

## PREOPERATIVE ASSESSMENT OF SCORING SYSTEM DESIGNED FOR PREDICTION OF DIFFICULT CHOLECYSTECTOMY IN PATIENTS WITH SYMPTOMATIC GALL STONES

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### ABSTRACT

**Objective:** To carry out preoperative assessment of scoring system designed for prediction of difficult cholecystectomy in patients with symptomatic gall stones.

**Study Design:** Prospective observational study.

**Place and Duration of Study:** The study was conducted in General Surgery Unit 1, ward 3, JPMC, from Jun 2017 to Aug 2018.

**Methodology:** During the study, 208 patients were enrolled who presented for the elective cholecystectomy. Personal data, comorbid illness, sonographic, clinical and biochemical parameters were assessed. Based on the preoperative scoring, outcome measure was easy, difficult or very difficult cholecystectomy.

**Results:** On the basis of preoperative assessment and scoring, 157 (75.5%) patients were preoperatively predicted for easy cholecystectomy whereas 51 (24.5%) patients were predicted for difficult cholecystectomy. Sensitivity and specificity of this scoring method were 96.5% and 68.5% respectively. Positive predictive value of this scoring method was 89.1% and 72.5% for easy and difficult cases, respectively.

**Conclusion:** The scoring system proposed in our study incorporating all the known factors for difficult cholecystectomy does provide a definite, objective and reliable prediction of difficult case pre operatively.

**Keywords:** Difficult cholecystectomy, Laparoscopic cholecystectomy, Preoperative scoring system.

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### INTRODUCTION

Laparoscopic cholecystectomy, since its introduction in 1987 has replaced conventional open technique and became the procedure of choice for routine gallbladder removal from its bed<sup>1</sup>. It has many advantages over previously done open cholecystectomy with respect to minimal postoperative pain, shorter hospital stay, better cosmesis and early recovery<sup>2</sup>. The procedure of laparoscopic cholecystectomy is considered as "difficult cholecystectomy" when safe completion of this procedure cannot be ensured<sup>3</sup>. These conditions may include dense adhesions at Calot's triangle, fibrotic and contracted gallbladder, acutely inflamed or gangrenous gallbladder and cholecystoenteric fistula etc. Various clinical and ultrasonological parameters that do help to predict the difficulty level preoperatively has

been noted and reported in many published studies<sup>4-8</sup>. Such risk factors include old age, male sex, attacks of acute cholecystitis with fever and leukocytosis, obesity, previous abdominal surgery, clinical signs of acute cholecystitis and certain ultrasonographic findings i.e. thickened gallbladder wall, distended gallbladder, pericholecystic fluid collection, impacted stone etc<sup>9</sup>. As laparoscopic cholecystectomy is the most common procedure that is being done by the surgical residents, such prediction scales will certainly ensure patient safety and will help the surgeon to better prepare for the intraoperative challenges. With such prediction scores, the expertise of the fellow senior surgeons can also be sought which will decrease the complication rate.

In recent study conducted by Vivek<sup>10</sup> additional preoperative and per-operative findings were analyzed which were not considered in other studies and certainly predicts the difficulty of cholecystectomy. This study was commenced

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after obtaining approval from the ethical committee of the institution.

## METHODOLOGY

This prospective observational study was conducted in a single unit, department of general surgery, ward 3, Jinnah Postgraduate Medical Centre, Karachi during a period of 14 months from June 2017 to August 2018. Total of 228 consecutive patients who were admitted for cholecystectomy with symptomatic gall stones were included in the study after prior informed consent.

Patients who had common bile duct stones, who had additional procedure to be done beside laparoscopic cholecystectomy (for e.g. hernia repair), patients who had conversion or delay due to anesthetic complications or equipment failure were excluded from the study. Patients who were unwilling to give consent for the procedure or procedures which were performed by trainees under direct supervision were also excluded from the study.

After the OPD workup which included baseline investigations and general anesthesia fitness, patients were admitted in ward. One day prior to surgery, patients were assessed based on their history; clinical examination and investigation were reviewed. Based on the findings, scoring was done on printed pro forma for each patient and were categorized as easy, (score less than  $\leq 6$ ) difficult (score of 7-15) or very difficult (more than  $>15$ ) cholecystectomy. Preoperative scores and prediction was blinded from the operating surgeon.

