

**“PRE-OPERATIVE CLINICO-RADIOLOGICAL ASSESSMENT OF DIFFICULTY IN LAPAROSCOPIC CHOLECYSTECTOMY”**

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**Introduction:**

Laparoscopic cholecystectomy (LC) is widely accepted as gold standard for treatment of symptomatic cholelithiasis<sup>1</sup>. Though considered the gold standard technique, it is also sometimes technically challenging for the surgeons in view of difficult intraoperative anatomy, difficulty in dissecting around the calot's triangle or dense adhesions between the gall bladder and the adjoining structures.

Gallstone disease is one of the most common problems affecting the digestive tract. The prevalence of gallstones is related to factors like age, gender, and ethnic background. The prevalence of gallstone varies widely from place to place. It is estimated that approximately 20 million people in the United States have gallstones and that approximately 1 million new cases of cholelithiasis develop each year. In India the prevalence is estimated to be around 4%<sup>2</sup>, changing incidence in India is mainly attributed to westernization of diet, change in socioeconomic structure and availability of ultrasound as investigation in both rural and urban areas.

The National Institute of Health (NIH) consensus development conference in the year 1992 concluded that laparoscopic cholecystectomy provides a safe and effective treatment for most patients with symptomatic gallstones<sup>3</sup>.

At present, laparoscopic cholecystectomy (LC) is considered the treatment of choice for symptomatic cholelithiasis. It has many advantages over open cholecystectomy in terms of minimal postoperative pain, shorter hospital stay, better cosmetics and early recovery. As the experience with LC is increasing throughout the world, selection criteria have become more liberal. Most of the factors like morbid obesity and previous upper abdominal surgery which were considered as absolute contraindication for attempting LC have no longer remained as absolute contraindications. The number of contraindications has come down significantly overtime. Attempts can be made in all cases of gall stone diseases with laparoscopic procedure except for patients with bleeding diathesis, carcinoma gallbladder and patients not fit for general anaesthesia<sup>4</sup>.

So, it is with this wider application of laparoscopy for technically difficult and high-risk patients, it is expected that the complication rates would rise as would rate of conversion to open cholecystectomy. In about 5% to 12% of laparoscopic cholecystectomy, conversion to open method may be needed for various reasons<sup>5-6</sup>. But irrespective of this, morbidity and mortality statistics still do favour laparoscopic cholecystectomy over open.

Thus, for surgeons it would be helpful to establish criteria that would assess the difficulty preoperatively. This would be useful for informing patients and a more experienced surgical team could be assembled when risk for conversion appears significant. Thus this study

is conducted at our hospital to assess the difficulty in laparoscopic cholecystectomy using various clinical and radiological parameters.

**Aims & objectives:** Pre-operative assessment of difficulty in laparoscopic cholecystectomy by analyzing clinical and radiological parameters.

**Materials & Methods:** Prospective, analytical, single center study done in the department of General Surgery in a tertiary care Hospital for a period of two years in 99 cases admitted with symptomatic cholelithiasis. Patients with acalculous cholecystitis, CBD stones, Carcinoma gall bladder were not included in the study. The Institutional Ethics committee was obtained. Clinical and radiological parameters were analyzed for significant correlation with the outcome of the surgery (dependent variables) to assess difficulty in laparoscopic cholecystectomy. **Clinical parameters:** Age, Gender, BMI, Presence of comorbid conditions like diabetes mellitus and hypertension, History of any intra-abdominal surgery, pericholecystic fluid collection on imaging with or without constitutional symptoms, requiring emergency admission. **Imaging parameters:** Number of stones, Gallbladder wall thickness, CBD diameter, Presence of pericholecystic fluid. **Dependent variables:** Duration of surgery, Pericholecystic fluid, Adhesion, Gallbladder wall thickness, Bile leak/stone spill, Calot’s triangle identification, Gallbladder bed dissection. All information is collected and analyzed.

**Statistical analysis:** Data were analyzed using SPSS software (version 22). Pearson chi-square ( $\chi^2$ ) tests for independence were used to investigate the correlations between the variables (categorical variables) of interest.

