

## ORIGINAL RESEARCH

# Comparative analysis of preoperative ultrasonography reports with intraoperative surgical findings in laparoscopic cholecystectomy

<sup>1</sup>Apurva Macwan, <sup>2</sup>Avaneet Shakya, <sup>3</sup>P.D.Gupta, <sup>4</sup>Amit Gupta

<sup>1-4</sup>Department of General Surgery, School of Medical Sciences & Research, Sharda University, India

### Corresponding Author

Apurva Macwan

Department of General Surgery, School of Medical Sciences & Research, Sharda University, India

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### ABSTRACT

**Aim:** Comparative analysis of preoperative ultrasonography reports with intraoperative surgical findings in laparoscopic cholecystectomy. **Materials and methods:** This cross sectional observational study was done in the Department of General Surgery, Sharda Hospital, School of Medical Sciences & Research (Greater Noida) from December 2020 to July 2022. 90 male and female patients with equal to or more than 18 years of age who are diagnosed with Cholelithiasis by Ultrasound whole abdomen and undergoing Laparoscopic Cholecystectomy will be included in the study. **Results:** In this study, in 21 patients, it took 90 minutes or more to operate. Out of which 7 patients had Adhesions and none of them were reported in USG, three had Mucocoele and none were reported in USG, one had impacted stone which was reported in USG, one had Empyema which was missed on USG. In two patients haemorrhage from liver bed was responsible for increased duration of surgery. The complications were reported among 20.9% subjects with Adhesions among 13.2%, Mucocoele among 3.3%, Empyema among 1.1% and Impacted stone among 1.1%. Out of 10 patients in which preoperative USG report showed increased GB wall thickness, four (40%) had adhesions, one had mucocoele (10%) and one had empyema (10%). The average time taken in these 10 patients was 92 minutes. **Conclusion:** The most reliable indicator of a challenging laparoscopic cholecystectomy was gall bladder wall thickness, which was impacted gall stones and mucocoele which can lead to increase in time taken for the surgery. Though impacted stones were a good indicator of difficult laparoscopic cholecystectomy, it may often be missed on USG.

**Keywords:** Ultrasonography, Intraoperative, Surgical Findings, Laparoscopic cholecystectomy.

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### INTRODUCTION

One of the most prevalent Gastrointestinal Illness, Gallstones afflict 10% of individuals in Western world<sup>[1]</sup>. They are mostly asymptomatic, only 10% and 20% will become symptomatic within 5 and 20 years of diagnosis respectively. Henceforth, the average risk of developing symptomatic disease is little, and approaches 2.0-2.6% per year<sup>[2,3]</sup>.

Patients with symptomatic gall stones may suffer with severe pain in the right upper abdomen, frequently accompanied by nausea and vomiting, that steadily worsen over the course from 30 mins to several hours. A patient may also feel referred pain (Boa's Sign) below the right shoulder area or between the shoulder blades. Attacks almost always occur at night particularly after a fatty meal<sup>[4]</sup>.

In the past, research has been done in a number of directions to provide less invasive ways to treat gall

stones. Stone content, size and number are restrictions on approaches, including application of oral desaturation agents (chenodeoxycholic acid, ursodeoxycholic acid), contact dissolution agents methyl tertbutylene ether (MTBE), and extracorporeal shock wave lithotripsy (ESWL). Additionally these approaches do not remove the gallbladder which is known to contain lithogenic bile. Therefore a major number of patients don't benefit from these non-operative procedures, and thus measures don't guarantee a permanent recovery from gall stone disorders<sup>[5]</sup>

Since Muhee first introduced laparoscopic cholecystectomy in 1986, it has grown in popularity and is currently regarded as the treatment of choice for symptomatic illness. It has a number of benefits over open cholecystectomy including shorter hospital stay,

less pain and morbidity, better cosmetic results, early return to work and significant cost savings<sup>[6]</sup>.

The most frequent major abdominal procedure performed now in the world is the cholecystectomy, which has quickly taken over as the preferred method for gallbladder removal. The benefits of laparoscopic cholecystectomy above open cholecystectomy have been characterized as "obvious and persuasive" based on retrospective evidence showing that the procedure is safe and effective. These include a shorter hospital stay, lower morbidity, quick healing, and improved cosmesis.<sup>[2-5]</sup> Additionally, analyses of physiologic and biochemical responses reveal little deviation from typical behaviour.<sup>[6]</sup>

Despite having various advantages over laparotomy, like reduced hospital stay, reduced morbidity, better cosmetic outcome and reduced financial burden, the number of patients not relieved by the procedure has significantly increased in comparison to laparotomy. Around 15-20% who have got their cholecystectomy, continue to experience various gastrointestinal symptoms<sup>[7]</sup>.

