

# Role of Laparoscopic Subtotal Cholecystectomy in Cases Requiring Conversion

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**Abstract:** *Laparoscopic cholecystectomy has become the gold standard in the treatment of cholelithiasis with cholecystitis and has replaced open cholecystectomy. The rate of conversion from laparoscopic cholecystectomy to open cholecystectomy is 5 to 10%. Hence it is necessary to study the role of laparoscopic subtotal cholecystectomy in cases requiring conversion for difficult laparoscopic cholecystectomy. Therefore this study was undertaken. In cases of difficult cholecystectomy like distorted gallbladder anatomy in conditions like acute / chronic inflammation, portal hypertension, In this prospective study 332 patients suffering from symptomatic cholelithiasis are evaluated using specific clinical and ultrasonographic parameters prior to Laparoscopic Cholecystectomy to assess whether the difficulty of the procedure can be predicted and the role of laparoscopic subtotal cholecystectomy in cases requiring open conversion, over a period of 2 ½ year. It would be useful to accurately identify a patient's risk for difficult cholecystectomy based on pre-operative details and can result in accurate preoperative patient counselling, better scheduling of surgery and appropriate assignment of surgical assistance, can increase the patient safety by reducing need of conversion to open, and improving the mental preparedness of surgeons and patients also.*

**Keywords:** Acute Cholecystitis (AC), Laparoscopic Cholecystectomy (LC), Conversion rate, Laparoscopic subtotal Cholecystectomy (LSTC)

## 1. Introduction

The advantages of laparoscopic cholecystectomy over open cholecystectomy are earlier return of bowel functions, less postoperative pain, improved cosmesis, shorter length of hospital stay, earlier return to full activity, and decreased overall cost. Laparoscopic cholecystectomy is associated with better preservation of immune function and a reduction of the inflammatory response compared with open surgery. Laparoscopic cholecystectomy has become the gold standard in the treatment of cholelithiasis and is replacing open cholecystectomy. The rate of conversion from laparoscopic cholecystectomy to open cholecystectomy is 5 to 10%. Hence it is necessary to study the role of laparoscopic subtotal cholecystectomy in cases requiring conversion for difficult laparoscopic cholecystectomy. Therefore this study was undertaken. In cases of difficult cholecystectomy like distorted gallbladder anatomy in conditions like acute / chronic inflammation, portal hypertension, laparoscopic subtotal cholecystectomy is a safe alternative these days and it is associated with less morbidity and mortality. In this prospective study done in Dept. of General Surgery, Katuri Medical College and Hospital, 332 patients suffering from symptomatic cholelithiasis are evaluated using specific clinical and ultrasonographic parameters prior to Laparoscopic Cholecystectomy to assess whether the difficulty of the procedure can be predicted and the role of laparoscopic subtotal cholecystectomy in cases requiring conversion, over a period of 2 ½ year. It would be useful to accurately identify a patient's risk for difficult cholecystectomy based on pre-operative details and can result in accurate preoperative patient counselling, better scheduling of surgery and appropriate assignment of surgical assistance, can increase the patient safety by reducing need of conversion to open, and improving the mental preparedness of surgeons and patients also.

## 1.1 Aims and Objectives

### 1.1.1 Study Goals

The aim of this study is to evaluate the role of laparoscopic subtotal cholecystectomy for all intraoperative difficulties and complications faced during Laparoscopic cholecystectomy.

### 1.1.2 Objectives

- To study clinical parameters in patient with symptomatic cholelithiasis undergoing laparoscopic cholecystectomy like Age, Gender, BMI, Previous surgeries whether they have any relation on the difficulties faced during LC.
- To study role of laparoscopic subtotal cholecystectomy in cases where difficulty of LC in terms of duration of surgery, bleeding during LC Gall Bladder bed dissection, difficulty in extraction, and whether the pre-operative clinical and ultrasonography findings help predict the difficulty in such cases.

## 2. Methodology

The method for the study included screening of patients who presented with upper abdominal pain, or vomiting or dyspepsia or jaundice. Such patients were studied in detail clinically and investigated as per the proforma detailed below.

Routine haematological and biochemical investigations were done. LFT and PT-INR were done in all patients. Ultrasonogram of the abdomen is done after a 12 hour fast. The patients confirmed by USG examination were evaluated with following factors: age, sex, h/o previous hospitalization, BMI wt (kg)/ ht (m<sup>2</sup>), abdominal scar, supraumbilical or infraumbilical, sonographic findings- wall thickness, GB size, number of stones, mobility of stones, stone size.

All the patients were received symptomatic treatment and vitamin K for 3 days pre-operatively.

Following evaluation the patient will be subjected to laparoscopic cholecystectomy and time taken, biliary / stone spillage or conversion were noted. All the patients were operated by experienced surgeons.

Post operatively cases were followed up for any complication. S/R was done 8<sup>th</sup> post OP day. All cases were followed up for any recurrent symptoms.

### Inclusion Criteria

The patients above 20 years of age, presenting with symptoms and signs of Cholelithiasis and diagnosed by USG examination. Data was collected on randomized non randomized and retrospective studies with data on laparoscopic subtotal cholecystectomy technical and outcome.

