Research Article

Evaluation the Effectiveness of Pre-Operative Prediction Scoring System for Difficult Laparoscopic Cholecystectomy

Hamdy Shaban, Ahmed Alsehily[*]**, Mohamed Kamal-Eldin Elhadary and Mohamed Ali Elkerkary**

Department of General Surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt

[*]**Corresponding author:** Ahmed Alsehily, Department of General Surgery, Faculty of Medicine, Suez Canal University, Ismailia, Egypt

Abstract

Introduction: Today`s Laparoscopic cholecystectomy (LC) has become the procedure of choice for the management of symptomatic gallstone disease. This procedure may be difficult and take a long time or can be converted to open surgery in some situations. This study aims to determine predefined preoperative factors that predict the degree of difficulties during Laparoscopic Cholecystectomy (LC) and to assess the conversion rate and its relation to different factors. Finally, to establish a Pre-Operative Prediction Scoring System for evaluation of difficult LC cases as a routine pre-operative assessment.

Patients and Methods: The study entailed 33 patients who underwent LC in the department of general surgery at Suez Canal University hospital, Ismailia, Egypt from 2015 to 2016. The patient's detailed history, clinical examination and ultrasonography results were prospectively analyzed to determine predictors of difficult LC and rate of conversion with relation to different factors.

Results: Of the 33 patients, 10 Patients Scored as Difficult and Very Difficult preoperatively, 9 of them were difficult intraoperatively and showed some complications with prediction accuracy of difficulty 94.45%. 3 cases (9 %) converted to open surgery due to dense adhesions at Calot's triangle and uncontrolled bleeding from the cystic artery. The sensitivity and specificity of this preoperative scoring method were found to be 93.75% and 52.94% respectively.

Conclusion: With preoperative clinical and ultrasonographic data, suitable patient selection can be done to help difficult LC prediction and the possibility of conversion to open one. We can conclude that obese patients who are over fifty with a history of previous upper abdominal surgery and the ultrasonographic picture showed thick-walled Gallbladder (GB) and the pericholecystic collection had a higher risk of conversion.

Keywords: Difficult; Laparoscopic Cholecystectomy (LC); Prediction; Scoring system

Introduction

Since 1987, Laparoscopic cholecystectomy (LC) has evolved to become the gold standard for the management of symptomatic gallstones. It took the upper hand over open cholecystectomy due to its minimal postoperative pain, shorter hospital stay, less rate of incisional hernia and cosmetic outcome [1,2]. In some instances, safe completion of LC can't be guaranteed, and at some conditions, surgeons are unable to identify ductal and vascular structures due to distorted anatomy following inflammation and adhesions that make creating a pneumoperitoneum and dissection at these conditions are "difficult" [3]. Difficult LC predictors have been identified by analysis of routine clinical parameters from history, clinical examination and investigation findings. This surgery may need skillfully experienced surgeons due to the high rate of conversion to open one [4]. Prediction of difficult LC has a major role in improving the patient safety and cost-effectiveness of therapy through deciding prior surgery the proper approach that decreases rates of conversion and complications [5].

This study aimed to determine predefined preoperative factors that predict the degree of difficulty during laparoscopic cholecystectomy and assessment of the effectiveness of the scoring system as a tool of prediction of difficulty of LC.

Patients and Methods

Study design

From April 2015 to March 2016 a prospective observational cross-sectional study was conducted in the department of general surgery, Suez Canal university hospitals, Ismailia, Egypt. This study was involving 33 patients above 18 years as a preliminary study. Institutional Review Board approved the study protocol and written informed consent was signed by the participants.

Inclusion criteria

- Adult patient aged over 18 years' old

- Both sexes who attended the general surgery outpatient clinic with chronic calcular cholecystitis (3 cases of them had a previous acute exacerbation of symptoms with a history of hospitalization) and arranged for Laparoscopic Cholecystectomy were included

Exclusion criteria

- Patients who were arranged for open Cholecystectomy

- Patients with acute cholecystitis, choledocholithiasis

- Patients had co-morbid conditions such as Coagulopathy, Acute MI and Liver cirrhosis (child C).

