## **Research Article**

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## Pre-operative prediction of difficult laparoscopic cholecystectomy

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## **ABSTRACT**

**Background:** 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 predictive factors for difficult laparoscopic cholecystectomy.

**Methods:** All patients are subjected to ultrasonographic evaluation. The patients confirmed by USG examination are evaluated with following factors: age, sex, BMI, h/o previous hospitalization, h/o previous abdominal surgeries, h/o acute cholecystitis / pancreatitis. Sonographic findings: GB wall thickness (>/< 3 mm), pericholecystic collection, number (solitary versus multiple) and liver parenchyma (Normal, fatty infiltration, liver fibrosis). Following evaluation the patients will be subjected to laparoscopic cholecystectomy and the following operative parameters: access to peritoneal cavity (easy/difficult), bleeding during surgery (normal/abnormal), gall bladder bed dissection (easy/difficult), injury to duct/artery, extraction of gall bladder (easy/difficult), or conversion to open surgery are noted.

**Results:** In the present study, BMI >32.5, history of cholecystitis, previous abdominal surgery, GB wall thickness>3mm, pericholecystic collection, multiple stones and liver fibrosis were significant predictors of difficult laparoscopic cholecystectomy.

**Conclusions:** In about 5 to 10% of the cases of laparoscopic cholecystectomy, conversion to open cholecystectomy may be needed for safe removal of gallbladder. Therefore it is necessary to analyse the risk factors that predict difficult laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, Gall bladder, Cholelithiasis, Difficult cholecystectomy

#### INTRODUCTION

Cholelithiasis is the most common biliary pathology. Gallstones are present in 10 to 15% of the general population and asymptomatic in the majority (>80%). The prevalence of gallstone varies widely in different parts of the world. In India it is estimated to be around 4%. Approximately 1-2% of asymptomatic patients will develop symptoms requiring cholecystectomy per year, making cholecystectomy one of the most common operations performed by general surgeons. Cholelithiasis is rare in the first two decades. Incidence gradually

increases after 21 years and reaches its peak in 5th and 6th decade. Women are more affected than men in the ratio of 4:1.1 In 1992, The National Institute of Health (NIH) consensus development conference stated that laparoscopic cholecystectomy "provides a safe and effective treatment for most patients with symptomatic The gallstones." advantages of laparoscopic cholecystectomy over open cholecystectomy are earlier return to bowel functions, less postoperative pain, informed cosmesis, shorter length of hospital stay, earlier return to full activity, and decreased overall cost.2-4 Laparoscopic cholecystectomy is associated with better preservation of immune function and a reduction of the inflammatory response compared with open surgery. The rate of postoperative infections seems to be lower.<sup>5</sup> 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 predictive factors for difficult laparoscopic cholecystectomy.

The aim and objectives of the study was to determine the predictive factors for difficult laparoscopic cholecystectomy & to study the risks of conversion from laparoscopic to open cholecystectomy.

#### **METHODS**

#### Inclusion criteria

Patient who have been clinically and radiologically (usg abdomen) diagnosed as cholelithiasis and planned for laparoscopic cholecystectomy.

## Exclusion criteria

Patients below 15 years of age, patients with common Bile Duct (CBD) calculus, dilated CBD where CBD exploration is required.

## Sample size

80 cases admitted to our hospital from September 2013 to June 2014. The methods for the study included screening of patients who presented with upper abdominal pain, vomiting or dyspepsia. Such patients are studied in detail clinically and investigated. Haematological and biochemical investigations (CBC, RFT, and LFT) are done. All patients are subjected to ultrasonographic evaluation. The patients confirmed by USG examination are evaluated with following.

## **Factors**

Age, sex, BMI, h/o previous hospitalization, h/o previous abdominal surgeries, h/o acute cholecystitis/pancreatitis.

## Sonographic findings

GB wall thickness (>/< 3 mm), pericholecystic collection, number (solitary versus multiple) and liver parenchyma (Normal, fatty infiltration, liver fibrosis). Following evaluation the patients will be subjected to laparoscopic cholecystectomy and the following.