TABLE NO 1: FINDINGS AND GRADES

Findings	Score	Maximum score
Duration	<60min(0), >60min(1)	1
Pericholecystic fluid	No (0), Yes(1)	1
Gallbladder wall thickness	<3 mm(0), >3mm(1)	1
Adhesions	None(0)/Flimsy(0), Dense(1)	1
Bile leak/ stone spill	No(0), Yes(1)	1
Calot triangle identification	Easy(0), Difficult (2)	2
Gallbladder bed dissection	Easy (0), Difficult (1)	1
Conversion to open cholecystectomy	No(0), Yes(3)	3

Total score:11;Easy:0-5&Difficult:6-11.

Results

Age group	Total		Total%	
	Males	Females	Males	Females
18–30	0	8	0	8.1
31–40	1	17	1	17.2
41-50	9	22	9.1	22.2
51–60	11	20	11.1	20.2
61–70	5	5	5.1	5.1
71 and over	0	1	0	1.0
<50 YEARS	50		50.5	
>50 YEARS	49		49.5	

Classification based on BMI	Total	Percentage
Normal(<25kg/m <sup>2</sup> )	32	32.3
Over weight(25-30kg/m <sup>2</sup> )	44	44.4
Obese(>30kg/m <sup>2</sup> )	23	23.2

TABLE NO 2: AGE DISTRIBUTION OF THE PATIENTS AGAINST THE GENDER

Co-morbidities / Clinical history		%
Diabetes		38.3
Hypertension		33.3
Previous abdominal surgeries		38.3
Right hypochondriac tenderness		88.9
Previous attacks		48.5
Dyspepsia		38.3
Vomiting		30.3
Pain duration	<1week	39.3
	>1week	34.3
	>1 month	26.2
Murphy's sign		23.2
Fever		21.2

TABLE NO 4: PERCENTAGE OF PATIENTS WITH CO-MORBIDITIES AND CLINICAL HISTORY

Parameter	% of patients
<b>Adhesion</b> Dense,	54.5
No/flimsy	45.5
<b>Calots dissection</b> Easy	62.6
Difficult	37.4
<b>Gallbladder dissection</b> Easy	84.8
Difficult	15.2
<b>Gallbladder thickness</b> Normal	63.6
Present	36.4
<b>Stone/bilespill</b> No	66.7
Yes	33.3
<b>Surgery duration</b> Less than "1h"	29.3
Morethan"1h"	70.7
<b>Conversion</b> No	95.9
Yes	4.1
<b>Difficult procedure</b> No	70.7
Yes	29.3

TABLE NO 6: DESCRIPTION OF INTRAOPERATIVE FINDINGS AMONG THE PATIENTS, DIFFICULTY IN THE

TABLE NO 3: DISTRIBUTION OF PATIENTS BASED ON THEIR BMI

Test	Patient count	%
<b>Gallbladder thickness</b>		
Less than 3mm	56	56.6
More than 3mm	43	43.4
<b>Gallstones</b>		
Single	26	26.3
Multiple	73	73.7
<b>CBD diameter</b>		
Less than 8mm	86	86.9
Greater than 8 mm	13	13.1
<b>Pericholecystic fluid</b>		
Absent	68	68.7
Present	31	31.3

TABLE NO 5: RESULTS FROM THE RADIOLOGICAL EXAMINATION OF THE PATIENTS.

		Intra op out come		Total	P value
		Easy	Difficult		
Age	<50	39	11	50	0.107
	>50	31	18	49	
Gender	Male	17	9	26	0.487
	Females	53	20	73	
BMI	<25	26	5	31	0.862
	25-30	31	14	45	
	>30	13	10	23	
Diabetes	Yes	20	18	38	0.0018
	No	50	11	61	
HTN	Yes	21	12	33	0.274
	No	49	17	66	
H/O Surgeries	Yes	9	15	24	0.000
	No	61	14	75	

TABLE NO 7: ASSOCIATION BETWEEN DEMOGRAPHIC DATA, CO-MORBIDITIES AND INTRA -

PROCEDURE AND THE CONVERSION.