In 1947, Womack and These said symptoms may represent either the continuation of symptoms that had been interpreted as resulting from pathology of gallbladder or the emergence of fresh symptoms that typically are linked to the gall bladder<sup>[8]</sup>. Crider first described Post Cholecystectomy Syndrome, defining it as -the persistence of symptoms following cholecystectomy.<sup>[8]</sup>

The most common extrabiliary causes to be mentioned in literature include gastrointestinal conditions like acute/chronic pancreatitis (and complications), pancreatic tumors, hepatitis, esophageal diseases, peptic ulcer disease, etc. The importance of studying post-cholecystectomy syndrome lies in the fact that even after a successful laparoscopic cholecystectomy, patients face similar symptoms which can be distressing.<sup>[8]</sup>

Cholecystectomy is associated with various physiological changes in the upper gastrointestinal tract which may account for the persistence of symptoms or the development of new symptoms after gallbladder removal<sup>[6]</sup>. In 85% of the cases, Post Cholecystectomy Syndrome was caused by alteration of bile flow because of loss of the gallbladder's reservoir function after cholecystectomy. The Increased bile flow in the upper gastrointestinal tract, leads to esophagitis and gastritis. In the lower gastrointestinal tract, it can cause diarrhea.<sup>[9]</sup>

Symptomatic cholelithiasis, with or without problems, and asymptomatic cholelithiasis in people at greater risk for gallbladder cancer or gallstone complications are among the indications for laparoscopic cholecystectomy, which are very much similar to those for open cholecystectomy.<sup>[10]</sup>

Laparoscopic cholecystectomy is becoming increasingly popular, although there have been some serious side effects that have been recorded. Appropriate patient selection, thorough technique, and

the willingness to switch over to open surgery when in question all contribute to the prevention of these problems.<sup>[11]</sup>

Abdominal ultrasonography (USG), a diagnostic procedure with comparatively low cost, free of any ionizing radiation and non-invasive is the most often utilized test to validate the preoperative diagnosis. This test is the gold standard for the detection of extra hepatic biliary disorders, identifying gallstones as small as 1.5–2 mm in diameter. Its estimated sensitivity and specificity are 84% and 99%, respectively.<sup>[12-14]</sup>

Existing ratings are used as arbitrary measures to identify patients at high risk, create risk-assessment models, and quantify the likelihood that a laparoscopic treatment would change into an open procedure. Conversion, however, does not accurately reflect the difficulty of an operation. Contrarily, operating time is seen as a repeatable indicator of the difficulty a surgeon would face.<sup>[15]</sup> Surgeons can choose the cases that are most suited to their abilities based on ultrasound results with the goal of avoiding operating room waste and operative difficulties.<sup>[3]</sup>

Preoperative ultrasound is useful in identifying surgical challenges or even the possibility of conversion.<sup>[16]</sup> The common bile duct's width and gall bladder wall thickness can also point to more challenging surgical steps.<sup>[16]</sup> Patients who have a gall bladder wall thickness of more than four millimetres on ultrasonography are more likely to have a difficult operation or conversion to open, as well as a higher risk of bile duct injury or harm to the adjacent viscera. There is a good correlation between gall bladder wall thickness and conversion to open procedure.<sup>[14]</sup>

Another study showed that stone impaction at the gall bladder neck can be a good predictor for conversion.<sup>[16]</sup> The accuracy of presence of pericholecystic fluid on ultrasonography, is another factor of difficult laparoscopic surgery. The presence of multiple stones within the gall bladder on ultrasonography is another indicator of difficult laparoscopic surgery.<sup>[14]</sup> Gall bladder wall thickness of more than 4 mm, stone impaction at GB neck, multiple stones and pericholecystic fluid on Ultrasonography are various factors that may point tow difficult Laparoscopic surgery. Due to paucity of the literature with respect to the current topic among our population. The present study was done to identify the ability of pre-operative Ultrasonography in predicting difficult Laparoscopic Cholecystectomy.

