

Original Research Article

Determination of predictive factors for difficult laparoscopic cholecystectomy

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ABSTRACT

Background: Cholelithiasis is the most common biliary pathology, with a prevalence of 10 to 15%. It is symptomatic in approximately 1 to 2% of patients. In about 5 to 10% of laparoscopic cholecystectomy, conversion to open cholecystectomy may be needed for safe removal of gallbladder. Laparoscopic cholecystectomy (LC) may be rendered difficult by various problems encountered during surgery. The objective of this study was to predict difficulty of LC before surgery using the clinical and ultrasonographic criteria.

Methods: The present study comprised of 45 cases admitted to National Medical College Teaching Hospital (NMCTH), Birgunj (Nepal) for a period of 12 months from 1st August 2013 to 30th September 2014. The cases confirmed by Ultrasonography were evaluated with following risk factors: age >50 years, male sex, BMI 25.1 to 27.5 and >27.5, previous surgery, prior hospitalization, palpable gall bladder, gall bladder wall thickening, impacted stone, pericholecystic collection and presence of adhesions. Each risk factor was given a score. The total score up to 5 predicted easy, 6 to 10 difficult and more than 10 very difficult.

Results: The highest age incidence of Cholelithiasis was in the 2nd to 4th decade and was more common in females. Ultrasonography detected gallbladder stones in all patients, wall thickening in 15 and pericholecystic collection in 8. BMI >27.5 presence of adhesions, male sex and pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy.

Conclusions: Numerous clinical, radiological and pre-operative features make LC sometimes difficult. Early determination of these predictive factors decreases the difficulty that we will be facing with LC.

Keywords: Cholelithiasis, Laparoscopic cholecystectomy

INTRODUCTION

Gallstone disease is common biliary pathology.¹ Approximately 1-2% of patients develop symptoms requiring surgical intervention. Cholelithiasis has peak in 5th and 6th decade and women are more affected than men in ratio of 4:1.¹ Cholecystectomy is a very common operation performed throughout the world. There are certain advantages of laparoscopic cholecystectomy over open cholecystectomy such as earlier return of bowel functions, less postoperative pain, better cosmesis and

short hospital stay, earlier return of function and less cost.¹ In addition the rate of surgical site infection is also less.

Laparoscopic cholecystectomy (LC) is gold standard procedure in the treatment of symptomatic gallstones.^{2,3} Efficiency and safety of LC depends on the experience and expertise of the surgeon and on the underlying pathology. In the hospitals where there is smaller number of experienced surgeons, prevention of injuries of the bile ducts and vascular structures during LC is extremely

important because very often there are no conditions for their definite successful treatment.³

It is accepted that the rapid adoption of laparoscopy as the technique of choice for cholecystectomy has been attributed to shorter hospital length of stay, decreased patient morbidity, faster return to routine activity, and improved overall patient satisfaction.⁴ It is currently estimated that more than 700,000 laparoscopic cholecystectomies (LCs) are performed annually in the United States which is approximately 90% of all cholecystectomies.⁵

Similarly, trend of use of LCs has dramatically increased in developing countries including Nepal but the data are lacking. The rate of conversion from LC to open cholecystectomy (OC) is consistently reported to range between 2% and 15%.^{6,7}

Various other studies have been done to find out possible factors responsible for conversion that include age; sex; obesity; diabetes mellitus; body mass index; duration of symptoms; total leucocyte count; LFT; ultrasound; acute cholecystitis; history of biliary diseases such as jaundice, cholangitis, etc.; history of pancreatitis and preoperative endoscopic retrograde cholangiopancreatography.^{8,9}

Several preoperative risk factors have been associated with a higher rate of conversion from LC to OC, including older age, male gender, cardiovascular disease, gangrenous cholecystitis, and acute cholecystitis associated with elevated leukocyte count.¹⁰

On the other hand, during operation, the need for conversion is usually due to difficulty in dissection at Calot's triangle, instrument failure or a complication.¹¹ Recent study explored that the most common reason for conversion was inadequate visualization of elements of Calot's triangle and unclear anatomy, bleeding from the GB lodges and lost stones, perforation of the GB with lost stones and injury of common bile duct at one patient with Mirizzi syndrome and empyema of the GB.¹²