OPERATIVE OUTCOME

		Intraop		Total	P value
		Easy	Difficult		
Rt hypochondriac Tenderness	Yes	23	27	50	0.00001
	No	47	2	49	
Dyspepsia	Yes	18	20	38	0.00005
	No	52	9	61	
Previous attacks	Yes	61	26	87	0.858
	No	8	4	12	
Vomitings	Yes	21	9	30	0.918
	No	49	20	69	
Pain	<1week	38	2	40	0.0001
	>1week	22	12	33	
	>1month	10	16	26	

TABLE NO 8: ASSOCIATION BETWEEN CLINICAL PARAMETERS AND INTRA OPERATIVE OUT COME

Conversion		Gall Bladder		Total
		Lessthan"3"	Morethan"3"	
No	Count	53	42	95
	Expected Count	53.2	41.8	95.0
	%within Conversion	55.8%	44.2%	100.0%
	Count	3	2	5
Yes	Expected Count	2.8	2.2	5.0
	%within Conversion	60.0%	40.0%	100.0%
	Count	56	44	100
Total	Expected Count	56.0	44.0	100.0
	%within Conversion	56.0%	44.0%	100.0%

TABLE NO 10: CROSS TABULATION OF CONVERSION AND GALL BLADDER THICKNESS

		Intra op outcome		Total	P value
		Easy	Difficult		
Murphy's Sign	Yes	9	14	23	0.001
	No	61	15	76	
Fever	Yes	5	16	21	0.001
	No	65	13	78	

TABLE NO 9: ASSOCIATION BETWEEN INFLAMMATORY SIGNS AND INTRA OPERATIVE OUTCOME

Conversion		Gall Stones		Total
		Single	Multiple	
No	Count	25	70	95
	Expected Count	24.7	70.3	95.0
	%within Conversion	26.3%	73.7%	100.0%
	Count	1	4	5
Yes	Expected Count	1.3	3.7	5.0
	%within Conversion	20.0%	80.0%	100.0%
	Count	26	74	100
Total	Expected Count	26.0	74.0	100.0
	%within Conversion	26.0%	74.0%	100.0%

TABLE NO 11: CROSS TABULATION OF CONVERSION AND SINGLE/MULTIPLE GALL STONES NOTICED IN RADIOLOGICAL EXAMINATION.

Conversion		CBD diameter		Total
		<"8"	>"8"	
No	Count	82	13	95
	Expected Count	81.7	13.3	95.0
	%within Conversion	86.3%	13.7%	100.0%
Yes	Count	4	1	5
	Expected Count	4.3	.7	5.0
	%within Conversion	80.0%	20.0%	100.0%
Total	Count	86	14	100
	Expected Count	86.0	14.0	100.0
	%within Conversion	86.0%	14.0%	100.0%

**TABLE NO 12: CROSS TABULATION OF CONVERSION AND CBD DIAMETER EXAMINED IN RADIOLOGICAL EXAMINATION**

Conversion		Pericholecystic Collection		Total
		No	Yes	
No	Count	66	29	95
	Expected Count	64.6	30.4	95.0
	%within Conversion	69.5%	30.5%	100.0%
Yes	Count	2	3	5
	Expected Count	3.4	1.6	5.0
	%within Conversion	40.0%	60.0%	100.0%
Total	Count	68	32	100
	Expected Count	68.0	32.0	100.0
	%within Conversion	68.0%	32.0%	100.0%

**TABLE NO 13: CROSS TABULATION OF CONVERSION AND PRESENCE OF PERICHOLECYSTIC COLLECTION EXAMINED IN RADIOLOGICAL EXAMINATION**