## MATERIALS AND METHODS

This cross sectional observational study was done in the Department of General Surgery, Sharda Hospital, School of Medical Sciences & Research (Greater Noida) from December 2020 to July 2022. 90 Patients diagnosed with gallbladder stones were included in this study.

**INCLUSION CRITERIA**

- Both male and female patients with equal to or more than 18 years of age who are diagnosed with Cholelithiasis by Ultrasound whole abdomen and undergoing Laparoscopic Cholecystectomy will be included in the study.

**EXCLUSION CRITERIA**

- Patients with Common Bile Duct stone/s
- Patients who are willing only for Open

Cholecystectomy.

**STATISTICAL ANALYSIS**

This is an observational study and the results are represented in percentage forms. Quantitative data will be presented as mean + SD. Chi square test was used for data analyzing wherever applicable. P value <0.05 was considered significant. Data was analysed by statistical package for social sciences (SPSS) version v24.0.

**RESULTS**

**Table 1: Distribution of study population according to Age**

Age groups	Frequency	Percent
20-30 years	32	35.5%
31-40 years	23	25.3%
41-50 years	16	17.6%
51-60 years	11	12.1%
> 60 years	8	8.8%
Mean±SD	39.30±13.59	

The mean age of the study population was 39.30±13.59 years with majority (36.3%) belonging to 20-30 years followed by 31-40 years (25.3%), 41-50 years (17.6%), 51-60 years (12.1%) and more than 60 years age group (8.8%).

**Table 2: Distribution of study population according to Gender**

Sex	Frequency	Percent
Male	12	13.2%
Female	78	86.8%

There were 13.2% males and 86.8% females.

**Table 3: Distribution of study population according to Impacted stone**

Impacted Stones	Frequency	Percent
No	89	98.9%
Yes	1	1.1%

Impacted Stones were reported among one (1.1%) subject.

**Table 4: Distribution of study population according to Increased GB wallthickness**

Thickened GB wall	Frequency	Percent
No	80	89.0%
Yes	10	11.0%

Thickened GB wall was reported among 11.0% patients.

**Table 5: Distribution of study population according to Time taken**

Time Taken	Frequency	Percent
30	2	2.2%
40	12	13.2%
45	8	8.8%
50	8	8.8%
60	24	26.6%
70	8	8.8%
75	3	3.3%
80	4	4.4%
90	14	15.4%
100	2	2.2%
120	5	5.5%
Mean ± SD	65.55± 21.93	

In this study, in 21 patients, it took 90 minutes or more to operate. Out of which 7 patients had Adhesions and none of them were reported in USG, three had Mucocoele and none were reported in USG, one had impacted

stone which was reported in USG, one had Empyema which was missed on USG. In two patients haemorrhage from liver bed was responsible for increased duration of surgery.

**Table 6: Distribution of study population according to Operative finding**

Operative Findings	Frequency	Percent
No abnormal finding except gall stones.	73	78.8%
Adhesions	12	13.2%
Mucocoele	3	3.3%
Empyema	1	1.1%
Impacted stone	1	1.1%

The complications were reported among 20.9% subjects with Adhesions among 13.2%, Mucocoele among 3.3%, Empyema among 1.1% and Impacted stone among 1.1%.

**Table 7: Distribution of study population according to Conversions**

Conversions	Frequency	Percent
No	88	97.8%
Yes due to Adhesions	2	2.2%

Though adhesions were reported (USG findings) in two cases, intraoperatively 12 cases had adhesions out of which two cases were subjected to conversion. Both of these cases which were converted to open did not have adhesions reported in preoperative USG finding. Out of the two cases which had adhesions as preoperative USG finding only one had adhesions intraoperatively. So in our study preoperative USG is not a good indicator of adhesions and is of little value in predicting difficult laparoscopic cholecystectomy and conversion.

**Table 8: Distribution of study population according to Complication :**

Complications	No	Yes
Yes (Hemorrhage)	88	2
	97.8%	2.27%
$\chi^2$ value = 0.819, p-value = 0.976		

Out of the 90 patients in the study two of them had complication of hemorrhage. Both these cases showed no USG finding other than hyperechogenicity with PAS and they were not subjected to conversion. The mean time taken in patients who had intraoperative haemorrhage was 105 minutes as compared to 65 minutes for total patients.