Preoperatively, detailed history, physical examination and relevant investigations including hepatic profile and abdominal Ultrasound (US) were done to all patients. The score was calculated for every patient based on the given data (Table 1). Most of the patients were presented and operated within the first year of discovery of their gall stones. All the surgeries were performed by the same general surgery team (5 surgeons operated all cases: 1 consultant, 2 senior registrars, and 2 registrars) the main surgeon in all surgeries was the consultant.

		score	M a x score
History			
Age	< 50	0	1
	≥ 50	1	
Sex	Male	1	1
	Female	0	
Hospitalization for acute cholecystitis	No	0	4
	Yes	4	
Clinical parameters			
BMI	<25	0	2
	25–27.5	1	
	> 27.5	2	
Abdominal Scar	No	0	2
	Infra-umbilical	1	
	Supra-umbilical	2	
Palpable gallbladder	No	0	1
	Yes	1	
Sonography			
Wall thickness	Thin < 4 mm	0	2
	Thick ≥ 4 mm	2	
Pericholecystic collection	No	0	1
	Yes	1	
Impacted stone	No	0	1
	Yes	1	

Score: {0 - 5 => easy}, {6 -10 => difficult}, {11 – 15 => very difficult}.

Table 1: Scoring system of 5 for prediction of difficult LC.

Operative technique

We started the LC by the standard steps for all patients which included, Firstly the pneumoperitoneum is achieved by closed Veress needle technique, then the umbilical 10 mm trocar is inserted for the 10 mm telescope (30 degrees). Another three ports, a 10 mm trocar is used in the epigastrium, one 5 mm trocar in the right lumbar region is used for GB fundus traction and a 5 mm trocar in the right hypochondrium is used as left hand working port for the surgeon. The Hartmann's pouch is retracted with left hand then anterior and posterior dissection is done in Calot's triangle and a wide window is created with the right hand and the Critical view of safety is clear to prevent bile duct injury. Clipping of the cystic duct and cystic artery is achieved from a 10 mm epigastric port. Finally Dissection from GB bed on the liver, GB extraction is generally done from either epigastric or umbilical port and Intra-peritoneal drain in GB bed was placed. Closure of the port site incisions by non-absorbable suture.

Intra-operatively significant data indicating the difficulty of the procedure were recorded such as {Bleeding per cystic artery, Bile spillage, prolonged Time of surgery > 60 min}, and cases divided into easy and difficult ones accordingly (Table 2). Postoperatively most of the cases transferred to the ward for 24

hours then discharged after removal of the drain and insuring no complications.

Parameters	Easy	Difficult
Time of operation	≤ 60 min	>60 min
Bile spillage or stone	No	Yes
Cystic a. injury	No	Yes
Conversion to open	No	Yes

Table 2: Scale for categorization of patients into easy, difficult intra and post-operative.

Statistical analysis

Data collected throughout detailed history, clinical examination and relevant investigations; then, outcome results were coded, entered and analyzed using Microsoft Excel software. Data then were imported into Statistical Package for the Social Sciences (SPSS version 11.0) software for multivariate analysis. Comparing the results of the study to confirm whether the preoperative prediction scoring system was a significant method or not.

Results

Of the 33 patients included in the study, there were 4 males (12.1 %) and 29 females (87.9 %). The mean age group of the study was 42.6 years' minimum age was 18 years and the maximum was 65 years. 23 (69.7%) patients were scored easy, 9 (27.3%) patients were difficult and 1 (3%) patient was a very difficult preoperatively. The cystic artery injury occurred in 7 cases but controlled with clips, while bile spillage occurred in 9 cases which were managed with saline irrigation and suction. The scale for categorization of patients into easy and difficult cases intraoperatively is shown at (Table 2). The Correlation between preoperative scores and the intra-operative outcomes showed that 94.45% of patients who expected to be difficult preoperative by preoperative prediction scoring system were difficult (Table 3). The conversion rate from laparoscopic to open cholecystectomy was 9 % due to severe adhesions at Calot's triangle and uncontrollable bleeding from a cystic artery. The analysis of the outcome with different parameters revealed that most of the variables were statistically significant in the preoperative prediction of difficult laparoscopic cholecystectomy (Table 4). The Sensitivity and Specificity of this Pre-Operative Prediction Scoring System (PPSS) were 93.75 % and 52.94 % respectively.

	Pre-op. Scoring	Intra-op. Outcome		Accuracy percentage	Overall
parameter		Easy	Difficult		
Easy	23 (69.7%)	15 (93.8%)	8 (47.1%)	65.22%	65.22%
Difficult	9 (27.3%)	1 (6.2%)	8 (47.1%)	88.89%	94.45%
V. Difficult	1 (3%)	0 (0%)	1 (5.9%)	100%	
This table showed the correlation between preoperative scores with the intra-operative outcomes.					