### Exclusion Criteria

#### Patients below 20 years of age

- Patients with CBD calculus where CBD exploration was needed.
- Patients with features of acute cholecystitis, obstructive jaundice, gall stone pancreatitis.
- Patients refusing surgery.
- Patients not willing for laparoscopic cholecystectomy.

#### Definition of variables

- Age is considered as a continuous variable.
- Body habitus is treated as a dichotomous variable 1.obese [body mass index >30 Kg/m<sup>2</sup>] versus 2. non-obese).
- Previous abdominal surgery is classified as any intra-abdominal surgery versus
- none.
- The sub-costal angle is classified as narrow and wide, narrow subcostal angle was defined as < 90 degrees.
- Acute calculous cholecystitis is defined as acute onset right hypochondrial pain, associated with gall bladder calculi and pericholecystitic fluid collection.
- Acute gallstone pancreatitis was defined as cholelithiasis with a raised serum amylase to ten times its normal level at any time prior to surgery.

The abdominal ultrasonological examination is done to assess six parameters, with each parameter classified into two classes

- The GB was classified as contracted or distended. It was defined as distended if the transverse diameter was greater than five centimeters<sup>3</sup>.
- GB wall was deemed thickened if wall thickness > 3mm.
- The mobility of the stone is determined by scanning the patient in various decubitus positions.
- Number of stones in Gall bladder. (Multiple versus Solitary).
- The largest stones's diameter is recorded and classified into two groups (<1 cm
- versus >1 cm)

The outcomes included the following operative observations:

- Duration of surgery (in minutes),
- Bleeding during surgery,
- Access to peritoneal cavity,
- GB bed dissection,
- Difficult extraction,
- Conversion to laparoscopic subtotal cholecystectomy

Bleeding during surgery was graded as minimal, moderate or severe. Moderate bleeding is defined as bleeding leading to tachycardia of greater than 100/min without drop in blood pressure. Severe bleeding is defined as bleeding leading to tachycardia of greater than 100/min with a greater than 10 mmHg drop in blood pressure. Duration of surgery included the time from insertion of the Veress' needle to closure of the trocar insertion site<sup>4</sup> and is evaluated as a dichotomous variable (<90 min versus >90 min. The operating surgeon was not aware of the preoperative US results and gave a opinion on LC difficulty at the end of the surgery in a two-level classification (easy, difficult) The parameters and outcomes are analysed using SPSS and EPI info statistical softwares.

### 3. Results

This study included 324 cases that were studied prospectively over a period of 2 ½ years, from August 2015 to November 2017, out of which 50 people underwent conversion to laparoscopic cholecystectomy.

#### Age Distribution

In the present series the youngest patient was 20 yrs of age and the oldest was 75 yrs of age. Majority of the patients in the present series were in the age group of 31-40 yrs of age.

#### Age distribution for people underwent conversion LSTC

Age Group	No Of Persons	Percent
20 yrs	1	2%
21-30 yrs	11	22
31-40 yrs	14	28
41-50 yrs	13	26
51-60 yrs	8	16
61-70 yrs	2	4
71-80 yrs	1	2
<b>Total</b>	<b>50</b>	<b>100%</b>

#### Sex distribution who under went LSTC

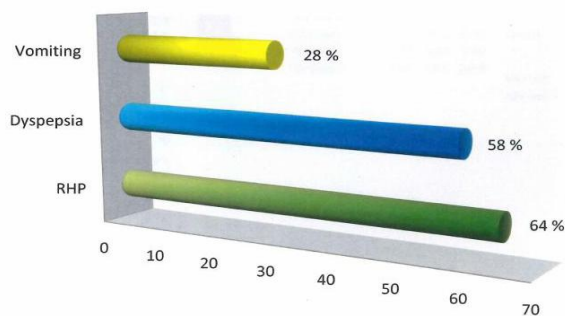
Out of 324 patients studied 50 people underwent conversion among which 37 were females and 13 were male patients. The male female ratio is 1 : 2.8.

#### Sex distribution

Sex	Present series	%	Hanif series	%
Male	13	26%	90	36%
Female	37	74%	160	64%

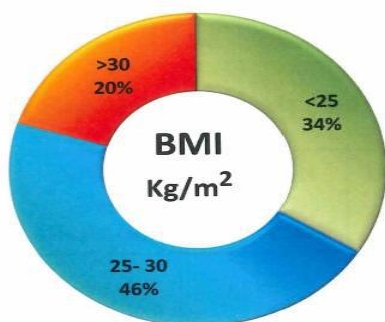
#### Presenting Symptoms Who Under Went LSTC

Pain was the predominant symptom seen in all 324 patients. Right hypochondrial pain was present in 194 (64%) of the patients 187(58%) of the patients had dyspepsia, 90.72 (28%) of the patients had vomiting.



**BMI**

Out of 50 patients, who underwent conversion to laparoscopic subtotal Cholecystectomy 10 patients were obese, while 23 were overweight and 17 had normal BMI.



The following table depicts the influence of BMI > 30 Kg/M2 as a factor on the various steps of Laparoscopic cholecystectomy.