Difficulty		Gall Bladder thickness		Total
		<"3"	>"3"	
No	Count	51	19	70
	Expected Count	39.2	30.8	70.0
	%within Difficulty	<b>72.9%<sup>^</sup></b>	<b>27.1%<sup>+</sup></b>	100.0%
Yes	Count	<b>5<sup>*</sup></b>	<b>25<sup>*</sup></b>	30
	Expected Count	<b>16.8<sup>*</sup></b>	<b>13.2<sup>*</sup></b>	30.0
	%within Difficulty	<b>16.7%<sup>\$</sup></b>	<b>83.3%<sup>#</sup></b>	100.0%
Total	Count	56	44	100
	Expected Count	56.0	44.0	100.0
	%within Difficulty	56.0%	44.0%	100.0%

**TABLE NO 14: CROSS TABULATION OF**

Predicting characteristic (%)	Value
Sensitivity <sup>#</sup>	83.3
Specificity <sup>^</sup>	72.9
Predicting false positive <sup>+</sup>	27.1
Predicting false negative <sup>\$</sup>	16.7

**TABLE NO 15: PREDICTION POWER OF GALL**

**DIFFICULTY DURING SURGERY AND GALLBLADDER THICKNESS**

Difficulty		Stones		Total
		Single	Multiple	
No	Count	19	51	70
	Expected Count	18.2	51.8	70.0
Yes	Count	7	23	30
	Expected Count	7.8	22.2	30.0
Total	Count	26	74	100
	Expected Count	26.0	74.0	100.0

**TABLE NO 16: CROSS TABULATION OF DIFFICULTY DURING SURGERY AND STONES IDENTIFIED IN RADIOLOGICAL EXAMINATION**

Predicting characteristic (%)	Value
Sensitivity <sup>#</sup>	26.7
Specificity <sup>^</sup>	91.4
Predicting false positive <sup>+</sup>	8.6
Predicting false negative <sup>\$</sup>	73.3

**TABLE NO 18: PREDICTION POWER OF CBD DIAMETER FOR DIFFICULTY IN SURGERY**

**BLADDER THICKNESS FOR DIFFICULTY IN SURGERY**

Difficulty		CBD diameter		Total
		lessthan"8"	Morethan"8"	
No	Count	64	6	70
	Expected Count	60.2	9.8	70.0
	%within Difficulty	<b>91.4%<sup>^</sup></b>	<b>8.6%<sup>+</sup></b>	100.0%
Yes	Count	<b>22<sup>*</sup></b>	<b>8<sup>*</sup></b>	30
	Expected Count	<b>25.8<sup>*</sup></b>	<b>4.2<sup>*</sup></b>	30.0
	%within Difficulty	<b>73.3%<sup>\$</sup></b>	<b>26.7%<sup>#</sup></b>	100.0%
Total	Count	86	14	100
	Expected Count	86.0	14.0	100.0
	%within Difficulty	86.0%	14.0%	100.0%

**TABLE NO 17: CROSS TABULATION OF DIFFICULTY DURING SURGERY AND CBD THICKNESS**

Difficulty		Pericholecystic Collection		Total
		No	Yes	
No	Count	53	17	70
	Expected Count	47.6	22.4	70.0
	%within Difficulty	<b>75.7%<sup>^</sup></b>	<b>24.3%<sup>+</sup></b>	100.0%
Yes	Count	<b>15<sup>*</sup></b>	<b>15<sup>*</sup></b>	30
	Expected Count	<b>20.4<sup>*</sup></b>	<b>9.6<sup>*</sup></b>	30.0
	%within Difficulty	<b>50.0%<sup>\$</sup></b>	<b>50.0%<sup>#</sup></b>	100.0%
Total	Count	68	32	100
	Expected Count	68.0	32.0	100.0
	%within Difficulty	68.0%	32.0%	100.0%

**TABLE NO 19: CROSS TABULATION OF DIFFICULTY DURING SURGERY AND PERICHOLECYSTIC COLLECTION**

**TABLE NO 20: PREDICTION POWER OF PERICHOLECYSTIC COLLECTION FOR DIFFICULTY IN SURGERY**

Predicting characteristic (%)	Value
Sensitivity <sup>#</sup>	50.0
Specificity <sup>^</sup>	75.7
Predicting false positive <sup>+</sup>	24.3
Predicting false negative <sup>\$</sup>	50.0

**Discussion**

The incidence of cholelithiasis in this study mostly fell under the age group of 31-50 years which is 50% of total study population. This is comparable to the study done by Randhawa Et al<sup>8</sup> which showed 54% among 30-50 age group. Another study by Gabriel Et al<sup>9</sup> showed 47% of patients between 31-50 years of age which is also comparable to the present study. Study done by kumar Et al<sup>10</sup> also had similar findings.