The current rates of OC or conversion to OC within different setting are variable. Moreover, it is unclear whether a higher rate of OC at a specific hospital or group of hospitals is due to a patient population with different characteristics, or to particular surgeons' technical expertise with laparoscopy.⁶

Preoperative knowledge of risk factors that indicate the occurrence of difficulties that can occur in different phases of the operation are of great importance not only for the safety of patients but also explore assessment of the competence of the surgical team for the performance LC.¹² Preoperative identification of operative difficulties predictors is particularly important in non-referential LC centers and in the hospitals where open cholecystectomy (OC) became a rarity as a primary prevention in intra-

operative injuries of the bile ducts and vascular structures.⁶

When the likelihood of conversion is high, proceeding to OC will help prevent initial laparoscopy with its associated risks of prolonged and dangerous dissections and its higher costs.¹³ When the factors leading to conversion can be addressed preoperatively, their elimination can result in higher rates of successful LC. In addition, the potential identification of non-patient-related predictors of a higher OC rates can provide insights leading to system-level improvements in the surgical care of patients with gallbladder disease.⁴

The objectives of this study are to determine various predictive factors for difficult laparoscopic cholecystectomy, to study various presentation of cholelithiasis and cholecystitis, to evaluate different complications of cholelithiasis and to study the surgical mode of management

METHODS

The materials for the present study on "Determination of predictive factors for difficult laparoscopic cholecystectomy" comprises of cases admitted to National Medical College and Teaching Hospital, Birgunj. This is a tertiary level hospital in Nepal. The study period was twelve months from 1st August 2013 to 30th September 2014. The proposal of this research was approved by the Institutional Review Board (IRB).

Sampling technique

Non randomized purposive sampling technique was utilized for the study.

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.

Ultrasound abdomen was done in all patients. Routine hematological and biochemical investigations were done. LFT and PT-INR were done in all patients.

The patients confirmed by USG examination were evaluated with following factors: age, sex, h/o previous hospitalization, BMI wt (kg)/ht (m²), abdominal scar-supraumbilical or infraumbilical, palpable gall bladder, sonographic findings- wall thickness, Pericholecystic collection, impacted stone. Each risk factor was given a score. The total score up to 5 predicted easy, 6 to 10 difficult and more than 10 very difficult.

All the patients received symptomatic treatment and vitamin K for 3 days preoperatively. Following evaluation, the patient was subjected to laparoscopic cholecystectomy and time taken, biliary/stone spillage,

injury to duct/artery, presence of adhesions and conversion were noted.

All patients were operated by two surgeons with similar years of experience in laparoscopic surgery. All cases were followed up post operatively cases for any complication. Drain was removed between 2nd and 5th post-operative day depending on the drainage, and suture removal was done 8th post-operative day. All cases were followed up for any recurrent symptoms.

Inclusion criteria

The patients aged between 16 and 70 years presenting with symptoms and signs of Cholelithiasis/ Cholecystitis diagnosed by USG examination in surgical outpatient department and ward of NMCTH Birgunj were included.

Exclusion criteria

Asymptomatic gall stone patients, patients with CBD calculus, raised ALP, dilated CBD, where CBD, exploration was needed, patients with features of obstructive jaundice, Patients refusing surgery, Patients not willing for laparoscopic cholecystectomy.

Ethical consideration was maintained throughout the research. Participants were explained about the aim and purpose of the study. Informed consent was obtained before starting research. Privacy and confidentiality were maintained throughout the research. They knew that they can withdraw the consent anytime during the study and that the withdrawal from the study will not affect patient care in the days to come.

The data was processed in the Statistical Package for Social Sciences (SPSS) Software for Windows. It was entered into the SPSS and Microsoft Excel. The association was tested using the test of statistical significance. Chi-square test was used and a P-value <0.05 was considered as significant. Findings were expressed in the form of tables and charts where feasible.

RESULTS

This study included 45 cases in a period of 12 months which were studied prospectively.