**BMI as Factor for difficult cholecystectomy**

BMI	Difficult Peritoneal access	Difficult Bed dissection	Difficult GB extraction	Duration of surgery	Difficult surgery
<30(n=40)	9(64%)	17(73%)	9(64%)	17(73%)	15(37%)
>30(n=10)	5(36%)	5(26%)	5(36%)	6(26%)	5(50%)

From the above results, it is evident that surgeons faced difficulty in accessing the peritoneal cavity and extraction of Gall bladder in persons with BMI > 30 kg/m2.

**Past Intra – Abdominal Surgery**

In this study, out of 50 patients who underwent conversion 15 patients had a previous history of Intra – abdominal surgery of which 6 had difficulty in accessing the peritoneal cavity. All patients had previous lower intra-abdominal surgery –Appendicectomy (4), Hysterectomy (4) LSCS (7). None of the patients had upper abdominal surgery.

**Past History of Surgery as Factor for difficult cholecystectomy**

Previous surgery	Difficult peritoneal access	Difficult surgery
Yes (n=15)	6 (42%) p=0.12	7 (35%) p=0.27
No (n=36)	8 (58%)	13 (65%)

**Sub – Costal Angle**

Out of 50 people who underwent conversion 20 subjects has sub-costal angle less than 90° 34.7% (8) of which had duration of surgery greater than 90 min.

**Sub-costal angles as Factor for difficult cholecystectomy**

Sub costal angle	Duration of Surgery	Difficult surgery
>90° (n=30)	15	13
<90° (n=20)	8 (p=0.25)	7 (p=0.28)

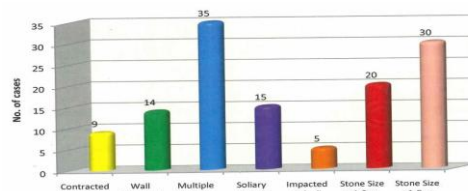
**Ultra-Sonogram Parameters**

The abdominal ultrasonogram findings of the 50 patients who underwent conversion are tabulated below.

**Ultrasonological Parameters as a factor for difficult surgery**

USG Parameters	No. of patients
Contracted GB	9
Wall thickness	14
Multiple calculi	35
Solitary calculi	15
Impacted calculi	5
Stone size >1cm	20
Stone size <1cm	30

**Ultrasonological Findings Who Underwent LSTC**



**Contracted GB as a Factor for Difficult Laparoscopic Cholecystectomy**

Contracted GB	Bleeding	Difficult bed dissection	Difficult extraction	Duration >90min	Difficult surgery
Yes(9)	3	8	7	6	7
No(41)	4	14	13	17	13

From above statistics, it was evident that the surgeons found contracted gall bladder to provide for difficult surgery by causing excessive bleeding and difficulty in bed dissection.

**Gall Bladder Wall Thickness**

Gall Bladder wall thickness was >4mm in 14 patients which indicated patient had chronic cholecystitis. This as a factor for difficult surgery is tabulated below.

**Thickened GB wall as a Factor for Difficult Laparoscopic Cholecystectomy**

Difficulty faced	Bleeding	Difficult bed dissection	Difficult extraction	Duration >90min	Difficult surgery
Thickened GB wall (n=14)	5 (p=0.007)	12 (p<0.00001)	9 (p=0.019)	13 (p<0.001)	12 (P<0.001)
Normal thickness <4mm (n=36)	2	10	13	10	8

**Gall stones**

**No. of Calculi:**

Out of 50 patients who underwent conversion 35 had multiple gall bladder calculi and 15 had solitary stone.

**No. of stones as a Factor for Difficult Laparoscopic Cholecystectomy**

Difficulty faced	Bleeding	Difficult bed dissection	Difficult extraction	Duration >90min	Difficult surgery
Multiple Calculi (35)	6 p=0.19	18 p=0.06	14 p=0.39	18 p=0.13	14 p=0.49
Solitary Calculi (15)	1	4	7	5	6

On the basis of above statistical analysis, multiple calculi proved to be problematic only during gall bladder bed dissection.

**Impacted Stone:**

Of the 50 patients who have underwent conversion, 5 patients had impacted stone while the rest had mobile stones determined by changing the patient position during USG.

**Impacted stone as a Factor for Difficult Laparoscopic Cholecystectomy**

Difficulty faced	Bleeding	Difficult bed dissection	Difficult extraction	Duration >90min	Difficult surgery
Impacted stone (n=5)	3 p=0.008	3 p=0.24	4 p=0.015	4 p=0.072	14 p=0.49
Mobile stone(n=45)	4	19	17	19	6

This analysis shows that there is correlation between impacted stone and moderate Bleeding during surgery and difficult extraction of gall bladder outside the abdomen.

**Size of the Calculi**

Of the 50 patients who underwent conversion, 20 persons had Gall bladder stone size greater than lcm which was considered to be an influencing factor for difficult surgery.

**Stone size as a factor for Difficult Laparoscopic cholecystectomy**

Difficulty Faced	Bleeding	Difficult Bed Dissection	Difficult Extraction	Duration > 90 mins	Difficult Surgery
Stone >1cm (n=20)	4	11	17	13	12
Stone <1cm (n=30)	3	11	4	10	8

**Peritoneal Access**

Difficulty in accessing the peritoneal cavity like adhesions was encountered in 14 patients.

