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Preoperative Predictive Factors in Case of Difficult Laparoscopic Cholecystectomy at Tertiary Center

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Abstract: ***Introduction: Laparoscopic cholecystectomy has become standard treatment for cholecystitis and cholelithiasis. Despite advances there are few things that make surgery difficult. Preoperative assessment for level of difficulty helps in deciding the approach of surgery, reduces the morbidity, reduces complications rate and also gives a better outcome. Aim: To detect preoperative predictors of intraoperative difficulties in Laparoscopic cholecystectomy, to evaluate predictor for conversion to open cholecystectomy and to validate a scoring system to predict difficult laparoscopic. Material method: Study was conducted in Moti Lal Nehru Medical college, prayagraj. All eligible patients undergoing Laparoscopic cholecystectomy in unit at department of general surgery at our institute were included. Study was done during October 2021 to September 2022. Preoperative difficulty parameters and intraoperative difficulty were assessed by scoring given by Randhawa J S et al. Each individual parameter (Age, Gender, History of Hospitalization for acute cholecystitis, BMI, Abdominal scar, Palpable gallbladder, Thick Gallbladder wall, pericholecystic collection and impacted stone at neck) was evaluated for association with intraoperative outcome. Result: On evaluating score, 55 patients scored 0 - 5 easy score and among them 2 (3.6%) had very difficult outcome, 6 (10.9%) had difficult outcome and 47 (85.5%) had easy outcome. Proportion of difficult laparoscopic cholecystectomy was higher in Males, patients who had previous history of hospitalization for acute cholecystitis and patients who had pericholecystic collection. Conclusion: Score by Randhawa JS et al, resulted sensitivity of 65.22% and specificity of 87% in predicting difficult laparoscopic cholecystectomy. Which makes score reasonably good. Proportion of difficulty is higher in male, patients with history of hospitalization and pericholecystic collection.***

Keywords: Predictive factors for Difficult Laparoscopic Cholecystectomy, factors associated with Difficult cholecystectomy, Male gender associated with difficult laparoscopic cholecystectomy

1. Introduction

Stone in the gallbladder has become a major health problem now - a - days. Almost 10 - 15% of adult population suffers with gallstone every year.[1, 2, 3, 4] In patients with asymptomatic gallstones, likelihood of developing symptoms and complications is 1 - 2% per year.[5.] With this vast prevalence and importance, treatment of gallstone always has been center of continuous research.

Cholecystectomy is one of the most common surgery done now - a - days throughout the world and number of surgeries have rapidly increased since 1950.[6] First time ever in 1867, John S. Bobb extracted gallstones from gallbladder and for this work he was honoured by title "father of gallbladder surgery".[7]

Laparoscopic cholecystectomy, as we know today was first time done by Erich Muhe in 1985 in Germany.[8] Erich Muhe himself was inspired by the first laparoscopic appendectomy that was done by a Gynaecologist Kurt Semm in 1980.9Introduction of laparoscopic surgery has lead to increase rate of cholecystectomy.[6, 10, 11]

Laparoscopic surgery has fully changed the world of cholecystectomy by reducing duration of hospital stay, bleeding, incisional hernia, postoperative pain, surgical site infection and also providing better cosmetic result.[12]

Laparoscopic surgery has almost completely replaced the open cholecystectomy in uncomplicated cases and open surgery is usually done when intraoperative findings of laparoscopic surgery makes difficult to operate.[13]

However there are few risk factors which usually makes laparoscopic cholecystectomy difficult such as male gender, obesity, history of previous hospitalization for acute cholecystitis, thick gall bladder wall, stone impacted at neck of gall bladder, history of previous abdominal surgery, history of ERCP, contracted gallbladder, distended gallbladder or pericholecystic collection etc.[14, 15] Minimal access surgery gives enhanced recovery after surgery to the patient as patient can be allowed for early feeding after surgery, early mobilization, minimal pain, minimal wound care and early discharge from hospital. In general, disadvantages of laparoscopic surgeries are lack of tactile Sensation, 2D vision, hand eye incoordination, difficult haemostasis.[16] Few specific difficulties in laparoscopic cholecystectomy such as distorted anatomy, vascular or ductal anomaly may lead to requirement of conversion to open cholecystectomy to avoid complications

There are multiple factors that play role in making surgery difficult and hence few scores has been developed by keeping those factors in view. Our study aims to know the preoperative predictive factors for difficult laparoscopic cholecystectomy and to validate a score for assessing difficult laparoscopic cholecystectomy preoperatively in tertiary care center.

Aims and Objectives

Primary

1) To detect preoperative predictors of intraoperative difficulties in laparoscopic cholecystectomy

Secondary

1) To evaluate predictor for conversion to open cholecystectomy.
2) To validate a scoring system to predict difficult laparoscopic cholecystectomy at our centre.

