal S. Transumbilical Laparoscopic cholecystectomy utilizes no incisions outside the umbilicus. J Laparoendos Adv Surg Tech. 1999;9:361-4.*

16. *Romanelli J, Roshek T, Lynn D, Earle D. Single-port Laparoscopic cholecystectomy :Initial experience Surg Endosc. 2010;24:1374-9.*

17. *Gurusamy KS, Samraj K. Early versus delayed Laparoscopic cholecystectomy for acute cholecystitis. Cochrane Database Syst Rev. 4: CD 005440,2006.*

18. *Reynolds W. The first Laparoscopic cholecystectomy. JSLS.2001, 5:89-94.*

19. *Early Laparoscopic Cholecystectomy. Author :Thakur K. Journal :The professional Medical Journal. ISSN:10248919. Year:2008 Volume:15 Issue:01 Pages:162-167 Provider: Inpdependent publishing house—DOAJ Publisher:independent publishing house.(IVSL).*

20. *Laparoscopic cholecystectomy during pregnancy. Authors :Singh Kuldip--- ohri A---Junejas. Journal:Indian Journal of Surgery Issn :09722068 Year:2005 Volume :67 Issune : 3 Pages :131-134 Provider: Medknow publications on behalf of the Assciation of Surgeon Publisher:Medknow publications on behalf of the Association of Surgeon.(IVSL).*