Original Article

Pre-operative Difficulty Assessment of Elective Laparoscopic Cholecystectomy: Validation of a Scoring System

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ABSTRACT

Laparoscopic cholecystectomy (LC) is performed all over the world, which is now considered as the gold standard procedure for management of cholelithiasis. Despite its safety standard, sometimes surgeons encounter various difficulties during this surgical procedure. A prospective, observational study was conducted in the Department of Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh, from December 2018 to June 2019, to identify various risk factors and their correlations with likely difficulty in patients admitted for elective laparoscopic cholecystectomy. All the patients were admitted before surgery and routine pre-operative procedures were done. The difficulty was predicted by a scoring system that included clinical, biochemical and sonological indicators with a maximum score of 25 and those were compared with per operative findings. A total of 200 individuals were assessed and analyzed. Age>50, BMI >30, history of acute attack, prolonged symptom duration, and previous abdominal surgery showed a statistically significant predictive association. Biochemical predictors also showed a similar trend with elevated WBC, total bilirubin, ALT, AST, and ALP. Radiologically, gall bladder wall thickness, pericholecystic collection, impacted stone, and fibrosed gall bladder were observed as significant factors. A preoperative score ≤ 5 provided easy dissection, less operating time, and a good outcome while a score of 6 or more was indicative of difficult laparoscopic cholecystectomy. Preoperative scoring and risk stratification can be used to predict difficult laparoscopic cholecystectomy. High-risk patients may be informed beforehand regarding the possibility of conversion to open surgery. Surgeons and hospital administration also may have to schedule the operating time and team appropriately. It also helps surgeons to be aware of probable complications in high-risk patients based on pre-operative scoring.

Keywords: *Cholelithiasis, laparoscopic cholecystectomy, pre-operative difficulty assessment*

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INTRODUCTION

With the evolution in biomedical engineering and quality enhancement of various sophisticated instruments, nowadays, laparoscopic cholecys-tectomy has become one of the most common laparoscopic procedures being performed by general surgeons all over the world.[1,2] With minimal postoperative morbidity due to minimal invasiveness complemented with safety and efficacy along with better cosmesis and patient satisfaction, laparoscopic cholecystectomy is the gold standard treatment option for symptomatic cholelithiasis.[3-5] Currently, about 80% of cholecys-tectomies are performed using laparoscopic technique. Though

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mostly safe, laparoscopic cholecystectomy can be difficult at times resulting in longer operative time, bile spillage, conversions, and bile duct injury.[10] This leads to an unexpected hospital stay, an increase in estimated cost to the patients and increased stress to the surgeons, pressure to complete the operative list.[2,4,6] Approximately 2% to 15% of patients require conversion to open technique due to various difficulties.[2] Hence preoperative prediction of difficulty or conversion is a vital aspect of planning laparoscopic surgery.[7] With the aid of prediction accuracy, high-risk patients may be categorized and receive counseling beforehand so that they have an opportunity to make necessary arrangements and get mentally prepared. On the other hand, surgeons also may get an indication of scheduling the time and team appropriately.[8] High risk patients should be scheduled for longer hospitalization and more intensive post- operative care. This also helps the hospital administration to plan and predict admission and bed vacancy more efficiently. Several studies have been negotiated to assess the difficulty preoperatively and different scoring methodologies have been suggested from time to time using different parameters further adding to the controversy.[9] Some studies done in neighboring countries showed various clinical, biochemical and radiological parameters have an important role. In our country, laparoscopic cholecystectomy is a common practice nowadays but studies regarding the prediction of preoperative difficulty have yet not been carried out. Considering the paucity of literature, the study was designed to establish and validate a scoring system using clinical, biochemical and sonological indicators that might help predict difficult laparoscopic cholecystectomy preoperatively.

METHODS

This prospective, observational study was conducted in the Department of Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh, a tertiary level teaching hospital in the country. The study was done between January and June of 2019. A total of 200 patients admitted into the Department of Surgery, Dhaka Medical College Hospital, aged >18 years, undergoing elective laparoscopic cholecystectomy were included in this study. We adopted a purposive sampling procedure. Preoperative workup in the form of radiological and laboratory tests was done for all the patients. Then a scoring was done using clinical, biochemical, and sonological indicators to predict per-operative difficulty pre-operatively in the following way:

Clinical variables	Score	Biochemical variables	Score	Sonological variables	Score
Age		WBC (per mm^3)		Gall bladder wall thickness	
<50	0	<11000	0	<3 mm	0
>50	1	>11000	1	>3 mm	1
Sex		Total bilirubin		Pericholecystic collection	
Female	0	<1.1 mg/dl	0	No	0
Male	1	>1.1 mg/dl	1	Yes	1
Smoking		Alanine transaminase(ALT)		Impacted stone	
No	0	<45	0	No	0
Yes	1	>45	1	Yes	1
History of acutecholecystitis		Aspartate transaminase(AST)		Fibrosed gallbladder	
No	0	<45	0	No	0
Yes	4	>45	1	Yes	1
Symptoms duration		Alkaline phosphatase			
<1 year	0	<306	0		
>1 year	1	>306	1		

DM	
No	0
Yes	1
COPD	
No	0
Yes	1
IHD	
No	0
Yes	1
Other Disease	
No	0
Yes	1
BMI	
<25	0
25-30	1
>30	2
Previous abdominal surgery	
No	0
Yes	1

The difficulty was predicted by a scoring system that included clinical, biochemical and sonological indicators with a maximum score of 25 and those were compared with per operative findings.