## Operative parameters

Access to peritoneal cavity (easy/difficult), bleeding during surgery (normal/abnormal), gall bladder bed dissection (easy/difficult), injury to duct/artery, extraction of gall bladder (easy/difficult), or conversion to open

surgery are noted. Analyses of pre-operative risk factors, their relation to the dependent factors are performed using t-test, chi-square test and significance (p value 0.05) is demonstrated. Results would be computed using relevant software (SPSS).

## **RESULTS**

Table 1: Age distribution.

Age group	Frequency	Percent
22-30	15	18.8
31-40	18	22.5
41-50	19	23.8
51-75	28	35.0
Total	80	100.0

## Age distribution

Majority of the patients in the present series were in the age group of 51 to 75 yrs.

Table 2: Sex distribution.

Sex	Frequency	Percent
Females	62	77.5
Males	18	22.5
Total	80	100.0

Table 3: History of acute cholecystitis.

	Frequency	Percent
Absent	57	71.3
Present	23	28.8
Total	80	100.0

Table 4: History of previous abdominal surgeries.

	Frequency	Percent
Absent	61	76.3
Present	19	23.8
Total	80	100.0

**Table 5: Ultrasonography.** 

Parameters	Cases	Percentage
GB Wall thickness>3mm	28	35%
Pericholecystic collection	18	22.5%
Liver fibrosis	16	20%
Multiple GB stones	47	58.8%

## Sex distribution

In the present series, out of 80 patients, 62 were females and 18 were males.

#### Past history

Among 80 patients 19 (23.8%) had previous abdominal surgeries, 23 patients among 80 (28.8%) had history of acute cholecystitis.

## Ultrasonography

In the present series of 80 patients, GB thickness > 3mm were found in 28 patients (35%), Pericholecystic collection present in 18 patients (22.5%), Fibrosis of liver parenchyma present in 16 patients (20%) and 47 patients (58.8%) had multiple GB stones.

**Table 6: Operative parameters.** 

Operative Parameters	Cases	Percentage
Access to peritoneal cavity	22	27.5%
GB bed dissection	21	21.3%
Abnormal bleeding	20	25%
Difficult extraction of GB	19	23.8%
Conversion to open	8	10%

#### Operative parameters

Among 80 patients, there was difficulty in access to peritoneal cavity for 22 (27.5%) patients, difficult GB bed dissection in 21 (26.3%) patients, abnormal bleeding in 20 (25%) patients and difficulty in extraction of gall bladder in 19 (23.8%) patients. 8 cases were converted to open cholecystectomy.

Table 7A: Access to peritoneal cavity: coefficients and standard errors.

Variable	Coefficient	Std. Error	P
BMI	0.74422	0.21970	0.0007
H/o Acute cholecystitis	-4.14653	4.54671	0.3618
H/o previous abdominal surgeries	1.16715	1.16251	0.3154
GB wall thickness	0.96133	4.28883	0.8226
Pericholecystic collection	4.71386	2.13492	0.0272
No of stones	-2.70217	1.31878	0.0405
Constant	-22.5880		

# Evaluation of predictive factors for difficult laparoscopic cholecystectomy

The preoperative parameters BMI, history of cholecystitis, previous abdominal surgery, GB wall thickness, pericholecystic collection, number of stones and liver parenchyma were analysed with operative parameters. Initially univariate analysis was done and statistically significant factors were found followed by multivariate analysis.

#### **BMI**

In present series, 22 patients had difficulty in access to peritoneal cavity with mean BMI 32.14, 20 patients with mean BMI 28.38 had abnormal bleeding, 19 patients with mean BMI of 32.026 had difficulty in extraction of GB, and 8 patients with mean BMI OF 32.475 were converted to open surgery.

Table 7B: Access to peritoneal cavity: odds ratios and 95% confidence intervals.

Variable	Odds ratio	95% CI
BMI	2.1048	1.3684 to 3.2376
H/o Acute	0.0158	0.0000 to
cholecystitis	0.0136	117.3339
H/o previous	3.2128	0.3291 to
abdominal surgeries	3.2126	31.3644
GB wall thickness	2.6152	0.0006 to
GB wan unckness	2.0132	11701.0069
Pericholecystic	111.4815	1.6979 to
collection	111.4613	7319.5328
No of stones	0.0671	0.0051 to 0.8893

## History of acute cholecystitis

Among 23 patients with history of acute cholecystitis 10 patients had difficulty in access to peritoneal cavity, 14 patients had bleeding, 16 patients had difficult gall bladder bed dissection, 10 patients had difficult extraction of GB, and 6 patients were converted to open surgery.