**Table 9: Distribution of study population correlating GB wall thickness with other Intraoperative findings and/or Complication**

GB wall thickness	Adhesions	Mucocoele	Empyema	Impacted stone	Hemorrhage
Normal	80	8	0	1	2
	10%	2.5%	0	1.2%	2.5%
increased	10	4	1	0	0
	40%	10%	10%	0	0

Out of 10 patients in which preoperative USG report showed increased GB wall thickness, four (40%) had adhesions, one had mucocoele (10%) and one had empyema (10%). The average time taken in these 10 patients was 92 minutes.

There was only one case with USG finding of an impacted stone which correlated with the operative finding. The time taken in this case was 90 minutes. Operative finding showed a mucocoele which was not picked up on USG. This patient did not have adhesions and there was no hemorrhage. Preoperatively five patients had impacted stones with three mucocoele and one empyema. So four out of these five cases were missed in preoperative USG. So in our study though impacted gall stone is a good measure of difficult procedure, USG failed to pick up impacted stones in majority of the cases.

In this study two patients were reported to have adhesions in USG. However 12 had adhesions intraoperatively. So 83% of patients who had adhesions were not reported in USG. The average time

taken was 87 minutes. The two patients which had adhesions in USG report correlated intraoperatively and had no other significant intraoperative finding and were not subjected to conversion.

### DISCUSSION

One of the most popular surgical procedures performed globally is laparoscopic cholecystectomy.<sup>[17]</sup> Even though a laparoscopic cholecystectomy appears to be one of the simpler procedures, it may be hazardous and challenging for even the best surgeons. Chances of iatrogenic bile duct injury that can have a significant impact on a patient's quality of life have been one of the most terrifying situations and wherever deemed necessary, appropriate measures should be taken to reduce the level of perseverance and early conversion.<sup>[18]</sup>

The conversion and surgical results are largely determined by anatomical heterogeneity and inflammatory variables. The late presentation of patients for medical care results from challenging

geographic diversity and a lack of understanding of the disease process. By the time they are noticed by the treating surgeon, the window of opportunity for treatment has already passed, and the course of the treatment changes.

### AGE

In present study, the mean age of the study population was  $39.30 \pm 13.59$  years with majority (36.3%) belonging to 20-30 years followed by 31-40 years (25.3%), 41-50 years (17.6%), 51-60 years (12.1%) and more than 60 years age group (8.8%). *Chindarkar et al.*<sup>[19]</sup> reported that the mean age of the patients was  $43.2 \pm 12.6$  years. *Khetan et al.*<sup>[20]</sup> found that the majority of patients were in the age group of  $\leq 50$  years (n=25) and only (n=5) were  $>50$  years. *Gupta et al.*<sup>[21]</sup> stated that 32% were in the age group of 40-49 years (range 8-77 years).

### GENDER

In current study, there were 13.2% males and 86.8% females. In line with our findings, *Chindarkar et al.*<sup>[19]</sup> reported that 28.3% were males and 71.7% were females. *Khetan et al.*<sup>[33]</sup> found that there were 11 males and 19 females. *Gupta et al.*<sup>[21]</sup> stated that sex ratio Female: Male was 4:1.

### CONVERSION

In our study, the conversion rate was 2.2% with only being adhesions. Laparoscopic cholecystectomy conversion rates range from 1.5 to 19%. According to *Yetkin et al.*<sup>[22]</sup> (17.33%) of the 108 patients required conversion to open cholecystectomy. The United States National Hospital Discharge Surveys,<sup>[18]</sup> which identified one million individuals who underwent cholecystectomy from 2000 to 2005, revealed a conversion rate of 9.5%.

*Chindarkar et al.*<sup>[19]</sup> reported that the conversion to an open operation was required in 45% challenging laparoscopic cholecystectomy patients. The conversion rate was 9/60 (15%). The several acute cholecystitis episodes previously before presenting to the hospital can be blamed for the study's relatively high conversion rate. All around India, this tendency is frequently observed. The conversion rate is greater in patients with acute cholecystitis, at 22% and in certain studies, it can reach up to 35%. *Cwik et al.*<sup>[23]</sup> reported that 24% of individuals with acute cholecystitis were converted to open. A few studies have looked at the best time to do surgery for acute cholecystitis, but generally, it has been suggested that after four days of symptoms, the conversion rate considerably increases.<sup>[21-23]</sup>

### USG FINDINGS

In our study, Hyperechogenicity with PAS was reported among 96.7% subjects. Impacted Stones were reported among one (1.1%) subjects. Thickened GB wall was reported among 11.0% patients. Empyema and Mucocoele were not reported in any cases.

