Original Research Article

Study of Risk factors predicting difficult Cholecystectomy and conversion from laparoscopic to open Cholecystectomy.

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Abstract

Background: Laparoscopic Cholecystectomy occasionally can become difficult due to various reasons. Preoperative risk factors which can predict difficult cholecystectomy are advanced age, male sex, high BMI, acute cholecystitis and previous hospitalisation for recurrent attacks, thickened gall bladder wall, impacted stone at neck of gall bladder and previous surgeries on abdomen. If preoperative factors can predict difficult Cholecystectomy, it will be helpful for surgeons to sort out low risk and high risk groups. Low risk group surgeries can be performed by trainees and high risk cases can be performed by more experienced surgeons or at specialized unit. **Objective:** To identify the risk factors predicting difficult Laparoscopic Cholecystectomy and need for conversion to open Cholecystectomy. Methodology: All the cases admitted for gallstone disease in Department of General Surgery at Hassan Institute of Medical Sciences, Hassan between September 2017 to September 2020 were studied retrospectively. Total of 255 patients met inclusion criteria and underwent LC were included in the study. Details of patients demographics, clinical findings, laboratory Investigations and imaging findings were recorded. **Results:** In the study 255 subjects who underwent Cholecystectomy were included in the study. In the study 82.3% had easy, 13.4% had difficult, 2% had very difficult and 2.4% underwent conversion to open Cholecystectomy. In the study considering the factors which were significant in Univariate analysis, Previous hospitalization, GB thickness >4 mm and presence of Impacted stone were significant factors in predicting difficult operation in Cholecystectomy. Previous hospitalization had 5.006 times higher chances of Difficult Cholecystectomy, GB Thickness >4 mm had 3.251 times higher chances of Difficult Cholecystectomy and Impacted Stone had 3.251 times higher chances of Difficult Cholecystectomy. **Conclusion:**We conclude that difficult laparoscopic cholecystectomy and conversion to open Cholecystectomy can be predicted preoperatively based on number of previous attacks of cholecystitis and hospitalization, gallbladder wall thickness and impacted stone at neck of gallbladder.

Keywords: Cholecystectomy, Gall Bladder, Laproscopic, Gall Stones, Abdominal Surgery

Introduction

Laparoscopic Cholecystectomy [LC] is the gold standard treatment at present for symptomatic gallstones.[1]

As the expertise in laparoscopic Cholecystectomy and training centres increased at many places all over the world, there are very few contraindications for LC now. Attempts are made in almost all cases of gallstone disease to treat with minimally invasive LC except coagulation abnormalities, Carcinoma gallbladder and patient unfit for general anaesthesia. [2]

Laparoscopic Cholecystectomy occasionally can become difficult due to various reasons. Preoperative risk factors which can predict difficult cholecystectomy are advanced age, male sex, high BMI, acute cholecystitis and previous hospitalisation for recurrent attacks, thickened gall bladder wall, impacted stone at neck of gall bladder and previous surgeries on abdomen. If preoperative factors can predict difficult Cholecystectomy, it will be helpful for surgeons to sort out low risk and high risk groups. Low risk group surgeries can be performed by trainees and high risk cases can be performed by more experienced surgeons or at specialized unit.[1-4]Conversion from Laparoscopic to open Cholecystectomy is seen in 2-15% of patients for various reasons and is associated with prolonged hospital stay, delay in return to work and increased morbidity[2-5].Common operative reasons for conversion include failure to visualize critical view of safety[6]or presence of intraoperative complications like bile duct injury,[7] hemorrhage or adjacent bowel perforations. Conversion to open cholecystectomy usually indicates difficult procedure and should not be viewed as a complication. Decision to convert should be viewed as a good judgement in the presence of adverse conditions, improves patient safety and avoid unnecessary litigations.[8-14]Various Studies have been published proposing preoperative and intraoperative scoring methods for predicting a difficult laparoscopic Cholecystectomy.

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Most scoring systems lack objective definitions of the difficulty encountered at the time of surgery, correlated to different measures of intraoperative difficulty. [15-19]

Objective

To identify the risk factors predicting difficult Laparoscopic Cholecystectomy and need for conversion to open Cholecystectomy.