Table 8: Gall bladder bed dissection: coefficients and standard errors.

Variable	Coefficient	Std. Error	P
BMI	0.024628	0.090914	0.7865
H/o Acute cholecystitis	-0.30956	1.20954	0.7980
H/o previous abdominal surgeries	0.85416	0.87392	0.3284
GB wall thickness	3.22078	1.27498	0.0115
Pericholecystic collection	0.45260	0.98162	0.6447
AGE	0.064114	0.045921	0.1627
No of stones	-1.20340	1.03997	0.2472
Constant	-6.5256		

## History of previous abdominal surgery

Among 19 patients with h/o previous abdominal surgery 9 patients had difficult access to peritoneal cavity, 8 patients had abnormal bleeding during surgery, 10 patients had difficult GB bed dissection, and 5 patients were converted to open surgery.

#### Gallbladder wall thickness

Among 28 patients with GB wall thickness >3mm, 13 patients had difficulty in access to peritoneal cavity, 17 patients had abnormal bleeding, 19 patients had difficulty in dissecting GB bed, 13 patients had difficult extraction of GB and 7 patients were converted to open surgery.

Table 9: Abnormal bleeding: coefficients and standard errors.

Variable	Coefficient	Std. Error	P
BMI	-0.021338	0.072076	0.7672
H/o Acute cholecystitis	0.17314	1.23425	0.8884
H/o previous abdominal surgeries	0.010259	0.86733	0.9906
GB wall thickness	3.54691	1.25092	0.0046
Pericholecystic collection	-0.79316	1.02064	0.4371
AGE	-0.018261	0.035834	0.6103
Liver parenchyma	1.54511	0.89891	0.0856
Constant	-1.7364		

## Pericholecystic collection

Among 18 cases with pericholecystic collection 9 cases had difficulty in access to peritoneal cavity, 10 cases had abnormal bleeding, 13 cases had difficulty in dissection from GB bed, 8 cases had difficulty in extraction of GB, and 6 cases were converted to open surgery.

Table 10A: Extraction of gall bladder: coefficients and standard errors.

Variable	Coefficient	Std. Error	P
BMI	0.55915	0.19443	0.0040
H/o Acute cholecystitis	-0.21232	1.48542	0.8863
H/o previous abdominal surgeries	-0.74638	1.16580	0.5220
GB bed dissection	0.17931	1.43269	0.9004
Pericholecystic collection	1.34975	1.61048	0.4020
No of stones	-19.40193	2037.72111	0.9924
AGE	0.016589	0.049923	0.7397
Liver parenchyma	0.46142	1.18533	0.6971
Constant	-17.9753		

## Number of stones

Among 47 patients with multiple GB stones 17 had difficulty in dissecting from GB bed, 19 had difficulty in extraction of GB, 8 patients were converted to open surgery.

Table 10B: Extraction of gall bladder: odds ratios and 95% confidence intervals

Variable	Odds ratio	95% CI
BMI	1.7492	1.1949 to 2.5606
H/o Acute cholecystitis	0.8087	0.0440 to 14.8665
H/o previous	0.4741	0.0483 to 4.6580
abdominal surgeries		
GB bed dissection	1.1964	0.0722 to 19.8338
Pericholecystic	3.8565	0.1642 to 90.5845
collection		
No of stones	0.0000	
AGE	1.0167	0.9220 to 1.1212
Liver parenchyma	1.5863	0.1554 to 16.1944

Table 11A: Conversion to open surgery: coefficients and standard errors.

Variable	Coefficient	Std. Error	P
BMI	0.61795	0.39833	0.1208
H/o Acute cholecystitis	-18.84746	3128.16667	0.9952
GB bed dissection	28.93112	4463.59784	0.9948
Pericholecystic collection	20.51760	3128.16681	0.9948
AGE	0.030630	0.096844	0.7518
Liver parenchyma	1.80143	1.58980	0.2572
Constant	-51.8186		

Table 11B: Conversion to open surgery: odds ratios and 95% confidence intervals.