All patients received per operative prophylactic antibiotic. Patient was draped and positioned in tredelenburg position. Camera port was inserted either in supra umbilical position or infraumbilical position with the help of 10mm trocar which was inserted with open technique. Pneumoperitoneum was created with the help of carbon dioxide and pressure was kept at 14mm of Hg. One epigastric 10mm and two 5mm working ports were inserted as in standard cholecystectomy. Per operative findings, intraoperative

events (i.e. bile/stone spillage, injury to duct/artery or conversion to open cholecystectomy) and the timing of surgery from the first port site incision till the last port closure was noted. Per operative objective assessment was compared with preoperative prediction based on the scores to calculate the sensitivity and specificity of the pre-operative scoring system.

## RESULTS

Total 228 patients were admitted in ward during the 12 months of study period. Out of these 228 patients, twenty patients were excluded due to various reasons. In the final analysis, a total of 208 patients were assessed. Among these patients we found female preponderance as 175 (84.1%) were females while 33 (15.9%) were male. The mean age was  $40.84 \pm 12.12$  years with a range from 22 to 72 years.

On the basis of preoperative assessment and scoring, 157 (75.5%) patients were preoperatively predicted for easy cholecystectomy whereas 51 (24.5%) patients were predicted for difficult cholecystectomy. None of the patient was predicted for very difficult cholecystectomy. The relationship between the prediction of difficulty level of the cases preoperatively and the actual outcome of cases is shown in table-III.

For patients with preoperative prediction of easy cholecystectomy, sensitivity and specificity of this scoring method were 96.5% and 68.5% respectively. Positive predictive value of this scoring method was 89.1% and 72.5% for easy and difficult cases, respectively. It is worth to note that no patient was preoperatively predicted for very difficult cholecystectomy and a total of 9 cases were converted to open procedure for various reasons shown in table-IV.

## DISCUSSION

Laparoscopic cholecystectomy is the most common surgery that is being performed all over the world and is undergoing continuous upgrades with improving technology to make it safer, cosmetically acceptable and cost effective. Initially the complication rate with laparoscopic cholecystectomy was high but now with increase

in the expertise, it has reached a remarkably low rate<sup>11</sup>.

Preoperative prediction of difficult cholecys-

case to an experienced surgeon and assistant, especially in cases where an inexperienced surgeon come across a difficult cholecystectomy. Not only this, but it also helps to plan the patient

**Table-I: Pre-operative Scoring System.**

History		Score	Maximum Score	Biochemical		Score	Maximum Score
Age in Years	≤60	0	1	White blood cell count	≤11,000	0	1
	>60	1			>11,000	1	
Sex	Female	0	1	Total Bilirubin	≤1.1	0	1
	Male	1			>1.1	1	
History of acute cholecystitis	No	0	4	Alanine transaminase	≤45	0	1
	Yes	4			>45	1	
<b>Comorbid Illness</b>					Alkaline phosphatase	>45	
Diabetes Mellitus	No	0	4	≤306		0	
	Yes	1		>306	1		
Chronic Obstructive Airway disease	No	0					
	Yes	1					
Congestive Cardiac Failure	No	0					
	Yes	1					
Other systemic illness	No	0					
	Yes	1					
<b>Sonography</b>							
Wall thickness	Thin <4mm	0	1				
	Thick >4mm	1					
Pericholecystic collection	No	0	1				
	Yes	1					
Impacted stone at neck of gallbladder	No	0	1				
	Yes	1					
Contracted gall bladder	No	0	1				
	Yes	1					
<b>Clinical</b>							
Body mass index	<25	0	2				
	25-27.5	1					
	≥27.5	2					
Abdominal Scar	No	0	2				
	Infraumbilical	1					
	Supraumbilical	2					
Palpable Gallbladder	No	0	1				
	Yes	1					

tectomy has several advantages not only for surgeons but also for the patients and their family. For the surgeons, it may help to plan the operative list accordingly and assign a difficult

surgery first on list to avoid time pressure as well as unexpected conversion to open procedure. For patients and family, preoperative assessment helpsthem to understand the possibility of diffi-

culties during the surgery, i.e. conversion to open

**Table-II: Per operative assessment of difficulty.**

Easy (0-6)	Time taken is less than 60 minutes and No bile spillage and No injury to duct/artery
Difficult (7-15)	Time take 61 - 120 minutes and/or Bile/stone spillage and/or Injury to duct and/or No conversion to open procedure
Very difficult (16-25)	Time >120 mins or Conversion to open procedure

procedure so they may plan accordingly keeping in mind the possibility of prolonged hospital stay and increased expenses.