Per operative difficulty assessment: Easy: Operation duration< 60 minutes without any adverse event; Difficult: Operation duration 60-120 minutes with difficult dissection, gall bladder perforation with or without spillage, and difficult control of bleeding; Very difficult: Operation duration >120 minutes or needs a conversion to open technique.

After the completion of data collection, the data were checked and verified for any omission, error, or irrelevance. Data were coded, entered, and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. Descriptive statistics such as mean, standard deviation as well as frequency and percentages were calculated. Chi-square and Unpaired Student's t-test were used to assess the significance of associations between variables. P-value of <0.05 at a 95% confidence interval was taken as significant. The results were presented in tables.

The study was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka, Bangladesh.

RESULTS

In our study, we analyzed the pre-operative clinical, laboratory and radiological data as well the per operative data of 200 patients undergoing elective cholecystectomy. The duration of operation recorded <60 minutes in 138(69%) and 60-120 minutes in 62(31%) cases. Injury to the duct/artery happened in 4(2%) cases. Bile/stone spillage was experienced in 48(24%) cases. Unfortunately, only 4(2%) cases conversions to open technique were required (Table-I). Among 200 patients, only 14(7%) had no history of acute cholecystitis, 132(66%) had their symptoms for <1 year, only 18(9%) had previous experience of abdominal surgery, 48(24%) had no history of smoking, 12(6%) had diabetes mellitus (DM), and 2(1%) had co-morbidities like chronic obstructive pulmonary disease (COPD), ischemic heart disease (IHD). For BMI, 58(29%) had <25, while 86(43%) had 25-30 and 56(28%) had >30. Age>50, BMI >30, history of acute attack, prolonged symptom duration (>1 year), and previous abdominal surgery as well as gall bladder wall thickness, pericholecystic collection, impacted stone, and fibrosed gall bladder showed a statistically significant predictive association related to difficulty in surgery affecting operative outcomes (P<0.05) (Table-II). Viewing at laboratory data, 8(4%) had lower levels of leukocyte counts (>11000/mm^3), 19(9.5%) had bilirubin levels >1.1 mg/dl.; 24(12%) had their ALT and AST levels >45 IU/L, while 14(7%) had their Alkaline phosphatase levels >306 IU/L. Elevated WBC >11000/mm^3, total bilirubin, ALT and AST >45 IU/L, and Alkaline phosphatase levels >306 IU/L were also proved to be significant factors related to difficulty in surgery affecting operative outcomes (P<0.05) (Table-III). A preoperative score ≤5 provided easy dissection, less operating time, and a good outcome while a score of 6 or more was indicative of difficult laparoscopic cholecystectomy (P=0.001) (Table-IV).

Table-I: *Per operative clinical data (n=200)*

Difficulties encountered	Frequency	Percentage
Duration of operation (in minutes)		
<60	138	69
60-120	62	31
>120	-	-
Injury to duct/artery		
No	196	98
Yes	4	2
Bile/stone spillage		
No	152	76
Yes	48	24
Conversion to open technique		
No	196	98
Yes	4	2

Table-II: *Multivariate analysis of intra-operative outcome with risk factors (based on pre-operative clinical and radiological data) (n=200)*

Variables	Frequency	EasyNumber (%)	DifficultNumber (%)	P value
Age				
≤50	152	103(67.8%)	49(32.2%)	0.031
>50	48	1(2.1)	47(97.9%)	
Sex				
Male	46	28(60.9%)	18(39.1%)	0.126
Female	154	76(46.2%)	78(53.8%)	
Smoking				
No	152	82(53.9%)	70(46.1%)	0.751
Yes	48	22 (45.8%)	26(54.2%)	
History of acute cholecystitis				
No	14	12(85.7)	2(14.3)	0.003
Yes	186	82(44.09)	104(55.91)	
Symptoms duration				
<1 year	132	91(68.9%)	41(31.1%)	0.026
>1 year	68	13(19.1%)	55(80.8%)	
DM				
No	188	146(77.6%)	42(22.4%)	0.589
Yes	12	8(66.7%)	4(33.3%)	
COPD				
No	198	104(52.5%)	94(47.5%)	0.647
Yes	2	-	2(100%)	
IHD				
No	198	104(52.5%)	94(47.5%)	0.647
Yes	2	-	2(100%)	
BMI				
<25	58	44(75.9%)	14(24.1%)	0.033
25-30	86	50(58.1%)	36(41.9%)	
>30	56	10(17.9%)	46(82.1%)	
Previous abdominal surgery				
No	182	152(80.8%)	30(19.2%)	0.001
Yes	18	2(11.1%)	16(88.9%)	
Gall bladder wall thickness				
<3 mm	184	144(78.2%)	42(22.8%)	0.013
>3 mm	16	4(25%)	12(75%)	
Pericholecystic collection				
No	198	148(74.7%)	50(25.3%)	0.002
Yes	2	-	2(100%)	
Impacted stone				
No	182	152(80.8%)	30(19.2%)	0.001
Yes	18	2(11.1%)	16(88.9%)	
Fibrosed gallbladder				
No	188	100(56.2%)	78(43.8%)	0.001
Yes	12	5(41.7%)	7(58.3%)	