Variable	Odds ratio	95% CI
BMI	1.8551	0.8498 to 4.0498
H/o Acute cholecystitis	0.0000	
GB bed dissection	3.67E+012	
Pericholecystic collection	814E+006	
AGE	1.0311	0.8528 to 1.2466
Liver parenchyma	6.0583	0.2686 to 136.6517

## Liver parenchyma

Among 16 cases with liver fibrosis 10 patients had abnormal bleeding, 11 had difficulty in dissecting from GB bed, and 6 cases were converted to open surgery.

#### Multivariate analysis

Patients with mean BMI >32.14 had difficulty in access to peritoneal cavity and difficulty in extraction of GB.

A patient with gall bladder thickness >3mm has difficulty in dissection of gall bladder bed and abnormal bleeding.

Patients with mean BMI >32.14 had difficulty in access to peritoneal cavity with significant p value 0.0007 and there is two times the risk with 95% confidence interval 1.3684 to 3.2376.

Patients with pericholecystic collection also had difficult access to peritoneal cavity.

A patient with gall bladder thickness >3mm has difficulty in dissection of gall bladder bed with significant p value – 0.0115.

Patients with gall bladder thickness >3mm has abnormal bleeding with significant p value – 0.0046.

Patients with mean BMI >32.14 had difficulty in extraction of gall bladder with significant p value of 0.0040 and there is 1.75 times increased risk.

In present series there are no factors associated with statistically significant conversion to open surgery.

## **DISCUSSION**

Cholelithiasis is the most common biliary pathology. Gall stones are present in 10 to 15% of the general population and asymptomatic in the majority of them, of about >80%. Approximately 1-2% of asymptomatic patients will develop symptoms requiring cholecystectomy every year, making it one of the most common operations performed.

In 1992, The National Institute of Health (NIH) consensus development Conference stated that laparoscopic cholecystectomy "Provides a safe and effective treatment for most patients with symptomatic gallstones". In about 5 to 10% of the cases of laparoscopic cholecystectomy, conversion to open cholecystectomy may be needed for safe removal of gallbladder. Therefore it is necessary to analyse the risk factors that predict difficult laparoscopic cholecystectomy. The risk factors for conversion were male sex, obesity, cholecystitis and choledocholithiasis.<sup>6</sup> Stocky male patients due to difficulty in initial port placement, Multiparous women with flabby abdomen due to thinned out lower abdominal musculature the effect of pneumoperitoneum is only in the lower abdomen.<sup>7,8</sup> Hence there is less space in right hypochondrium to work, previous upper abdominal surgery, Cirrhosis of liver, Present or previous acute cholecystitis or acute severe pancreatitis, previous treatment: percutaneous drainage or cholecystectomy. 9,10

#### Ultrasound criteria

Thick walled gallbladder (>3mm), Contracted (nonfunctioning) gallbladder, Packed stones and large calcified GB, Polyp or mass lesion without acoustic shadow, Evidence of acute cholecystitis:-impacted stones -Oedematous gallbladder wall, Pericholecystic fluid collection, Air in the gallbladder (emphysematous cholecystitis), Sub phrenic collection, Intraperitoneal fluid collection due to perforated GB.

The following risk factors were evolved- age>50 years, male sex, H/O prior hospitalization for acute cholecystitis/ biliary pancreatitis, BMI 25-27.5 and >27.5, abdominal scar, palpable GB, wall thickening, impacted stone, and pericholecystic collection. Out of this BMI >32.5, H/O prior hospitalization for acute cholecystitis, H /o previous abdominal surgery , GB wall thickening, and pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy, as per present study.

Hence it's mandatory to adopt the following:

## Safety measures

Selective open technique of pneumoperitoneum, intraoperative cholangiography to identify biliary anatomy and the CBD stones. Laparoscopic ultrasound is useful in mapping biliary and vascular anatomy and is superior to operative cholangiogram. Adequate instrumentation, Additional ports for retraction to get adequate exposure.

The highest incidence of gallstone in present series is in age group of 51 to 75 years.

Incidence of gallstones is more in females compared to males, Ultrasound is the most accurate and sensitive investigation for diagnosis of Cholelithiasis.

The conversion rate from laparoscopic cholecystectomy to Open Cholecystectomy was 10% and in the present series on multivariate analysis there are no predictive factors associated with statistically significant conversion to open surgery.

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