Materials and Methods

All the cases admitted for gallstone disease in Department of General Surgery at Hassan Institute of Medical Sciences, Hassan between September 2017 to September 2020 were studied retrospectively. Total of 255 patients met inclusion criteria and underwent LC were included in the study. Details of patients demographics, clinical findings, laboratory Investigations and imaging findings were recorded. Surgery was done using Co_2 pneumoperitoneum with 14 mm of pressure and using standard two 10mm and two 5mm ports. The operative time were noted from first port incision till last port closure. All the intraoperative events were recorded as per operative notes. Intraoperative findings were divided into easy LC, Difficult LC, Very difficult and Conversion to open Cholecystectomy. All the cases received standard postoperative care and follow-up as per institutional protocol. Patients with Jaundice, Cholangitis, CBD stones, dilated CBD, critically ill high risk patients, suspected carcinoma gallbladder were excluded from study.

Easy/Difficult Criteria

Easy: Time taken< 60 minutes
No bile spillage
No injury to duct, vessel

Difficult: Time taken 60-120 minutes
Bile /stone Spillage
Injury to Duct
No conversion

Very Difficult: Time taken > 120 minutes - Conversion

Statistical Methods

All the dataentered into Microsoft excel data sheet and analyzed using SPSS windows version 22 software [IBM SPSS Statistics, Somers NY, USA].Categorical data was represented in the form of frequencies and proportions. Chi square test was used as a test of significance for qualitative data and used to find the significant association of findings of preoperative risk factors with perioperative outcome.

Graphical representation of data

MS Excel and MS Word were used to obtain various types of graphs such as bar diagram.

Univariate analysis of Chi square test have been used to find significant association of risk factors with perioperative outcome and multivariate analysis of logistic regression has been used to find the predictive association of risk factors in predicting the perioperative outcome i.e., easy, difficult and very difficult. P -value <0.05 was taken as statistically significant.

Results

Table 1: Profile of subjects in the study

		Count (n = 255)	%
Age	<50 years	185	72.5%
	>50 years	70	27.5%
Gender	Male	68	26.7%
	Female	187	73.3%
BMI	<25	79	31.0%
	25 to 27.5	139	54.5%
	>27.5	37	14.5%
ASA Score	<2	245	96.1%
	>2	10	3.9%
Cholecystitis	Acute Cholecystitis	8	3.1%
	Chronic Cholecystitis	247	96.9%
Previous Surgery	No	226	88.6%
	Yes	29	11.4%
Previous Hospitalization	No	200	78.4%
	Yes	55	21.6%
Impacted Stone	No	241	94.5%
	Yes	14	5.5%
GB Thickness	<4 mm	194	76.1%
	>4 mm	61	23.9%

In the study 255 subjects who underwent Cholecystectomy were included in the study. Majority of subjects were in the age group <50 years (72.5%), 73.3% were females and 26.7% were males, majority had BMI 25 to 27.5 (54.5%), in majority ASA grade was <2 (96.1%), 3.1% had acute cholecystitis and 96.9% had chronic cholecystitis, 11.4% underwent previous surgeries, 21.6% had previous hospitalizations, 5.5% had impacted stone and Gall bladder thickness was <4 mm in 76.1% and >4 mm in 23.9%.