11% of the patients in this study are having age >60 years which is comparable to the study done by Kauvar et al<sup>11</sup>. Of the total of 99 patients in the present study majority of them were females 73.7% and the percentage of males were 26.3%. Oymaci et al<sup>12</sup> had incidence of 68% females which was comparable to present study.

Normal (<25 kg/m<sup>2</sup>) BMI is seen 32.3% of patients, overweight (25-30kg/m<sup>2</sup>) seen in 44.4% and obese (>30kg/m<sup>2</sup>) seen in 23.2% of patients. Most of the patients in this study are under overweight category similar to study done by Randhawa et al<sup>8</sup>, study done by Gabriel et al<sup>9</sup> had most of the patients 58% in Normal BMI group which is contrast to the present study. Obesity is a well-established risk factor for gall stone disease.

In this present study 38.3% of patients have diabetes and 33.3% of patients with hypertension. Insulin resistance predisposes to cholesterol gall stones formation<sup>13</sup> suggesting altered cholesterol and bile salt metabolism. Hepatic insulin resistance may act by enhancing hepatic cholesterol secretion, depressing bile salt synthesis and impairing gallbladder motility<sup>14</sup>. In this study 38.3% of the patients had history of previous abdominal surgeries. History of previous abdominal surgeries were 18% in study done by Nachnani et al<sup>15</sup> and 26.1% study done by Gholipur et al<sup>16</sup>.

In the present all the patients 100% (n 99) had upper abdominal pain. Pain was their chief complaint, associated with vomitings in 30.3% and dyspepsia in 38.3%. Patients were divided in to three different groups based on their duration of onset of pain. 39.3% in <1 week, 34.3% in >1 week/<1 month and 26.3% >1month were distributed among the study patients. Abdul Baki et al<sup>17</sup> reported 90% of their study group (n40) had dyspepsia as their chief complaint which is contrary to the present study.

There is almost equal distribution of patients who exhibited gallbladder wall thickness more than or less than 3 mm. Syed Amzad Ali rizvi et al<sup>18</sup> had 32.8% and Nachnani et al<sup>15</sup> had 30.5% of patients with >3mm thickness. Lal et al<sup>19</sup> had only 4.1% of patients with dilated CBD. Multiple gallstones were seen in 73.7% (n73) of patients and single stone was seen in 26.3%(n26) of them. Pericholecystic fluid was seen in 31.3% (n31) and absent in 68.7%(n68) of the patients. Conversion

rate of 1.3 % was reported by Randhawa et al<sup>8</sup> only 3 cases out of 228 patients which was exceptionally low. Gabriel et al<sup>9</sup> reported conversion rate of 26% which was very high and it was attributed to the learning phase of surgeon. Lal et al<sup>19</sup> also reported the very high 23.3% of conversion rate. The conversion rate in the present study is only 4.1%.

Based on intra operative data scoring 29.3% of the cases were difficult and 70.7% of them were easy. Patient who underwent conversion were also grouped under difficult group. Dense adhesions were noted in 54.5% of patients, Calot's triangle dissection was difficult in 37.4% of patients. Gallbladder bed dissection was difficult in 15.2% of patients. Intra operatively bile spillage or stone spillage noted in 33.3% of patients. The average time taken for the surgery was 90 minutes. 70.7% of them had > 1 hr duration and 29.3% had <1 hr of duration of surgery. In studies done by Rosen et al<sup>20</sup> 32.8% and Nachnani et al<sup>15</sup> 30.5% had thickened gallbladder.