Parameter	NO.	P value
BMI >30 kg/m2	5	P=0.3
Contracted GB (n=9)	8	P=0.001
Thickened GB Wall (n=14)	12	P=0.0001
Multiple calculi (n=35)	18	P=0.06
Impacted calculi (n=5)	3	P=0.24
Stone size >lcm (n=20)	11	P=0.06

**Bleeding During Surgery**

Of the 50 patients who underwent conversion, moderate bleeding was encountered in 7 patients and none of the patients had severe bleeding.

Parameter	NO.	P value
BMI >30 kg/m2	5	P=0.05
Contracted GB (n=9)	3	P=0.007
Thickened GB Wall (n=14)	5	P=0.007
Multiple calculi (n=35)	6	P=0.19
Impacted calculi (n=5)	3	P=0.008
Stone size >lcm (n=20)	4	P=0.17
Past H/o. Surgery (n=15)	6	P=0.12

**Gall Bladder Bed Dissection**

Out of 50 patients who underwent conversion to LSTC, surgeons encountered difficult gall bladder bed dissection in 22 persons.

**Relationship between GB Bed Dissection and various parameters**

Parameter	No.	P value
BMI >30 kg/m2	5 (26%)	P=0.3
Contracted GB (n=9)	8 (89%)	P=0.001
Thickened GB Wall (n=14)	12 (85%)	P<0.0001
Multiple calculi (n=35)	18 (52%)	P=0.06
Impacted calculi (n=5)	3 (60%)	P=0.24
Stone size >lcm (n=20)	11(55%)	P=0.06

**Gall Bladder Extraction:**

Of 50 patients who underwent conversion to LSTC, difficulty in extraction of the Gall Bladder out of the abdominal cavity was observed in 20 patients. 4 patients needed extension of the port incision for extraction while rest of the patients required removal of stones using forceps followed by extraction.

**Relationship between GB Extraction and various parameters**

Parameter	NO.	P value
BMI >30 kg/m2	5 (36%)	P=0.03
Contracted GB (n=9)	8 (89%)	P=0.001
Thickened GB Wall (n=14)	12 (85%)	P<0.0001
Multiple calculi (n=35)	18 (52%)	P=0.06
Impacted calculi (n=5)	3 (60%)	P=0.24
Stone size >lcm (n=20)	11(55%)	P=0.06

**Duration of Surgery:**

Duration of surgery was prolonged (>90 mins) in 23 of the 50 patients who underwent conversion to LSTC.

Parameter	No.	P value
BMI >30 kg/m2	6	P=0.17
Narrow sub costal angle	8	P=0.25
Contracted GB (n=9)	6	P=0.09
Thickened GB Wall (n=14)	13	P<0.001
Multiple calculi (n=35)	18	P=0.13
Impacted calculi (n=5)	4	P=0.072
Stone size >lcm (n=20)	13	P=0.016

**4. Discussion**

Laparoscopic Cholecystectomy has become the gold standard treatment for symptomatic cholelithiasis with failure rates between 2 to 15 %. Laparoscopy subtotal cholecystectomy is a safe alternative than open cholecystectomy and it. does not strictly mean failure or a complication; it is seen as a measure to prevent further complication during the surgery. In this study of 50 patients



undergoing LC, we have evaluated the factors, both clinical and Ultrasonological, which can be used to predict the difficulty in LC pre-operatively so that it can result in accurate planning of surgery and also proper counselling of the patient.

Analysing the age of the patients, most of them were equally distributed within the age range of 30 to 50 years whereas in Herman's series and Hanif series the majority of them were in the age group of 51- 60 yrs and 41-50 yrs respectively<sup>45</sup>. Categorizing the age into two groups one less than 50 years and the other more than 50 years did not yield any significant correlation with the difficulties in surgery (p value = .45), which is similar to multiple studies in our review of literature. This is in contrast with the study by Eldar et al<sup>46</sup> which found age > 65 years, a significant independent factor associated with conversion. Schaefer et al also identified age as a significant independent predictor of conversion. The observed disparity may be due to younger age of patients in the present study. The mean age of patients in the present study was 37.74 years. In Schaefer's series mean age was 61.4 years with age range of 23-95 years.

The sex ratio of 1:2.4 was comparable to studies by Jagdish et al and Hanif et al. Male sex significantly predicted the conversion of laparoscopic cholecystectomy and was also found to be associated with significantly higher intraoperative severity grades (pvalue=0.04) Eldar et al and Schaefer et al<sup>52</sup> also found male sex to be a significant predictor of severity. The reason for higher rate of difficulty faced during LC in males can be explained from the observations that males have more intense inflammation and fibrosis resulting in difficult dissection of gall bladder bed. In our study too, the 50 % of the male patients had difficulty in gall bladder bed dissection.

Obese patients (BMI >30 kg/m<sup>2</sup>) had a significant effect on difficult peritoneal access (p=0.05) and gall bladder extraction (p=0.03) thus contributing to difficult cholecystectomy. This is comparable to observation by Philips et al and Schirmer et al.