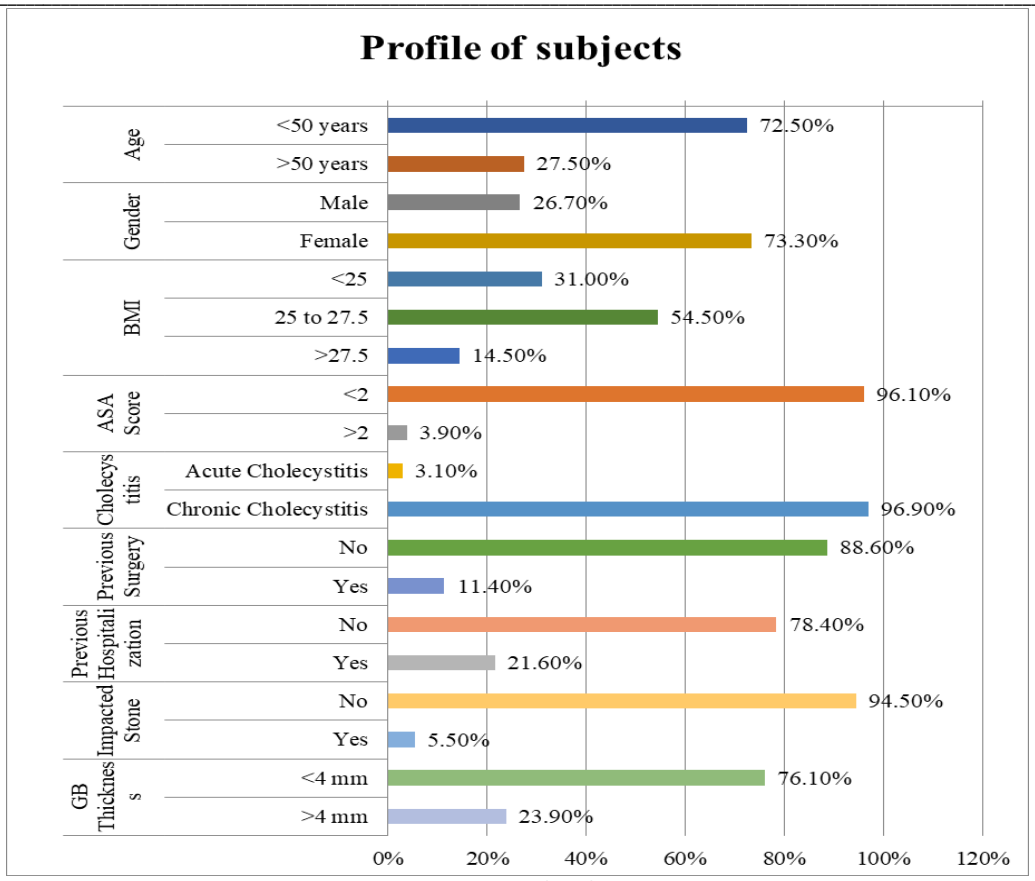

Fig 1: Bar diagram showing Profile of subjects in the study

Table 2: Operative Findings distribution

		Count	%
Operative Findings	Easy	209	82.3%
	Difficult	34	13.4%
	Very Difficult	5	2.0%
	Conversion	6	2.4%

In the study 82.3% had easy, 13.4% had difficult, 2% had very difficult and 2.4% underwent conversion to open Cholecystectomy.

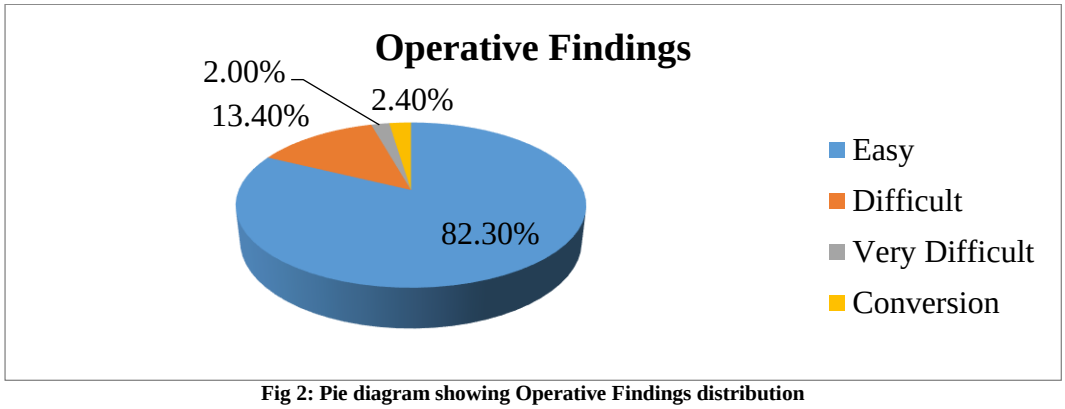

Fig 2: Pie diagram showing Operative Findings distribution

Table 3: Reason for Conversion

		Count	%
Reason for Conversion	CBD Injury	1	16.7%
	Dilated Cystic duct	1	16.7%
	Frozen Calot's	4	66.6%

In the study reason for conversion was 16.7% had CBD injury, 16.7% had dilated Cystic duct and 66.6% had Frozen Calot's.