Age distribution

Figure 1 show the age distribution of patients, in which majority of them were between the age range of 21-40. Minority of them were in age group 11-20(6.7%) and >60 years (2.2%). The present study has the youngest age as 18 and oldest as 62.

Sex distribution

In present study, out of 45 patients 32 were female and 13 were male. It illustrates that the male patients are less in

number in comparison to female. 28.9% were male whereas 71.1% were females.

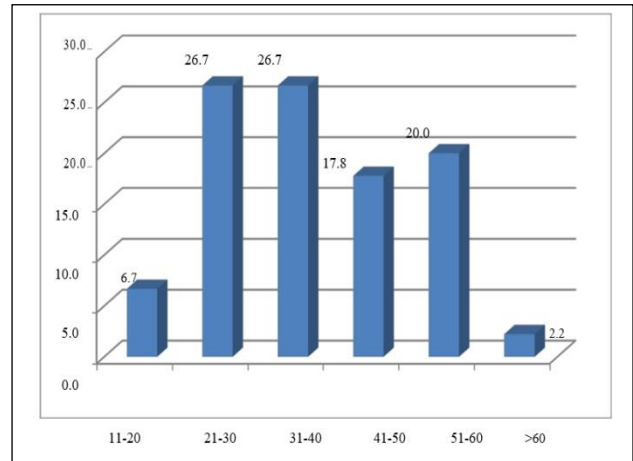


Figure 1: Age distribution of patients.

Presenting symptoms

In our study, pain was present in all patients. Figure 2 shows that vomiting and dyspepsia were present in apparently 1/3rd of patients.

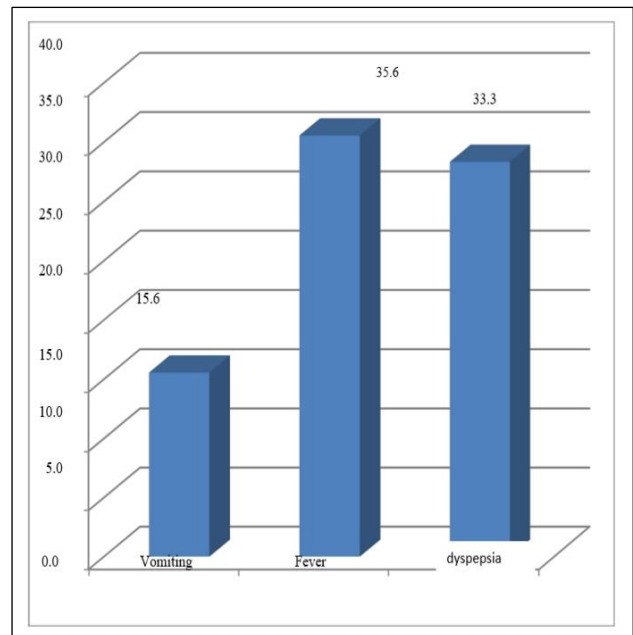


Figure 2: Clinical presentations of the patients.

Presenting signs

Tenderness was present in 35 patients. Guarding and rigidity present in 3 patients and mass palpable in 3 patients. In our study, there were only 6.7 % of patients with Gall Bladder mass whereas no such finding in 93.3% of patients which shows that the case selection was appropriate.

Ultrasonography

All 45 patients had stone in Gall Bladder. 15 patients had wall thickening and 8 patients had pericholecystic collection. 30 had multiple calculi, 9 had solitary calculi and 6 had solitary impacted calculi as shown in Table 1.

Table 1: USG findings.

Ultrasonography	No of cases
Multiple calculi	30
Wall thickening	15
Solitary calculi	9
Solitary impacted calculi	6
Pericholecystic collection	8

It illustrates that 66.7% having multiple calculi. There were 20% of single and 13.3% of single impacted calculi in our study. Figure 3 shows that 33.3 % of patients were having thickened gall bladder wall whereas it was normal in 66.7% of patients in our study. In our study among 45 patients, 17.8% patients were having pericholecystic collection whereas 82.2% were didn't have pericholecystic collection.