History of previous intra-abdominal surgery did not have significant correlation with difficulties faced during LC especially getting peritoneal access (p=0.27) which is in contrary to the observations by Alpana et al and Darodhek et al. This can be explained on the basis that most of the patients had undergone lower abdominal surgery with only one having undergone upper abdominal surgery. However, the one patient who had undergone upper abdominal surgery (Epigastric hernia) had to be converted to open due to dense adhesion.

Narrow sub-costal angle did not prove to be a significant predictive factor for difficult surgery (p=0.28) as observed in the study by Supe et al.

Ultra-sonological parameters had significant correlation with prediction of difficult cholecystectomy with each having influenced specific part of a surgery. In our study, Contracted gall bladder (n=9) had significant correlation with gall

bladder bed dissection (p= 0.001) and bleeding during surgery (p=0.05). Thickened gall bladder wall (n= 14) proved to be a significant predictor of difficult surgery by having a good correlation with moderate bleeding during surgery (p < 0.01), gall bladder bed dissection (p<0.001) and which subsequently prolonged the surgery more than 90 mins (p<0.001). This can be explained by the fact that thick walled gall bladder and contracted gall bladder occurs most commonly in chronic cholecystitis which would have produced inflammation and fibrosis. Thickened GB wall was found to be most important predictor of difficulty in studies by Supe et al and Fried et al observations of which are comparable to our study.

Multiple calculi had a moderate correlation with difficult bed dissection (p=0.06). Impacted stone (n=5) also had a moderate correlation with bleeding during surgery (p<0.008) reason being fibrosis and inflammation in gall bladder due to impaction. Stone size greater than 1 cm (n= 20) was significantly associated with difficulty in extraction of gall bladder (p<0.001) Only 2 patients had their LC converted to open surgery, one due to dense adhesion due to previous abdominal surgery, while the other was difficulty in gall bladder bed dissection. Our study had a conversion rate of 4 % which is comparable to other data available.<sup>34/44</sup> Reasons for conversion also correlated with observations made in study by Fried et al<sup>11</sup>. In our study, Thickened Gall bladder wall, contracted gall bladder, Stone size >1 cm significantly predicted the difficulty in Laproscopic cholecystectomy. Other factors which also played role were BMI >30 kg/m and male gender. Fried et al's prospective study of 1,676 patients has similar observations except that our study had two extra parameters that were significant namely contracted gall bladder and stone size >1cm. The Primary outcome of the study was accuracy of CBD injury. Secondary outcomes include subtotal cholecystectomy related injuries like hemorrhage, sub hepatic collection, bile leak, retained stones, post op ERCP, wound infection, re-operation and mortality. Re-operation was not required at all.

Laparoscopic subtotal cholecystectomy produced less risk of sub hepatic collection, wound infection, but bile leaks are present in most of the cases. Laparoscopic subtotal cholecystectomy is an important tool for use in difficult gallbladder and achieves less morbidity compared to open cholecystectomy. It has potential advantages like short hospital stay, no wound infection, no biliary injury and avoids conversion to open cholecystectomy.

Median post operative stay was 3 days (2 – 9 days)

After performing Laparoscopic sub total cholecystectomy, gall bladder neck was managed by endosuturing of the stump (n=35), serial clipping. (n=10) and stump was left unsutured only in 5 patients. Bile leaks were seen in 4 patients out of which one closed spontaneously and three closed following ERCP. None of the patients had wound infection and there was no mortality. There was no bile duct injury at all.

In one case gall stones were found in residual stump after 9 months for which revision lap cholecystectomy was done and residual stump along with cystic duct has been removed.

There is an important tool in case of difficult conditions like BMI > 30 kg/m<sup>2</sup>, past intra abdominal surgery, Narrow sub-costal angle, contracted gal bladder, gall bladder wall thickness > 4 mm, in case of solitary stone, in case of impacted stone, in case of size of calculi > 1.5 cm, difficult peritoneal access, bleeding during surgery, difficult gallbladder bed dissection, difficult gallbladder extraction in cases like huge empyema.

It is also a safe modality in conditions where the duration of surgery exceeding more than 90min. if the patient had associated comorbidities like diabetes, hypertension, morbid obesity with increased BMI and in conditions like where patients cannot tolerate general anaesthesia like low residual lung volume, low ejection fraction, COPD, post – MI and with bleeding diathesis. In cases of acute cholecystitis with elevated bilirubin level, bleeding is a major problem, in such conditions where time of surgery is exceeding along with hemorrhage laparoscopic sub total cholecystectomy is a safe alternative which can be followed by revision laparoscopic cystectomy if required in later period which would avoid morbidities associated with open cholecystectomy.

Laparoscopic subtotal cholecystectomy is also a safe alternative in huge gallbladders like empyema gallbladder with cholecystitis where dissection, extraction and hemorrhage are associated problems.

Laparoscopic sub total cholecystectomy is a safe alternative in conditions where in experienced / young surgeons could not identify / recognize CBD / cystic duct and where one could not identify difference between CHD / CBD it is a safe alternative where one could come out safely without creating further complications. So, laparoscopic subtotal cholecystectomy is an important tool for use in difficult gallbladders and achieves less morbidity compared to open cholecystectomy.