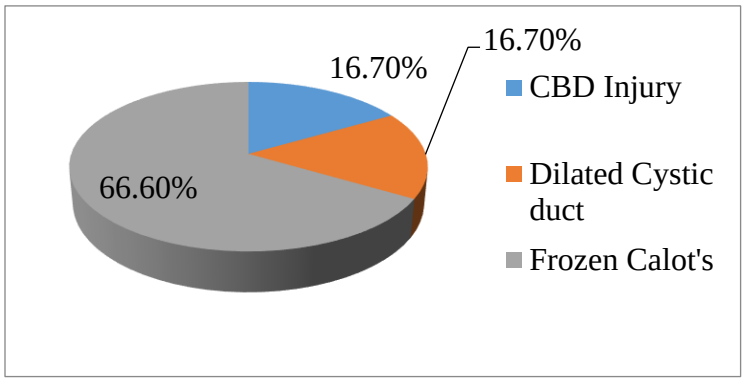

Fig 3: Pie diagram showing Reason for Conversion

Table 4: Complications distribution

		Count	%
Complications	Nil	235	92.2%
	Port site Infection	17	6.7%
	Biliary Peritonitis	3	1.2%

In the study 6.7% had port site infection and 1.2% had biliary peritonitis.

Table 5: Association between various parameters with Operative findings

		Operative Findings				P value
		Difficult		Easy		
		Count	%	Count	%	
Age	<50 years	34	75.6%	151	71.9%	0.618
	>50 years	11	24.4%	59	28.1%	
Gender	Male	14	31.1%	54	25.7%	0.458
	Female	31	68.9%	156	74.3%	
Previous Surgery	No	38	84.4%	188	89.5%	0.330
	Yes	7	15.6%	22	10.5%	
Previous Hospitalization	No	22	48.9%	178	84.8%	<0.001*
	Yes	23	51.1%	32	15.2%	
BMI	<25	21	46.7%	58	27.6%	0.039*
	25 to 27.5	18	40.0%	121	57.6%	
	>27.5	6	13.3%	31	14.8%	
ASA Score	<2	42	93.3%	203	96.7%	0.296
	>2	3	6.7%	7	3.3%	
Cholecystitis	Acute Cholecystitis	1	2.2%	7	3.3%	0.698
	Chronic Cholecystitis	44	97.8%	203	96.7%	
GB Thickness	<4 mm	23	51.1%	171	81.4%	<0.001*
	>4 mm	22	48.9%	39	18.6%	
Impacted Stone	No	36	80.0%	205	97.6%	<0.001*
	Yes	9	20.0%	5	2.4%	

On Univariate association, it was observed that there was significant association between Previous hospitalization, BMI, GB thickness and impacted with operative findings.

I.e. among subjects with difficult findings, 51.1% had h/o previous hospitalization and among subjects with easy findings, 15.2% had h/o previous hospitalization. Among subjects with difficult findings, 46.7% had BMI <25, 40% had BMI 25 to 27.5 and 13.3% had BMI >27.5 and among subjects with easy findings, 27.6% had BMI <25, 57.6% had BMI 25 to 27.5 and 14.8% had BMI >27.5.

Among subjects with difficult findings, 48.9% had GB thickness >4 mm and among subjects with easy findings, 18.6% had GB thickness >4 mm.

Among subjects with difficult findings, 20% had impacted stone and among subjects with easy findings 2.4% had impacted stone.

Table 6: Multivariate logistic regression to determine independent predictor of difficult operation

Operative Findings		P value	Exp(B) OR	95% Confidence Interval for Exp(B)	
				Lower Bound	Upper Bound
Difficult	Previous Hospitalization = Yes	<0.001*	5.006	2.315	10.828
	BMI = 25 to 27.5	0.182	0.451	0.140	1.452
	BMI >27.5	0.564	1.404	0.444	4.441
	GB Thickness >4 mm	0.003*	3.251	1.483	7.128
	Impacted Stone= Yes	0.002*	3.251	1.483	7.128

In the study considering the factors which were significant in Univariate analysis, Previous hospitalization, GB thickness >4 mm and presence of Impacted stone were significant factors in predicting difficult operation in Cholecystectomy.

Previous hospitalization had 5.006 times higher chances of Difficult Cholecystectomy, GB Thickness >4 mm had 3.251 times higher chances of Difficult Cholecystectomy and Impacted Stone had 3.251 times higher chances of Difficult Cholecystectomy.

Discussion

Laparoscopic Cholecystectomy [LC] being the gold standard treatment of symptomatic gallstone disease. [10]Preoperative risk factors predicting difficult cholecystectomy is an important aspect of planning laparoscopic cholecystectomy, informing patients, predicting certain outcomes like possibility of conversion to open surgery.