According to *Gupta et al.*<sup>[21]</sup> 72% of patients had a distended GB and 22% of patients had developed GB. 18% of individuals had GB thickness more than three mm. 82% of USG had several stones.

### OPERATIVE FINDINGS

In present study, the Operative Findings were reported among 20.9% subjects with Adhesions among 13.2%, Mucocoele among 3.3%, Empyema among 1.1%, Hemorrhage among 2.2% and Impacted stone among 1.1%. Conversion to open was seen in 2.2% subjects, the reason solely being adhesions.

### ASSOCIATION OF OPERATIVE FINDINGS WITH USG FINDINGS

In present study, Increased GB wall thickness in USG report was associated with 40% adhesions, 10% mucocoele and 10% empyema intraoperatively and is thus helpful in predicting difficult laparoscopic cholecystectomy. In our study none of these patients needed conversion to open procedure. *Randhawa and Pujahari.*<sup>[24]</sup> found statistically significant indicators in predicting problematic LC which included palpable GB and USG finding of Thick-walled GB. *Cwik et al.*<sup>[23]</sup> identified the anatomical structures because of localized, severe inflammation on 34% of patients, and it was seen on ultrasound in 31% of patients who needed conversion.

*Gupta et al.*<sup>[21]</sup> reported that Gall bladder wall thickness  $>3$  mm, sessile gall bladder, male gender, and occluded architecture of Calot's owing to adhesions were all significant predictors of conversion. *Nidoni et al.*<sup>[25]</sup> stated that GB wall thickness of  $>3$ mm, and Pericholecystic collection were all statistically significant. In this study, pericholecystic fluid was not reported in any preoperative USG. *Kumar et al.*<sup>[26]</sup> stated that initial increased gallbladder wall thickness is associated with difficult GB dissection. Bivariate studies of preoperative and intraoperative observations revealed a statistically significant association between the GB wall thickness and the degree of surgical difficulties.

*Gupta et al.*<sup>[21]</sup> reported that the conversion rates increased six fold when thick GB walls ( $>3.5$  mm) were discovered by ultrasonography. In their study of 200 patients having LC, *Sharma et al.*<sup>[27]</sup> discovered that 3/42 patients needed conversion and that instances with contracted GB on ultrasonography had ambiguous Calot's. Due to uncertain Calot's anatomy, four out of 32 patients with inflated GB on ultrasonography required conversion. In present study two cases were subjected to conversion with adhesions being the only reason which was not reported in preoperative USG.

The difficulty experienced during laparoscopic cholecystectomy was significantly correlated with gallbladder wall thickness more than four mm, which is consistent to other research with the exception of one study where the opposite has been documented. Other studies have found a relationship between

the common bile duct diameter and the difficulties in laparoscopic cholecystectomy as well as conversion to open operation.<sup>[28,29]</sup> The common bile duct diameter and gall bladder wall thickness were the two best ultrasonographic indicators for predicting the difficulties of laparoscopic cholecystectomy, according to *Daradkeh et al. and Lal et al.*<sup>[28,29]</sup>

### IMPACTED STONE

In this study one preoperative USG reported Impacted stone which was consistent with the Intraoperative finding. The treatment was challenging for *Kidwai et al.*<sup>[30]</sup> because of an impacted stone near Hartmann's pouch. 2-15% of people receiving elective LC need to convert to open.<sup>[31]</sup> In contrast to those findings, stone impaction was shown to have a modest connection in other investigations.<sup>[28]</sup>

*Nachmani and Supe.*<sup>[32]</sup> came to the conclusion that difficulties in extraction was related to calculi larger than one cm, but not to the quantity of stones. In the *Gabriel et al.* study, the individuals with numerous calculi had a greater incidence of conversion (34%). 60% of the sixty patients with GB wall thickness more than three mm, experienced conversion.<sup>[33]</sup>

### CONCLUSION

This study has demonstrated a substantial relationship with challenging laparoscopic cholecystectomy and pre-operative USG abnormalities such as gall bladder wall thickness and impacted gall bladder stones. The most reliable indicator of a challenging laparoscopic cholecystectomy was gall bladder wall thickness, which was impacted gall stones and mucocoele which can lead to increase in time taken for the surgery. Though impacted stones were a good indicator of difficult laparoscopic cholecystectomy, it may often be missed on USG. It has also been seen that USG is not a good predictor of adhesions which was the sole reason of conversion in this study.

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