Age is recognized as a risk factor for both difficult laparoscopic cholecystectomy and conversion to open surgery, probably because of the longer duration of disease with multiple attacks of cholecystitis causing dense adhesions. Kama et al<sup>21</sup> found age > 60 years and Kauvar et al<sup>22</sup> found age > 65 years strongly associated with difficult cholecystectomy. Male patients are found to have more severe inflammation and fibrosis making it difficult in calot's triangle dissection and achieving critical view of safety, difficult gallbladder bed dissection from liver surface. Study done by Phillips et al<sup>23</sup> divided obese and non- obese patients in to two groups. Rosen et al<sup>20</sup> found BMI > 30 kg/m<sup>2</sup> independently predicted conversion in patients with acute cholecystitis. Kumar et al<sup>10</sup> also found significance between higher BMI and difficulty in LC.

In the present study there is statistically significant (p value-0.0018) association between diabetes and difficult LC. Study done by Ibrahimetal<sup>24</sup> found that association between poorly controlled diabetes with an increased risk of converting to open .

In the present study patients with hypertension had no statistically significant (p value-0.274) association with the difficult LC. In the present study there is statistically significant association (p value-0.004) between history of previous abdominal surgeries and difficulty in LC. Studies had reported association between previous intra-abdominal surgeries and difficulty in LC. Previous surgeries cause intra - peritoneal adhesions making it difficult in port placement, creating pneumo peritoneum, need for adhesiolysis before reaching gallbladder thus increasing the operative time. Previous upper abdominal surgeries can also cause distortion of normal biliary anatomy. Poor visualisation of calot's triangle and dense adhesions can increase the risk of bile duct injury and bleeding. Studies done by Bhar et al<sup>108</sup> and Dhanke et al<sup>25</sup> didn't find any statistical significance which is contrary to the findings in the present study.

Pain is an important factor indicating the severity of the gallbladder disease. There was no statistically significant association between previous attacks (p value -0.858) and difficulty in LC. Sanabria et al<sup>26</sup> reported that attacks more than 10 was significantly associated with conversion whereas Kumar et al<sup>10</sup> found association with difficult surgery with more than 5 attacks of pain in the past, p=0.001. Fever, tenderness in right hypochondrium indicates presence of ongoing/persisting inflammation with edema of gallbladder making surgery difficult. Kumar et al<sup>10</sup> reported that conversion rate was also significantly higher in patients with history of fever (17.46% vs. 4.66%) and tenderness in the right hypochondrium at presentation (36% vs. 4.8%).

Dilated common bile duct on imaging generally indicates biliary obstruction. Choledocholithiasis can cause inflammation of the hepatoduodenal ligament making Calot's triangle dissection difficult. Common bile duct size was found to have a good correlation with difficulty in surgery in Lal et al<sup>19</sup>. They had a total of 3 patients with dilated common bile duct,



surgeries for all 3 were difficult and 2 were converted to open procedure.

Pericholecystic edema or fluid collection indicates on going inflammation of the gallbladder. There will be difficulty in holding the gallbladder wall due to the friability of the structures. There will be inflammatory ooze during dissection making visualization of structures difficult. Dhanke et al<sup>25</sup> found presence of pericholecystic fluid as a significant predictor of difficult cholecystectomy (p=0.001). Similarly, Syed amjadalirizvi et al<sup>18</sup> found that sonographic presence of pericholecystic fluid should alert the surgeon of a possible conversion (OR=4.396, CI= 1.212 - 15.947).

**Conclusion:**

Cholelithiasis was mostly found in 30-50 age group (50%), Age, gender, BMI, previous cholecystitis attacks, presence of single/multiple stones were not considered as a risk factor for difficult LC. In the present study there was strong association with difficult LC and diabetes, history of previous abdominal surgeries, dyspepsia, Pain duration, fever and murphys sign, GB thickness >3mm, CBD diameter >8mm, Pericholecystic fluid collection.

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