2. Materials and Methods

This Study was conducted in Department of General Surgery, Moti Lal Nehru Medical College and Swaroop Rani Nehru Hospital, Prayagraj

Study population - All the Eligible patient undergoing laparoscopic cholecystectomy in a unit of Department of General Surgery, Moti Lal Nehru Medical College, Prayagraj were considered as study population.

Study period and duration - The data collection for the study was done between October 2021 to September 2022 for a period of 1 year.

Study design: The current study was a cross sectional study.

Sampling method: Sampling method was time bounded Universal sampling. All the patients presented to our unit for laparoscopic cholecystectomy were included in study.

Inclusion criteria	Exclusion criteria
Patient with Symptomatic Cholelithiasis / Acute cholecystitis requiring laparoscopic cholecystectomy	inability to understand and give consent or refuse to surgery
Patient age 16+ years.	Jaundice or CBD stone
Patient of either sex.	chalangits or Raised ALP
Patients guardian must be able to understand and follow study related advices.	Acalculous cholecystitis
Patients guardian must be able to understand and give consent for the study.	Patients with Anaesthetic complications
	Or other comorbidities

Sample size: Total 77 patients underwent laparoscopic cholecystectomy in our unit during the study time. All patients evaluated through clinical history, physical examination and USG parameters. Following score system was used to categorize the patients preoperatively to easy, difficult and very difficult categories.

Preoperative score[20]

		Score	Max Score
History			
Age	<50 yrs	0	1
	>50 yrs	1	
Sex	Male	1	1
	Female	0	
H/O Hospitalization for Acute Cholecystitis	Yes	4	4
	No	0	
Clinical Parameters			
BMI	<25	0	2
	25 - 27.5	1	
	>27.5	2	
Abdominal Scar	No	0	2
	Infra - umblical	1	
	Supra - umblical	2	
Palpable Gall Bladder	Yes	1	1
	No	0	
Sonography			
Wall Thickness	Thin <4mm	0	2
	Thick >4mm	2	
Pericholecystic Collection	No	0	1
	Yes	1	
Impacted Stone	No	0	1
	Yes	1	

0 - 5 Easy
6 - 10 Difficulty
11 - 15 Very Difficulty
None of our patient scored >10 (very difficult)

Intraoperative Assessment		
Parameters	Score	Grading
Time Taken <60 min & No Bile Spillage & No Duct Injury	0 - 5	Easy
Time Taken 60 - 120 min and/or Bile or Stone Spillage and/or Duct Injury	6 - 10	Difficult
Time Taken >120 min or conversion	11 - 15	Very Difficult

Each component of score individually compared with intraoperative outcome to know which factor have significant association with intraoperative outcome and then score was compared with intraoperative outcome to come to a conclusion whether preoperative score was useful method or not.

Intraoperative outcome was considered as outcome variable. That was Easy or Difficult or Very Difficult.

The preoperative risk group classified by structured scoring system as Easy or Difficult or Very difficult. But none of our patient score >10 hence none was listed as very difficult preoperative score.

Each individual parameter (Age, Gender, History of Hospitalization for acute cholecystitis, BMI, Abdominal scar, Palpable gallbladder, Thick Gallbladder wall, pericholecystic collection and impacted stone at neck) was evaluated for association with intraoperative outcome by statistical test. Chi Square test was used to test statistical significance.

Then Preoperative score (by Randhawa JS et al) was also evaluated for predicting intraoperative outcome. Sensitivity, specificity and predictive values of preoperative score in predicting the intra - operative outcome were calculated. P - value <0.05 was considered statistically significant. IBM SPSS version 22 was used for statistical analysis.

3. Observations and Result

		Frequency	Percentages
Age Group	≤50 years	60	77.9
	>50 years	17	22.1
Gender	Female	61	79.2
	Male	16	20.8
H/O hospitalization for acute cholecystitis	Yes	22	28.6
	No	55	71.4
BMI Category	<25	53	68.8
	25 - 27.5	8	10.4
	>27.5	16	20.8
Abdominal Scar	No	68	88.3
	Yes (Infraumbilical)	7	9.1
	Yes (Supraumbilical)	2	2.6
Palpable Gallbladder	Yes	4	5.2
	No	73	94.8
Thick Gallbladder wall	Yes	18	23.4
	No	59	76.6
Pericholecystic collection	Yes	15	19.5
	No	62	80.5
Impacted stone at neck	Yes	7	9.1
	No	70	90.9
Preoperative score	0 - 5 Easy	55	71.4
	6 - 10 Difficult	22	28.6
Intraoperative outcome	Easy	54	70.1
	Difficult	15	19.5
	Very Difficult	8	10.4