Table 3: Correlation of the preoperative score and the outcome.

| Risk factors | | Pre-operative grading | | | | Post-op grading | | | |
		Easy no.	Difficult no.	Very difficult no.	P-value Pre-op	Easy no.	Difficult no.	P-value post-op	Overall P-value
Age	< 50	17	5	0	0.251	15	7	0.001	0.003
	>= 50	7	3	1		1	10		

Sex	Female	24	5	0	0.000	16	13	0.039	0.001
	Male	0	3	1		0	4		
Hospitalization for acute cholecystitis	No	24	5	1	0.014	16	14	0.085	0.046
	Yes	0	3	0		0	3		
BMI	<25	5	0	0	0.000	4	1	0.136	0.000
	25:27.5	16	1	0		9	8		
	>27.5	3	7	1		3	8		
Previous abdominal surgeries	No	15	3	0	0.001	12	6	0.052	0.002
	IU	9	4	0		4	9		
	SU	0	1	1		0	2		
Palpable GB	No	24	6	0	0.000	16	14	0.082	0.001
	Yes	0	2	1		0	3		
Impacted stone	No	24	5	0	0.000	16	13	0.039	0.000
	Yes	0	3	1		0	4		

Pericholecystic collection	No	24	3	0	0.000	16	11	0.007	0.000
	Yes	0	5	1		0	6		
GB wall thickness	<4mm	15	0	0	0.001	8	7	0.624	0.002
	>=4mm	9	8	1		8	10		

BMI: Body mass index **IU: Infra umbilical** **SU: Supra umbilical** **GB: Gallbladder**

History Data Examination Data Ultrasound Data

Table 4: Multivariate analysis of preoperative and outcome with P values.

Discussion

Laparoscopic Cholecystectomy (LC) is considered the gold standard treatment of symptomatic cholelithiasis. It is important to predict difficult LC preoperatively so that senior surgeons can be requested to be present during surgery rather than less experienced junior surgeons prolonging the surgery which may lead to intraoperative complications [6]. Preoperatively predicted difficult cases require an early decision of conversion that can be made to avoid unnecessarily prolonging the surgery and to prevent complications that may increase the patient hospital stay and costs, also reducing perioperative complications which is a desirable objective for quality-improvement and patient safety [7]. Many studies mentioned predictors for difficult LC that included different factors [8,9]. Our study conducted on 33 patients who underwent LC with different predictive risk factors for the difficulty which included old age, male sex, history of hospitalization, BMI, previous abdominal surgery, palpable GB, and ultrasonographic findings [GB wall thickness, pericholecystic fluid collection, and impacted stone]. Most of these factors encountered during our practice, to evaluate their effect on difficulty.

Most of the literatures studied the age and its significant relation to difficulty, so they chose the age of 50 as a cut-edge between young and old ones and found it as a significant risk factor for difficult laparoscopic cholecystectomy [10]. In our study, the majority of patients were in the age group of less than 50 years (22 patients) and 33.3% (11 patients) were more than 50 years. We found that 4 patients above fifty who scored difficult and very difficult were at outcome scoring difficult (100% of cases) which means the significant correlation between age and the difficulty

level of surgery. Only one patient converted to open surgery over fifty, while patients less than 50 years and predicted to be difficult were 5 of 22 patients at this category showed that patients less than fifty were easier than over fifty. This may be explained by the small sample size and distribution of cases there is no significant rate of conversion related to old age.

Worldwide, Male gender is a statistically significant predictor for difficult laparoscopy for symptomatic gallstones presented as chronic cholecystitis and the conversion rate with high morbidity had been reported in the male sex [11]. Other studies with a large sample number have no significant relationship between sex and difficulty similar to results by Chndio, et al [10]. Our study included 4 males and 29 females. Of 4 males, 3 were predicted to have a difficult surgery and 1 expected to be very difficult. Post-surgery 100% of males turned out to have a difficult procedure. There was statistical significance in the relation between male sex and the difficulty of LC. Only one male patient converted to open cholecystectomy due to uncontrollable bleeding from the cystic artery with bile and stone spillage intraperitoneal. Patients who require hospitalization for repeated attacks of acute cholecystitis carry more chances of difficult laparoscopic cholecystectomy and conversion, probably due to dense adhesions at the Calot's triangle and GB fossa. There are reports of a higher rate of bleeding, ductal injury and subsequent conversion in acute cholecystitis [9]. We have noticed 3 patients had a history of admission to hospital due to repeated attacks of acute cholecystitis all 3 (100%) patients were predicted to be difficult and intraoperative bile spillage made the operation longer than expected time and outcome were difficult; hence, there was a significant correlation between the history of acute attack and difficulty.