## 5. Conclusion

From our study we can conclude that various pre-operative predictors of difficult LC are present which influence various stages of the surgery which

Cumulatively or as a single factor make the surgery difficult for even the experienced laparoscopic surgeons. The parameters that significantly correlate with the difficult surgery were thickened gall bladder wall, contracted gall bladder, stone size >1 cm and to some extent BMI and Male gender. Ultrasonological parameters play an upper hand in predicting the course of the surgery than by the clinical parameters. Hence a detailed Abdominal USG to look for these parameters would surely help in predicting the difficult surgery before hand. To conclude, prediction of difficult LC and conversion to Laparoscopy subtotal cholecystectomy will be helpful to both the patients and surgeons. For the patients, pre-op mental preparation can drastically reduce the post-operative stress and morbidity.

From surgeon's point of view, patients with high risk for difficult LC could be operated by a experienced surgeon. Surgeons in the early phase of their training can mentally prepare for a difficult surgery there by negating intra-operative panic or can performs the LC under supervision of experienced surgeon. On knowing the chances of difficult surgery or possibility of conversion to Laparoscopy subtotal cholecystectomy prior to LC itself can enable the surgeon to convert to Laparoscopy subtotal cholecystectomy early if faced by any difficulties which can help in reducing the duration of surgery and subsequently the post-operative morbidity.

## 6. Limitations

- Duration of follow up of patients who underwent LSTC was less
- Study population of patients who underwent LSTC was less

## References

- [1] Rakesh Tendon, "Diseases of gallbladder and biliary tract". API text book of medicine, Dr. Siddarth N Shah, 7th edition, 2003, PP 642 - 644.
- [2] Conference, N C. Gallstones and laparoscopic cholecystectomy: JAMA 1992; 269: 1018-1024.
- [3] Ravi S Chari, MD and Shinul A Shah, MD. Biliary system, Sabiston textbook of surgery; Courtney M Townsend, R Laniel Beauchamp, B. Mark Evers,
- [4] Kenneth L Mattox. 18th edition, Saunders Elsevier, vol 2, 2009. Chapter 54, PP: 1547-1588.
- [5] Boni L, et al. Infective complication of laparoscopic surgery. Surg infect (Larchmt), 2006; 7 suppl 2: S109-11.
- [6] Stewart L, Oesterle A L, Erdan I, et al: pathogenesis of pigment gallstones in western societies: The central role of bacteria. J Gastrointest Surg 6: 891-903, 2002.
- [7] Nakeeb A, Commuzzie A G, Martin L et al: Gallstones: Genetics versus environment. Am Surg 235; 842-849, 2002.
- [8] Bellows C F, Berger C H, Crass R A: Management of gallstones. Am Fam Physician 72: 637-642, 2005.
- [9] Glasgow R E, Cho M, Blutter M M, Et Al: The spectrum and cost of complicated gallstone disease in California. Arch Surg 135; 1021- 1025,2000.
- [10] Ko C W, Lee S P; Epidemiology and natural history of common bile duct stones and prediction of disease, Gastrointest Endosc 56:S165,2002.
- [11] Trownbridge R L, Rutkowski N K, Shojania K G: Does this patient have acute cholecystitis? JAMA 289; 80-86, 2003.
- [12] Gibbons A: Geneticists trace the DNA trail of the first Americans. Science 259:312-313,1993.
- [13] Alexander P Nagle, Nathaniel J Soper, James R Hines; Colecystectomy (open and laparoscopic).Michael J Zinner, Stanley W Ashley; Maingot's Abdominal Operations; 11th edition, Mc Graw Hill, 2007. Chapter 32, PP:847-864.
- [14] Ransohoff D, Gracie W, Wolfenson L, Et Al. Prophylactic cholecystectomy or expectant management of silent gallstones: a decision analysis to assess survival. Ann inter med 1983; 99: 199- 204.