If preoperative parameters predicting difficult cholecystectomy are accurate, it is safe if senior experienced consultant operates so that junior surgeon's learning curve improves and also lessens prolongation of operative time and intraoperative complications. Though many studies have attempted to form scoring system to predict difficult LC, they are difficult to use in day to day practice.[18-21]. Old age [age>50 years] has been found to be a significant risk factor for difficult laparoscopic cholecystectomy as well as conversion to open cholecystectomy in earlier study by Randhawa et al.[19]In our study it was not a risk factor, may be cut off age >60 years would have contributed for statistical significance as recommended by western literature[29]

Many studies have reported that laparoscopic cholecystectomy is a safe and effective treatment for acute cholecystitis, optimal timing for the procedure is still a matter of debate, safer to follow Tokyo guidelines.[20-22]The feasibility and safety of early LC for acute cholecystitis have been reported in several randomized and non-randomized studies. [23-26]In our study, only 3.1% cases with acute cholecystitis underwent laparoscopic Cholecystectomy mostly preferred delayed LC.Male sex was reported to have difficult cholecystectomy in many studies.[26,27] Increased Conversion rate and intraoperative complication has been reported in male sex. We did not find it as a significant factor in our study. Complication rate with LC was high earlier but with technical advancement and expertise due to better training, it has now reached very low level at 2.6%.[28-29] Conversion rate of 7-35% has been reported in literature.[30] In our study, laparoscopic Cholecystectomy was performed in 255 patients and different preoperative predictive risk factors for difficult LC were analyzed. Old age, male sex, recurrent attacks of cholecystitis with hospitalisation, obesity, previous abdominal surgeries, gallbladder wall thickness, impacted stone were included as risk factors in this study.Calot's triangle difficulty was associated with age >65, male sex, previous recurrent attacks of cholecystitis, post ERCP, abnormal LFT, presence of multiple stones, presence of cirrhosis on ultrasound [27]Patients required hospitalization for recurrent attacks of cholecystitis predicted to have difficult laparoscopic cholecystectomy and conversion probably due to dense adhesions at calot's triangle and gallbladder fossa. In our study it was found to be a significant factor for prediction of difficult LC [P value <0.001]Obesity with high BMI considered as another risk factor for difficult cholecystectomy as observed by Rosen et al.[8] However certain studies found no difference in operative time or complications. Nachnani et al [33] have found BMI >30 to be significantly associated with difficulty in umbilical port entry and creating pneumoperitoneum. In our study BMI >25 did not significantly affected the outcome [P value 0.182] and number of easy and difficult cases were almost equal in both groups of patients [BMI 25-27.5 and >27.5]. Obese group without mentioning BMI reported to be having conversion rate of 6.2% compared to overall conversion of 5.4%.[8]Thickened gallbladder wall is an ultrasonographic finding in many acute or acute on chronic cholecystitis and it was significant factor in predicting difficult LC and conversion in previous studies.[30-32] The thickness of gallbladder associated with difficult LC and conversion varies from different studies with cutoff value of 3mm and 4mm.In our study, among difficult findings at surgery,48.9% had GB wall thickness>4mm as compared to 18.6% easy cholecyste-ctomy ,it was found that gallbladder wall thickness >4mm predicted difficulty and conversion.[P value < 0.001]Impacted stone at neck of gallbladder with distended gallbladder can be predicted to have difficult cholecystectomy by preoperative ultrasound [30-32] and these cases can have difficulty in grasping gallbladder during surgery. [3,10] In our series, among difficult findings during surgery, 20% had impacted stone and prediction was found to be statistically significant.[P value < 0.001].After previous abdominal surgeries there may be adhesions form between intraabdominal contents and abdominal wall. There may be chances of injury to these structures during insertion of first port and risk of conversion was reported to be higher. [33]In our study, only twenty nine patients had previous abdominal surgeries and many of them had successful laparoscopic cholecystectomy probably due to small sample size and did not predict difficult cholecystectomy.

Conclusion

We conclude that difficult laparoscopic cholecystectomy and conversion to open Cholecystectomy can be predicted preoperatively based on number of previous attacks of cholecystitis and hospitalization, gallbladder wall thickness and impacted stone at neck of gallbladder.

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