In our study, among 208 patients, different

**Table-III: Relationship between the prediction of difficulty level of the cases preoperatively with per-operative assessment.**

		Per-Operative Assessment			Total
		Easy	Difficult	Very Difficult	
Preoperative Prediction	Easy	140 (67.3%)	17 (8.17%)	-	157
	Difficult	5 (2.40%)	37 (17.7%)	9 (4.32%)	51
Total		145 (69.7%)	54 (26%)	9 (4.3%)	208

predictive risk factors were assessed which were based on history, comorbid, sonographic or clinical finding and biochemical predictors. First proposed by Randhawa<sup>12</sup>, we have done several modifications including other factors under the heading of biochemical parameters along with the extended history of the patient. Such factors have shown significance in various studies<sup>13,14</sup>. As these factors do not put an additional cost to the

**Table-IV: Reasons for lap converted to open cholecystectomy.**

Reason	n (%)
Frozen calot's triangle	2
Adhesions	3
Anatomical anomaly	1
Bleeding	2
Gut injury	1

patient, they were included in the final analysis of the factors. Each predictor was assessed separately as a predictive risk factor for difficult cholecystectomy.

Increase age (>55 years) has been found to be significant risk factor for difficult cholecystec-

tomy in many studies<sup>15,16</sup> and higher conversion rate from laparoscopic to open procedure has been shown. In our study, 34 (16.34%) of patients were old age or above 55 years of age. Out of these, only 10 patients (29.4%) had easy cholecystectomy compared to 24 (71.6%) of patients who experienced either difficult or very difficult cholecystectomy. These results were significant with a *p*-value of <0.001.

Male gender is associated with a significant risk of difficult cholecystectomy as reported in several studies<sup>15,17</sup>. In one study, conversion rate and significantly higher mortality rate has been reported in male sex<sup>18</sup>. However in our study, it has not been found to be a significant factor.

The most significant factor among all the predictors was previous history of acute cholecystitis<sup>19</sup>. It had the maximum weightage for difficult cholecystectomy and conversion to open procedure due to adhesions secondary to ongoing inflammatory processes. These adhesions usually require more time for dissection at calot's triangle and dissection of gall bladder from liver bed. In our study, similar results were observed and this factor was found to be significant (*p*-value ≤0.001) in predicting the probability of difficult laparoscopic procedure.

Among the patients enrolled for study, 29 (13.94%) patients were found to have some comorbid. These comorbid have shown the increase likelihood of difficulties during cholecystectomy in several studies<sup>20</sup>. Among all the comorbid 16 (55.17%) patients were diabetic; 4 (13.8%) patients had previous history of pancreatitis secondary to cholelithiasis; 4 (13.8%) were hypertensive; 2 (6.9%) patients were of chronic liver disease; 2 (6.9%) patients were both diabetic and hypertensive; 1 (3.44%) patient was having

CRF; and 1 (3.44%) patient had tricuspid regurgitation. In our study, these comorbid have also shown to be significant risk factor (0.001) for a difficult cholecystectomy.

Based on evidence from multiple studies

pericholecystic collection, impacted stone at neck and contracted gall bladder. Among these factors wall thickness (<0.001) and contracted gall bladder (0.008) were found to be significant. However, impacted stone at neck (0.212) was insignificant in our study and none of the patient