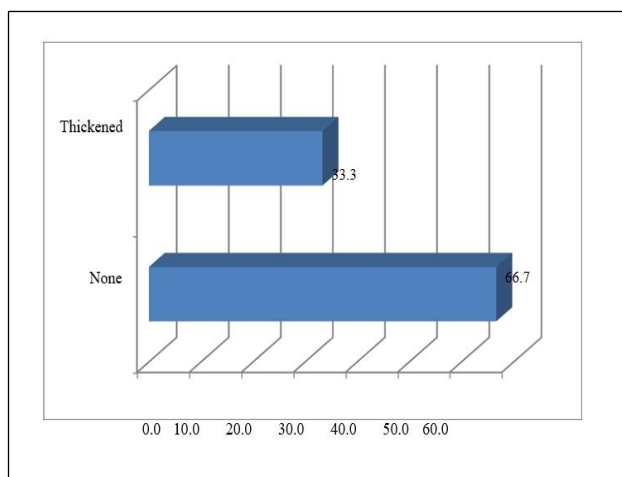


Figure 3: Distribution of gall bladder wall thickening.

In the present study (Table 2) male sex, BMI >27.5, thick GB wall, adhesions and pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy.

Only 3 patients had wound infection at the port site which need dressing (Table 3). In our study among 45 patients, 3(6.75%) patients were having superficial surgical site infection. All improved with minor dressings.

There were 40 cases of chronic cholecystitis and 4 cases of acute cholecystitis (Table 4). One case of malignancy was detected. It was staged 0 after HPE.

Table 2: Analysis of preoperative outcome with risk factors.

Risk factors	Level	Per-op outcome		P value
		D	E	
Age (years)	≤50	16	14	
	>50	4	6	
Sex	Female	12	18	0.028
	Male	8	2	
BMI wt(kg)/ht(m ²)	≤25	9	17	0.026
	25.1-27.5	2	1	
	>27.5	9	2	
Previous Surg.	Nil	14	11	0.327
	Yes	6	9	
GB palpable	NP	17	20	0.230
	Yes	3	0	
USG- wall thick	N	6	20	<0.001
	Yes	14	0	
Adhesions	Nil	4	18	<0.001
	Yes	15	3	
P/C collection	Nil	11	21	

Table 3: Post-operative complications.

Post op complications	No of cases
Wound infection	3
Retained stone	0
Bile leak	3
Hemorrhage	0
Fever	0

Table 4: Histopathological examination.

Histopathological examination	No of cases
Chronic cholecystitis	40
Acute cholecystitis	4
C/A Gall Bladder	1
Gangrenous gall bladder	0
Rupture Gall Bladder	0

Post-operative treatment

In all cases, post-operative treatment included nasogastric aspiration till the patient recovered from the postoperative ileus evidenced from appearance of bowel sounds and passage of flatus and I-V fluids continued till oral liquid diet was started, i.e. following removal of Ryle's tube. Broad spectrum antibiotic for 5 days, analgesics as and when required, drainage tube was removed between 1st and 4th post OP day.

Post-operative complication

Only 3(6.75%) patients had infection of the epigastric port site which required about 2 to 3 dressing.

Follow up

All patients were followed up for a period of 1 month and no significant complication was noted.

Table 5: Comparison of the study with other similar studies.

Symptoms	GaneyS study	%	Sharma A	%	Our study	%
Pain	987	95	58	100	45	100
Vomiting	576	55.6	48	82.8	16	35.5
Jaundice	101	10	3	5.17	0	0
Dyspepsia	222	21	5	8.62	15	33
Fever	92	9	0	0	7	15.5

Table 6: Comparison of clinical signs.

Signs	Hadfield Study (%)	Our Study	Our Study (%)
Tenderness in right hypochondrium	65.5	35	77.7
Guarding	18.7	7	15.5
Mass	7	3	6.6

Table 7: Comparison of USG finding with other study.