		Intraoperative outcome			Chi - square	p - value
		Very difficult	Difficult	Easy		
Age group	≤50 years (n=60)	6 (10.0%)	12 (20.0%)	42 (70.0%)	0.078	0.962
	>50 years (n=17)	2 (11.8%)	3 (17.6%)	12 (70.6%)		
Gender	Female (n=61)	6 (9.8%)	3 (4.9%)	52 (85.2%)	**41.609**	**<0.001**
	Male (n=16)	2 (12.5%)	12 (75.0%)	2 (12.5%)		
History of Hospitalization	Yes (n= 22)	6 (27.3%)	9 (40.9%)	7 (31.8%)	**22.156**	**<0.001**
	No (n= 55)	2 (3.6%)	6 (10.9%)	47 (85.5%)		
BMI Category	<25 (n= 53)	4 (7.5%)	9 (17.0%)	40 (75.5%)	4.198	0.380
	25 - 27.5 (n= 8)	1 (12.5%)	1 (12.5%)	6 (75.0%)		
	>27.5 (n=16)	3 (18.8%)	5 (31.3%)	8 (50.0%)		
Abdominal Scar	No (n=68)	7 (10.3%)	14 (20.6%)	47 (69.1%)		
	Yes infra - umbilical (n=7)	0	0	7 (100.0%)		
	Yes Supra - umbilical (n=2)	1 (50.0%)	1 (50.0%)	0		
Palpable gallbladder	Yes (n=4)	1 (25.0%)	1 (25.0%)	2 (50.0%)	1.177	0.555
	No (n=73)	7 (9.6%)	14 (19.2%)	52 (71.2%)		
Thickened gallbladder wall	Yes (n=18)	4 (22.2%)	3 (16.7%)	11 (61.1%)	3.534	0.171
	No (n=59)	4 (6.8%)	12 (20.3%)	43 (72.9%)		
Pericholecystic collection	Yes (n=15)	3 (20.0%)	5 (33.3%)	7 (46.7%)	4.954*	0.084*
	No (n=62)	5 (8.1%)	10 (16.1%)	47 (75.8%)		
Impacted stone	Yes (n=7)	0	3 (42.9%)	4 (57.1%)		
	No (n=70)	8 (11.4%)	12 (17.1%)	50 (71.4%)		

Comparison of intraoperative outcome with each parameter

To evaluate the Sensitivity, Specificity, Positive predictive value and Negative predictive value of Preoperative score used in Randhawa JS et al study, We have merged the data of difficult and very difficult intraoperative outcome at our centre. As the whole purpose of preoperative score is to identify the difficult laparoscopic cholecystectomy preoperatively.

Preoperative score	Intraoperative outcome	
	Difficult	Easy
Difficult (6 - 10)	15	7
Easy (0 - 5)	8	47

Comparison of Intraoperative outcome and Preoperative score

Parameters	Value	95% CI	
		Lower	Upper
Sensitivity	65.22%	42.73%	83.62%
Specificity	87.04%	75.10%	94.63%
Positive predictive value	68.18%	50.23%	81.98%
Negative predictive value	85.45%	76.88%	91.21%
Diagnostic accuracy	80.52%	69.91%	88.67%

Positive Likelihood ratio	5.03	2.37	10.68
Negative Likelihood ratio	0.4	0.23	0.71

4. Discussion

Laparoscopic surgery has become the gold standard treatment of gallbladder disease. Laparoscopic surgery is technically demanding and need expertise as it is associated with surrounding visceral injury and bile duct injury. Complications rate was high previously. With advancement in technology and more expertise, complications rate has now reduced drastically and procedure has become more safe. As per literature, complication rate has reduced to 2 - 6%.[17] Conversion rate reported in literature is 7 - 35%.[18]

With such advancements, laparoscopic cholecystectomy becomes difficult sometime. Adhesion, bile spillage and stone spillage takes time to operate and sometime also need conversion to open. It is very difficult to say preoperatively that which case will be difficult or easy and also difficult to exactly predict level of difficulty.

Difficult laparoscopic cholecystectomy has been a core issue of debate and arguments in last decade among the surgeons. This has been a constant research topic with an aim to find out the factors that can predict the difficulty level and conversion rate preoperatively. Based on cumulative evidence of multiple studies there are certain factors that can predict difficult laparoscopic cholecystectomy preoperatively.[19] Randhawa et al in their study gave a score that can evaluate difficult laparoscopic cholecystectomy preoperatively.[20]

In our study 77 patients were taken in study and all patients were analyzed for few factors that can predict difficult laparoscopic cholecystectomy and compared with intraoperative difficulty level. Factors evaluated in our study are age, gender, previous history of hospitalization for acute cholecystitis, obesity, previous history of abdominal surgery, clinically palpable gallbladder, gallbladder wall thickness on ultrasound, pericholecystic collection and impacted stone at gallbladder neck. Aim of our study was to find out the factors that can predict difficult laparoscopic cholecystectomy preoperatively, factors that can predict conversion to open cholecystectomy and to assess the role of score (given by Randhawa JS et al) in predicting difficult laparoscopic cholecystectomy preoperatively at tertiary center. Prediction can help in informing the patients and family members about the risk of complications and risk of conversion that will help them to get mentally prepared and can adjust their expectations accordingly.