P value reached from Unpaired Student's t-test and Chi-square test.

Table-III: *Multivariate analysis of intra-operative outcome (based on pre-operative laboratory data) (n=200)*

Variables	Frequency	EasyNumber (%)	DifficultNumber (%)	P value
WBC (per mm^3)				
<11000	192	142(73.9%)	50(26.1%)	0.001
>11000	8	3(37.5%)	5(62.5%)	
Total bilirubin (mg/dl)				
<1.1	181	131 (72.9%)	50(29.1%)	0.011
>1.1	19	8(42.2%)	11(57.8%)	
ALT (IU/L)				
<45	176	127(72.1%)	49(27.9%)	0.001
>45	24	6(25.0%)	18(75.0%)	
AST (IU/L)				
<45	176	127(72.1%)	49(27.9%)	0.001
>45	24	6(25.0%)	18(75.0%)	
Alkaline phosphatase (IU/L)				
<306	186	157(77.9)	29(22.1%)	0.022
>306	14	6(42.9%)	8(57.1%)	

P value reached from Chi-square test.

Table-IV: *Preoperative score and operative outcome (n=200)*

Preoperative score	Easy Number (%)	Difficult Number (%)	P value
0-5	90(76.3)	28(23.7%)	0.001
6-15	14(17.1%)	68(82.9%)	
>15	-	-	
Total	104(52%)	96(48%)	

P value reached from Chi-square test.

DISCUSSION

Old age has a significant effect on per-operative difficulty in laparoscopic cholecystectomy (LC) (p=0.031). Similar observations were reported in several previous studies.[9,10] Female preponderance (77%) was observed in this study. However, male sex was not a statistically significant predictor (p=0.126). However, previous studies showed male gender as a significant predictor.[9,10] The patient factors of smoking, DM, COPD and IHD were not statistically significant as in other studies.[9] 93% of patients (186/200) in the present study had past episodes of acute cholecystitis. Among these 55.91% of patients had encountered some intraoperative difficulties. This factor was an important predictor of difficult laparoscopic cholecystectomy (p=0.003) consistent with other studies.[1,2] It is thought that previous abdominal surgery, especially upper abdominal surgery may complicate the cholecystectomy due to periumbilical and pericholecystic adhesions.[1] Our study also supports this correlation (p=0.001). In the present study, out of 200 patients, 68 patients had a duration of symptoms >1 year, of which 55 (80.8%) had difficult surgery. It reveals that the duration of symptoms is an acceptable (p-0.026) predictor of difficulty.[2] BMI >30 was associated with significant intraoperative difficulty (p-0.033). Similar observations were reported by previous studies.[6,9] It is interlinked with the difficulty in fast access and extraction of the gall bladder. Obesity not only makes the port placement difficult but also, makes the dissection difficult at Calot's triangle.[1,2,9]

In this study, strong positive correlation with elevated WBC, total bilirubin, alanine transaminase, aspirate transaminase, and alkaline phosphatase in difficult laparoscopic cholecystectomy. Abnormal leukocyte counts showed significant association with difficult LC, as evident in other previous studies.[9-11]

In this study, 8 patients had raised WBC and out of them 5 had difficult cholecystectomy (p=0.001) and 1 patient was converted to open cholecystectomy. The conversion rate was 2%. Lee et al.[10] experienced 11.9%, while Nidoni et al.[11] reported 5.56% conversion to

open cholecystectomy in their studies respectively.

Gall bladder wall thickness >3mm as well as small fibrosed gall bladder are significantly related to difficult cholecystectomy (p=0.013 and p=0.001 respectively). In this study, gall bladder wall thickness >3mm in 16 patients, out of them, 12 patients had difficult laparoscopic cholecystectomy. Gall bladder wall thickness, pericholecystic collection, and impacted stone are significant factors of difficult laparoscopic cholecystectomy.[1,8,10-12] In our study, 2 patients had a pericholecystic fluid collection and both had difficult laparoscopic cholecystectomy (p=0.002).

CONCLUSION

We conclude that a preoperative score <5 provides easy dissection, less operating time, and a good outcome of laparoscopic cholecystectomy. However, a score of 6 or more provides difficult dissection, prolonged operation time, and bad surgical outcome. Therefore, our scoring system may be considered a good predictor of difficulty that arises during cholecystectomy laparoscopically.

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