	Sharma A Study	Our Study
Calculi present	98.3%	100%
GB wall thickening	5.2%	33.3%
Multiple stones	73.7%	66.7%
Single stones	26.3%	33.3%
Bile duct stones	5.2%	0%

DISCUSSION

Age distribution

Majority of the patients in our study were in the age group of 21-40 years. In contrast, study done by Herman et al pointed out the age group of 51-60 years.¹⁴ Another study found the majority of them were in the age group of 41-50 years.¹⁴ This contrast distribution may be due to geographical variations and treatment seeking habit of patients.

Sex distribution

The study revealed that out of 45 patients, 32 were females and 13 were male patients. The male and female ratio was 1:2.46. Our study finding was similar to finding

of study done by Bhattachary where majority (71.4 %) of the patients were females.¹⁵ Another study also revealed similar findings where almost 2/3rd (64%) were female.¹⁶ Many studies pointed out male gender as the risk factor even though females were predominant in the study.^{7,17}

Presenting symptoms

Pain was the predominant symptom seen in all 45 patients. All the 45 patients presented with chronic recurring pain. In approximately 1/3rd of patients, pain was in the right hypochondrium. Of the 45 patients, 2/3rd of patients had colicky type of pain. Our study finding was consistent with other studies findings which were done in the done in similar setting.^{14,18}

Vomiting was present approximately among one third of the patients along with pain. Vomiting was spontaneous and occurred mostly during the attack of pain. Jaundice was not present in any patient in the study. Similarly, dyspepsia was present approximately in one third of the patients. Fever was present in approximately one seventh of patients. Studies done in the similar settings shows similar presentation in some symptoms and contrast in other as shown in Table 5.¹⁹

Past history

The study revealed that approximately one third of the patients had undergone abdominal surgery. Study done by Gupta et al in similar context pointed out the risk factor as history of hospitalization especially prior abdominal surgery along with abdominal surgery scar.²⁰ Sensitivity and specificity of preoperative scoring method were found to be 95.74% and 73.68% respectively in that study. Similarly, recent study done by Jethwani et al also explored past history of abdominal surgery as the risk factor for difficult laparoscopic cholecystectomy.²¹ They have concluded from this that early prediction may help both patient and surgeon to know the high risk and to prepare beforehand regarding the probability of conversion and hence they may have a chance to make arrangements accordingly.

General physical examination

The study revealed approximately one fourth of the patients had BMI >27.5 which was found significant (P=0.026) and was similar to the finding of the Randhawa study. In the study of Rosen et al, patients with acute cholecystitis were evaluated only a body mass index >30 kg/m² (5.6 OR, P = 0.02) predicted conversion. For patients undergoing elective cholecystectomy, a body mass index >40 kg/m² (33.1 OR, P = 0.01) and a wall thickness >0.4 cm (24.7 OR, P<0.004) predicted conversion. Finally, an ASA >2 (5.3 OR, P = 0.01) predicted conversion in patients undergoing nonelective cholecystectomies.²²

Presenting signs

Tenderness in right hypochondrium was present in 35(77.7%) patients (Table 6). Guarding and rigidity was present in 7(15.5%) patients in contrast to 18.7% seen in Hadfield's study. Murphy's sign was present in 12(26.6%) patients.²³ Mass was palpable in 3(6.6%) patients while in Hadfield's study mass was palpable in 7% of the patients.²³ Grossly, our study finding was consistent with other past studies.^{2,20}

Investigations

Routine biochemical and hematological investigations like Hb%, urine examination, blood grouping, RFT, RBS, PT-INR and LFT were done in all cases which were approximately within normal limits. However some studies showed significant predictors of conversion to open cholecystectomy in univariate analysis were increasing elevated white blood cell count, high aspartate transaminase, alkaline phosphatase and total bilirubin levels.¹⁶ Similarly, study done by Simopoulos et al found out the conversion from laparoscopic to open cholecystectomy in acute cholecystitis patients was associated with greater white blood cell count, fever, elevated total bilirubin, aspartate transaminase, and alanine transaminase levels, and the various types of inflammation.⁷

Ultrasonography

Ultrasound was done as a routine investigation in all the patients. The sonologic criteria used to diagnose gall stones were acoustic shadowing of the opacities in the gall bladder and change in the position of the opacity with the change in patient position. Study done by Sharma pointed similar finding as our study except GB wall thickening as shown in Table 7.²⁴