Obese patients may have a difficult laparoscopic surgery due to various factors; port placement in an obese patient takes longer time due to the thick abdominal wall, dissection at the Calot's triangle is also technically difficult due to the obscure anatomy because of excessive intraperitoneal fat and difficulty in the manipulation of instruments through an excessively thick abdominal wall [8]. This result argued by S. S. Sikora, et al in their series they failed to identify the statistical significance of BMI in predicting the difficulty or the conversion [12]. Wen-Tsan Chang, et al also studied the impact of body mass index on laparoscopic cholecystectomy in Taiwan. Based on their results, they concluded that BMI was not associated with clinical outcomes and that LC is a safe procedure in obese patients with uncomplicated gallstone disease and laparoscopic surgery has been suggested by some as the preferred approach for obese patients [13]. This study included 28 patients were BMI $\geq$ 25 only 9 predicted to be difficult and the outcome was 16 patients had a difficult operation. The surgical expertise of the operating surgeon could be one of the reasons for this discrepancy. BMI was not found to be a significant predictor (p= 0.136) according to the outcome score of difficult cholecystectomy.

One of the clinical parameters of assessment of difficult LC was palpable GB, it was found to be a predictor of difficult LC; Palpable GB could be due to a distended GB, mucocele GB, thick-walled or due to the adhesions between the GB and the omentum [9]. Our cases demonstrated only 3 patients had clinically palpable GB, all of them (3 of 3) turned out to have a difficult procedure post-surgery and two of them converted to open surgery. Previous upper or lower abdominal surgery may lead to intraperitoneal adhesions present between viscera or omentum and the abdominal wall that may increase the probability of injury and bleeding while the placement of umbilical port and risk of conversion was reported to be higher [14]. It was found to be a statistically significant factor in our study as 2 of 2 patients had previous upper abdominal scars had a 100% conversion rate to open due to severe adhesions. Chand, et al. all patients in their study with impacted stone at the neck of GB turned out to be difficult laparoscopically because of distension of GB and thick GB wall, it was difficult to grasp the GB neck to allow adequate retraction during dissection of the Calot's triangle [15]. 12.12% of patients (4 out of 33) in our series had GB stone impacted at the neck of GB and turned out to be difficult (100%) of them which showed a significant predictor of intraoperative difficulty.

Despite the ultrasonographic thickening of the GB wall signifies acute cholecystitis, associated with difficulty with grasping, manipulation and dissection of the GB from its bed, confuses the identification of the anatomical landmarks and considered an implied significant element in previous studies [8,15]. We found no significant correlation between the GB wall thickness and the difficulty level of surgery as only around half of our patients (18 of 33) had wall thickness > 4 mm. Nine patients of them predicted to be difficult and the 3 cases who were converted to open cholecystectomy. It may be better if a larger sample size would have allowed us to extrapolate the results into the general population.

The ultrasonographic pericholecystic fluid was found to be a predictor of difficult LC, this was demonstrated in 6 (18%) patients. It is also to be noted that of the 3 cases who were converted to open cholecystectomy had pericholecystic collection surrounding GB. The overall conversion rate in our study was 9.1%, all three cases had mostly similar predictive factors such as palpable GB, pericholecystic collection, an increased wall thickness of GB and BMI $\geq$ 25, previous abdominal surgeries, while gender and age factors were of no significance for conversion. This matches with S Kumar et al., the study which included 536 patients who underwent laparoscopic cholecystectomy the overall conversion rate in their study was 7.81% [16]. While the study of Sharma SK et al., was comprising 200 patients undergoing laparoscopic cholecystectomy at Kathmandu medical college the conversion rate in their study was 4% [17]. Gupta N, et al, their results showed sensitivity and specificity of this preoperative scoring method were found to be 95.74% and 73.68% respectively [6]. These results nearly matching the preoperative prediction scoring system was used in our study for prediction of difficult laparoscopic cholecystectomy with sensitivity and specificity of our scoring system for prediction of easy or difficult laparoscopic cholecystectomy were 93.75% and 52.94% respectively.

Intra-operative factors that indicate the difficulty of LC (Bile spillage, bleeding from cystic artery & prolonged time of operation) were mostly dependent on prior factors detected preoperatively such as pericholecystic collection, palpable GB, previous upper abdominal operations, impacted stones, and increased GB wall thickness [18]. Although vascular anatomical variations are of importance for documenting difficulty in many literatures [3]. In our study, due to the small sample, we didn`t face any cases with atypical vascular anatomy. There was cystic artery injury with 7 cases, bile spillage with 9 cases and 15 cases suffered from the prolonged time of operation; all previous intraoperative data increased the risk of difficulty and rate of conversion.

Conclusion

In conclusion, we can report that obese patients who are over fifty with history with previous upper abdominal surgery and the ultrasonographic picture showed thick-walled GB and the pericholecystic collection had a higher risk of conversion. At this study scoring system was used for prediction of difficult laparoscopic cholecystectomy sensitivity was 93.75% and specificity was 52.94% of the scoring system at score 5 for

prediction of easy or more than 5 for difficult and very difficult laparoscopic cholecystectomy. A larger sample is recommended for a more conclusive score.

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