- [15] Tagge E, Otherson H J, Jacksons, Et Al. Impact of laparoscopic cholecystectomy on the management of cholelithiasis in children with sickle cell disease. *J Pediatr Surg* 1994; 29: 209-212.
- [16] Hull D, Bartus S, Perdrizet G, Et Al. Management of cholelithiasis in heart and lung transplant patients: with review of laparoscopic cholecystectomy. *Conn Med* 1994; 58: 643-647.
- [17] Sopr N. Laparoscopic cholecystectomy. *Curr Probl Surg* 199; 28: 585-655.
- [18] Strasburg S M. The "Hidden cystic duct" syndrome and the infundibular technique of laparoscopic cholecystectomy - the danger of the false infundibulum. *J Ann Coll Surg*, 2000; 191(6): 661-7.
- [19] Strasburg S M, Hertl M, Soper N S. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *J Ann Coll Surg* 1995; 180: 101-125.
- [20] T Satish Kumar, A P Saklani, R Vinayagam, R L Blackett. Spilled gallstones during laparoscopic cholecystectomy: a review of the literature. *Post grad Med J* 2004; 80: 77-79.
- [21] Cullen J. Laparoscopic cholecystectomy: Avoiding complications. In: Birkett D H, Ronsky J L, Stiegmann G V. the SAGES manual- Fundamentals of Laparoscopic and GI Endoscopy. Springer, 2003: 137-142.
- [22] Way L W, Stewart L, Gantert W, et al. Causes and prevention of laparoscopic bile
- [23] duct injuries: analysis of 252 cases from a human factors and cognitive psychology perspective. *Ann Surg* 2003; 4:460.
- [24] Deziel D, Millikan K, Economou S, et al. Complication of laparoscopic cholecystectomy: a national survey of 4292 hospitals and analysis of 77604 cases. *Am J Surg* 1993; 165: 9-14.
- [25] The southern surgeons club. A prospective analysis of 1518 laparoscopic cholecystectomies. *N Engl J Med* 1991. 324: 1073-1078.
- [26] Seiler C, Glattly A, Metzger A, Czerniak A. Injuries to the diaphragm and its repair during laparoscopic cholecystectomy. *Surg Endosc* 1995; 9: 193-4.
- [27] Armstrong P, Miller S, Brown G. Diaphragmatic hernia seen as a late complication of laparoscopic cholecystectomy. *Surg Endosc* 1999; 13: 817-818.
- [28] Kama N A, Dogary M, Dolapa M. Reise, Attli M, et al! Risk factors resulting in conversion of laparoscopic cholecystectomy to open cholecystectomy. *Surgical endoscopy*, Springer New York; VI5 : 965-968.
- [29] Daradkeh S, laparoscopic cholecystectomy: What are the factors determining difficulty? *Hepatogastroenterology*. 2001 Jan-Feb; 48(37): 76-78.
- [30] Jorgensen J O, Hunt D R: laparoscopic cholecystectomy. A prospective analysis of the potential causes of failure. *Surg laparos endosc* 3: 49-53, 1993. 29.
- [31] Pastulka P S, Bistran B R, Benotti P N, et al: The risks of surgery in obese patients. *Ann intern med* 104: 551-556, 1985.
- [32] Polk H C Jr. Carcinoma and the calcified gallbladder. *Gastroenterology* 1966; 50: 582-585.
- [33] Nadu A, Gallilli Y, Soffer D, Kluger Y: Disruption of Cholecystoenteric fistula induced by minor blunt trauma. *J Trauma* 1996; 41:914-915.
- [34] J. S. Randhawa . A. K. Pujahari, preoperative prediction of difficult lap chole: a scoring method. *Indian Journal of Surgery*, volume 71, number 4, July-August 2009, PP: 198-201.
- [35] Sir Alfred Cuscheri, "Disorder of the biliary tract". Textbook of surgery, Sir Alfred Cuscheri, 4th edition, Arnold publication, 2002 PP:375-453.
- [36] Heng-Hui Lein MD, Ching-Shui Huang (2002) Male gender: Risk factor for severe symptomatic cholelithiasis. *World J Surg* 26:598- 601.
- [37] Fried GM, Barkun JS, Sigman HH, Joseph L, Uas D, Garzon J, Hinchey EJ, Meakins JL (1994) Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy.
- [38] Ahmet Alponat, Cheng K, Bee C Koh, Andrea R, Peter MY Goh (1997) Predictive factors for conversion of laparoscopic cholecystectomy. *World J Surg* 21:629-633.
- [40] Kanaan SA, Murayama KM, Merriam LT, Dawes LG, Puystowsky JB, Reye RB, Jochi RJ (2002) Risk factors for conversion of laparoscopic to open cholecystectomy. *J Surg Res* 106:20-24.
- [41] Schrenk P, Woisetschlager R, Reiger R, et al. (1998) Preoperative ultrasonography and rediction of difficulties in laparoscopic cholecystectomy. *World J Surg* 22:75-77.
- [42] Pichler.J.M., "Primary carcinoma of gallbladder." *Surgery, Gynecology and Obstetrics*, 1978, 147: PP 929-942.
- [43] Ganey J B, " Cholecystectomy: Clinical Experience With A Large Series", *Am J Surg*, 1986, PP. 352-357.
- [44] Bhattacharya R, " Cholecystectomy In West Port, New Zealand.", *Indian Journal Of Surgery*, Aug 1983, PP.450-455.
- [45] Maj. Alok Sharma, " Towards A Safer Cholecystectomy- The Fundus Porta Approach", *Indian Journal Of Surgery*, June 1997, PP. 141-145.
- [46] Hanif G Motiwala. (1991): Operative Technique Cholecystectomy. A Study Of 250 Cases: *Surgery In The Tropics* . Ed: Sakens: Jhawes Pk: Purohit A : Mc Millan India Ltd., 1991, 56, 204.
- [47] Haziq U1 Yaqin, Hadfield (1970): Chronic Cholecystitis, *International Surgery*, 1970.
- [48] Hermann R E . , " Biliary Disease In The Aging Patients.", *New York, Masson*,1983, PP. 227-232.
- [49] S. Das Biliary System. Chapter 38 In: *A Concise Textbook Of Surgery*, Das S 6th Edition. Somanth Das, July 2010
- [50] Barkun J S, Barkun A N, Sampalis J S, et al. Randomized Controlled Trial Of Laparoscopic Versus Mini-Cholecystectomy. *Lancet* 1992;340:1116-1119.
- [51] 48.Bass E B, Pitt H A, Lillanore K D. Cost Effectiveness Of Laparoscopic Cholecystectomy Versus Open Cholecystectomy. *Am J Surg* 1993;165:466-471.
- [52] Soper N, Barteau J, Clayman R, Et Al. Laparoscopic Versus Standard Open Cholecystectomy: Comparison Of Early Results. *Surg Gynaecol Obstet* 1992; 174:114-118.
- [53] History Of Minimal Access Surgery: An Article By R K Mishra. 100
- [54] Maringhini A, Marceno Mp, Lanzarno F, Et Al. Sludge And Stones In Gall Bladder After Pregnancy:

- Prevalence And Risk Factors. *J Hepatol* 1987; 5: Pp218-223.
- [55] Liddle Ra, Goldstein R B, Saxton J. Gallstone Formation During Weight- Reducing Diet. *Arch Intern Med* 1989; 149: PP.1750-1753.
- [56] Messing B, Bories C, Kunstlinger F, Bernier J J. Does Total Parenteral Nutrition Induce Gallbladder Sludge Formation And Lithiasis? *Gastroenterology* 1983; 84: PP: 1012-1019.
- [57] Jermiah S Healy, Neil R Borley, Caroline Wigley, editors. Gall bladder and biliary tree. Susan standing , editor. *Gray's anatomy : the anatomical basis of clinical practice*. 39th edition, Elsevier Churchill livingstone , 2005. chapter 86, PP: 1227-1231.
- [58] T.W.Sadler. Liver and gallbladder and pancreas; Digestive System.Langman's Medical Embryology, 7th edition, Elsevier. Chapter 14, PP:254-258.
- [59] Lee H J , Choi B I , Han J K , et al : Three dimensional ultrasonography using the minimum transparent mode in obstructive biliary disease: Early experience. *J ultrasound Med* 21:443,2002.
- [60] Regulation of Gastrointestinal function- liver and biliary system. William .F. Ganong. *Review of Medical Physiology*. 22nd edition, Mc Graw Hill. Chapter 26, PP: 498-504
- [61] James M Crawford, Liver and Biliary tract. Robbins and Cotran pathologic basis of disease; Vinay Kumar, Abdul K Abbas, Nelson Fausto, 7th edition, Elsevier. Chapter 18, PP 877-939.
- [62] L. H. Blumgart, L. E. Hann; *Surgical and Radiological anatomy of the liver,*
- [63] *biliary tract and pancreas.* Leslie H Blumgart, *Surgery of the Liver, Biliary tract, and Pancreas*, 4th edition, Elsevier-Saunders, 2007. Chapter 1, PP:3-30.
- [64] Kenneth R Mcquaid, M D; *Drugs used in the treatment of gastrointestinal diseases.* Betram G Katzung, Susan B Masters, Anthony J Travor; *Basic and Clinical pharmacology*; 11th edition; TATA Mc Graw Hill, Mc Graw Hill Lange;2010. Chapter 62; PP 1067-1103.
- [65] John G Hunter , Sarah K Thomson; *Laparoscopic cholecystectomy, Intraoperative cholangiography, and Common bile duct exploration.* Josef E Fischer, Kirby I Bland, Mark P Callery, G Patrick Claret, Daniel B Jones, Frank W Logerfo, James M Seeger; *Mastery of Surgery*;volume 1; 5<sup>th</sup> edition; Wolter Kluver, Lippincott Williams And Wilkins, 2009; chapter 98; PP 1116-1129.
- [66] Kevin Conlon; *The gallbladder and bile ducts.*Norman S Williams, Christopher J K Bulstrode, P Ronan O Connell; *Bailey and Love's Short Practice of Surgery*, 25th edition; Hodder Arnold, 2008. Chapter 63, PP: 1111-1130. 63.
- [67] Margret Oddsdottir, Thai H Pham, John G Hunter; *Gallbladder and the Extrahepatic biliary system.* F Charles Brunicardi, Dana K Andersen, Timothy
- [68] R Billiar, David L Dunn, John G Hunter, Jeffery B Mathews, Raphael E Pollock;
- [69] *Schwart's Principles of Surgery*, 9th edition, Mc Graw Hill, 2010. Chapter 32, PP: 1135-1167.
- [70] *Evolution of laparoscopic surgery.* C Palanivellu; Foreward: Jacques Perissat, Horacio J Asbun *Art of Laparoscopic Surgery*, textbook and atlas; 1st edition, Jaypee,2005. Chapter 1, PP:3-11.
- [71] *Laparoscopic cholecystectomy.* C Palanivellu; Foreward: Jacques Perissat, Horacio J Asbun; *Art of Lparoscopic Surgery*, textbook and atlas; 1<sup>st</sup> edition, Jaypee,2005. Chapter 36, PP:555-585.
- [72] Raza M H, Khan M A, Nairn M, "Gallstones disease". *Indian Journal of Surgery* September 1990, PP:415-420.
- [73] *Difficult cholecystectomy.* C. Palanivellu; Foreward: Jacques Perissat, Horacio J Asbun; *Art of Lparoscopic surgery, Surgery, text book and atlas*; 1st edition, Jaypee, 2005. Chapter 39, PP: 607-635.

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