**Table-V: Association of individual parameter with difficult laparoscopic cholecystectomy.**

		Postoperative Assessment			p-value
		Difficult	Easy	Very Difficult	
Age	<55 years	37 (21.3%)	135 (77.6%)	2 (1.1%)	<0.001
	≥55 years	17 (50%)	10 (29.4%)	7 (20.6%)	
Gender	Female	46 (26.3%)	122 (69.7%)	7 (4%)	0.853
	Male	8 (24.2%)	23 (69.7%)	2 (6.1%)	
History of acute cholecystitis	Yes	44 (38.6%)	61 (53.5%)	9 (7.9%)	<0.001
	No	10 (10.6%)	84 (89.4%)	-	
Comorbids	No	35 (19.6%)	136 (76.4%)	7 (3.93%)	0.001
	Diabetes	8 (50%)	6 (37.5%)	2 (12.5%)	
	Others	11 (78.6%)	3 (21.4%)	-	
Wall thickness	Thin <4mm	48 (23.8%)	145 (71.8%)	9 (4.5%)	<0.001
	Thick >4mm	6 (100%)	-	-	
Pericholecystic Collection	No	54 (26%)	145 (69.7%)	9 (4.3%)	-
	Yes	-	-	-	
Impacted stone at neck	No	30 (22.4%)	99 (73.9%)	5 (3.7%)	0.212
	Yes	24 (32.4%)	46 (62.2%)	4 (5.4%)	
Contracted gallbladder	No	48 (24.5%)	141 (71.9%)	7 (3.6%)	0.008
	Yes	6 (50%)	4 (33.3%)	2 (16.7%)	
Body Mass Index	<25	18 (13.3%)	112 (83%)	5 (3.7%)	<0.001
	25-27.5	32 (47.1%)	32 (47.1%)	4 (5.9%)	
	>27.5	4 (80%)	1 (20%)	-	
Abdominal scar	No	32 (21.6%)	110 (74.3%)	6 (4.1%)	0.046
	Infraumbilical	20 (34.5%)	35 (60.3%)	3 (5.2%)	
	Supraumbilical	2 (100%)	-	-	
Palpable gallbladder	No	45 (23%)	145 (74%)	6 (3.1%)	<0.001
	Yes	9 (75%)	-	3 (25%)	
White blood count	<11,000	50 (26.5%)	132 (69.8%)	7 (3.7%)	0.0358
	>11000	4 (21.1%)	13 (68.4%)	2 (10.5%)	
Total bilirubin	<1.1	49 (24.6%)	144 (72.4%)	6 (3%)	<0.001
	>1.1	5 (55.6%)	1 (11.1%)	3 (33.3%)	
Alanine transaminase	<45	48 (24.4%)	143 (72.6%)	6 (3%)	<0.001
	>45	6 (54.5%)	2 (18.2%)	3 (27.3%)	
Aspartate transaminase	<45	50 (24.6%)	145 (71.4%)	8 (3.9%)	0.002
	>45	4 (80%)	-	1 (20%)	
Alkaline phosphatase	<360	40 (21.5%)	142 (76.3%)	4 (2.2%)	<0.001
	>360	13 (61.9%)	3 (14.3%)	5 (23.8%)	

showing evidence of sonographic findings as important factor in assessing the difficult cholecystectomy<sup>21</sup>, we assessed similar sonographic factors in our study which include wall thickness,

had a pericholecystic collection at the time of procedure.

Obese patients may have a difficult laparoscopic cholecystectomy<sup>22</sup>. Probable reasons

include difficult port placement and handling of instruments, difficult dissection at the calot's triangle due to obscure anatomy secondary to increase intra peritoneal fat. In our study, BMI was found to be a significant risk factor (<0.001) in predicting a difficult cholecystectomy.

Upper abdominal scar which is an indicator of previous abdominal surgery may cause formation of intra-abdominal adhesions that may lead to increase chances of intra-abdominal bleeding at the time of placement of umbilical port. In our study, it was found to be statically significant (<0.001).

Palpable gall bladder is also a clinical finding which is seen in patients with distended gall bladder either due to mucocele or empyema. During laparoscopic cholecystectomy, it is difficult to properly hold the gall bladder and often aspiration of the contents of gallbladder is required to hold the gallbladder properly. Such method is time consuming and chances of spillage of contents into the peritoneal cavity are high. Randhawa *et al*<sup>12</sup>, in his study correlated such factor with significant results. In our study, total 12 patients were found to have a palpable gall bladder, among these 9 (75%) had difficult cholecystectomy while 3 (25%) had very difficult cholecystectomy. Thus our results are significant (<0.001).

Biochemical markers which were assessed in our study were white cell count, total bilirubin, alanine and aspartate transaminase and alkaline phosphatase. All of these factors were found to be significant.

In our study 32 (15.3%) patients had bile spillage. Intraoperative time in 13 of these patients was <60 minutes but due to bile spillage they were included in difficult cases. Only 2 patients among 32 require conversion to open procedure other patients were managed by irrigation and suction alone.

Conversion rate reported in literature was between 7 and 35%<sup>23</sup>. In our study, it is 4.32%. Without any doubt the experience of a surgeon is an important factor and all surgeries in our

department were performed by experience surgeons.

### LIMITATION OF STUDY

Being a single centre study with small sample size the results may not be generalized. Although the operating surgeons were blind, performance bias cannot be ruled out.

### CONCLUSION

The scoring system proposed in our study incorporating all the known factors for difficult cholecystectomy does provide a definite, objective and reliable prediction of difficult case pre operatively.

### CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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