In Sharma A study revealed 98.3% had stones in GB and 5.2 % had GB wall thickening. Of the 98.3%, 73.7% had multiple stones, 26.3% had solitary stones and 5.2% had bile duct stone.²⁴

Thickening of gall bladder wall was present in one third of the patient in our study (Table 7) which was consistent with other studies and they pointed out preoperative ultrasound findings of a thickened gallbladder wall and dilated common bile duct are risk factors and predicted conversion.²⁰ Study done in similar setting in India explored ultrasonography findings of multiple calculi and gall bladder wall thickness of more than 3 mm as the predictor of difficult LC.²⁵ The ultrasound findings in a study in India also revealed similar findings.²⁶

Evaluation of predictive factors for difficult laparoscopic cholecystectomy

The following risk factors were explored from our study which were age>50 years, male sex, BMI >27.5, palpable

GB, previous history of surgery, wall thickening, adhesions and pericholecystic collection. Out of this BMI >27.5, male sex, gall bladder wall thickening, adhesions, and pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy. Our study findings were consistent with other similar type of studies.^{10,26} A retrospective study revealed several factors responsible for difficult laparoscopic cholecystectomy include age; sex; obesity; diabetes mellitus; body mass index; duration of symptoms; total leucocyte count; LFT; ultrasound; acute cholecystitis; history of biliary diseases such as jaundice, cholangitis, etc.; history of pancreatitis and preoperative endoscopic retrograde cholangiopancreatography.²² Male gender, age older than 60 years, previous upper abdominal surgery, diabetes, and severity of inflammation were all significantly correlated with an increased conversion rate to laparotomy and were the predictors.⁷ In addition, investigation related to greater white blood cell count, fever, elevated total bilirubin, aspartate transaminase, and alanine transaminase levels were found to be predictors which was contrast to our study result.

Predictors may be preoperative or intraoperative. Several preoperative risk factors have been associated in the past study including older age, male gender, cardiovascular disease, gangrenous cholecystitis, and acute cholecystitis associated with elevated leukocyte count.¹⁰ Likewise, intraoperative predictors include difficulty in dissection at Calot's triangle, instrument failure or a complication.¹¹ Moreover, inadequate visualization of elements of Calot's triangle and unclear anatomy, bleeding from the GB lodges and lost stones, perforation of the GB with lost stones and injury of common bile duct also found to be important predictors.^{27,28}

Correlation of pre-operative score and the outcome

Approximately 11% patients have found difficulty doing LC due to gross adhesions and having difficulty in dissection and was categorized as very difficult. Past studies explored that extensive inflammation and adhesions around Calot's triangle increase risk of bleeding and make anatomy unclear.¹²

Under such conditions, dissection of adhesions around GB, dissection of the elements of Calot's triangle and dissection of GB from the liver parenchyma is very hard and dangerous. Time of surgery is very important when it comes to the outcome of the surgery. Most studies find out that the surgery must be done between 48 to 72 hours since the first symptoms appear.¹² Conversion rate from lap. cholecystectomy to open cholecystectomy in our study was 11%. In many studies the rate of conversion to the open procedure is between 2 to 15%. However, a study by Randhawa JS and Pujahari AK, of the 228 patients studied; cases with 0 to 5 pre-operative score were 178 of which 158 were easy LC, 14 were difficult LC and 6 were very difficult LC. The positive prediction value for easy prediction was 88.8% and for difficult

prediction was 92%.²⁸ The conversion rate was 1.315% and all were due to anomalous ducts.²⁹

Our study has several limitations. This study was totally hospital based and only 45 sample size was considered and was purposive in nature. The sample also excluded subject from general population.

CONCLUSION

Cholelithiasis is the most common biliary pathology. Gall stones are present in 10 to 15% of the general population and asymptomatic in most 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 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 following risk factors were considered- age>50 years, male sex, BMI >27.5, palpable GB, wall thickening, adhesions and pericholecystic collection. Out of this BMI >27.5., male sex, gall bladder wall thickening, adhesions, and pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy, as per present study.

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