Many studies done in previous decade to develop scoring system which includes assessment of multiple factors with intraoperative outcome. All studies did not involve same risk factors but there is big overlap of most risk factors among these studies. As scores are complex, it is difficult to use them in day to day practice.[21, 22]

As per lot of studies old age is a risk factor for difficult laparoscopic cholecystectomy.[23] In our study there is no association existed between old age and difficult laparoscopic cholecystectomy. That also may be due to small sample size and also inequality between age group as in our study patients of age 50 or less are 60 and patients of age more than 50 are only 17.

Male gender is risk factor for difficult laparoscopic cholecystectomy but still controversial as many studies have proved gender to be risk factor for laparoscopic cholecystectomy.[24, 25, 26] and few studies did not notice such relation.[27] As per our study there is significant relation between male gender and difficult laparoscopic cholecystectomy.

History of Hospitalization for acute cholecystitis has been a risk factor for difficult laparoscopic cholecystectomy.[24, 26, 27] In our study 22 patients had previous history of hospitalization, among them 6 (27.3%) had very difficult outcome and 9 (40.9%) had difficult outcome. History of hospitalization for acute cholecystitis is associated with difficult laparoscopic cholecystectomy.

Obesity because of many factors as difficulty in port placement, dissection of calot‟s triangle and also in manipulation of instruments due to thick abdominal wall is an important predictive factor as per many studies.[15] However in our study there is no significant association observed between high BMI and difficult laparoscopic cholecystectomy. Relation of abdominal scar of previous surgery with difficult laparoscopic cholecystectomy could not be assessed in our study because of too small candidates in group of abdominal scar. Also no strong association seen in previous studies also.

Palpable gall bladder is not a predictive factor for difficult laparoscopic cholecystectomy as per our study. There is also extreme low number in our study with palpable gallbladder n=4. However there are many studies that proved that clinically palpable gallbladder is associated with difficult laparoscopic cholecystectomy.[20]

Thick gallbladder wall has been proved good predictor of difficult laparoscopic cholecystectomy in many studies.2[4, 29] In our study thick gallbladder wall not seen as a predictor of difficult laparoscopic cholecystectomy.

Previous studies considered pericholecystic collection as a predictor of difficult laparoscopic cholecystectomy.[15] In our study also, pericholecystic fluid collection is a predictor of difficult laparoscopic cholecystectomy.

In our study, No statistical test could be applied for evaluating role of impacted stone of neck in difficult laparoscopic cholecystectomy as there was no patient in group of very difficult outcome.

Overall on evaluating score, 55 patients scored 0 - 5 easy score and among them 3.6% had very difficult outcome, 10.9% had difficult outcome and 85.5% had easy outcome. Sensitivity of score by Randhawa JS et al in our study is 65.22% and specificity 87.04%. Which is similar to results observed in previous studies.[20, 30] Hence this score is good and can be consider for prediction of difficult laparoscopic cholecystectomy.

Although sample size is small but the predictors of difficult laparoscopic cholecystectomy correlated well with previous

study. So we conclude that score used in our study is reliable in predicting difficult laparoscopic cholecystectomy. Small sample size may be an impediment in attaining complete statistical validity. We propose a multicentric study on a large scale to evaluate role of each factor and score in predicting difficult laparoscopic cholecystectomy.

5. Conclusion

Current study conducted on 77 patients undergoing for laparoscopic cholecystectomy at our tertiary center.

- The preoperative score classified 55 patients with easy (0 - 5) score and 22 patients categorized with difficult (6 - 10) score.
- Total 20% patients have difficult intraoperative outcome and 10% had very difficult outcome. On merging data 30% had difficult outcome.
- Proportion of difficult laparoscopic cholecystectomy was higher in Males as compared to females, in patients who had previous history of hospitalization for acute cholecystitis and in patients who had pericholecystic collection.
- Age of patient, BMI, Abdominal scar, palpable gallbladder, thick gallbladder wall and impacted stone of neck had no association with difficult intraoperative outcome in our study.
- Preoperatively score by Randhawa JS et al, used in study, resulted sensitivity of 65.22% and specificity of 87% in predicting difficult laparoscopic cholecystectomy. Which makes score reasonably good.

6. Limitations and Recommendations

Limitations

Sample size is small in our study. Probability of chance occurrence of many statistical association was very high.

Recommendations

Further study on large scale with large sample size to demonstrate consistency of performance of the predictive score.

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