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Original Research Article

Effectiveness of preoperative scoring in predicting the difficult and extremely difficult laparoscopic cholecystectomy

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ABSTRACT

Background: To reduce the complications and conversion rate among the patients undergoing laparoscopic cholecystectomy, preoperative scores have been developed based upon the experience of surgeons and experience of the surgeries. Certain preoperative factors are thought to predict the difficult or extremely difficult laparoscopic cholecystectomy. Studies have shown the utility of the preoperative scoring to predict the difficult or extremely difficult laparoscopic cholecystectomy. To study the effectiveness of pre operative scoring in predicting the difficult and extremely difficult laparoscopic cholecystectomy.
Methods: Present study was hospital based cross sectional diagnostic evaluation study carried out among 50 patients who were posted for laparoscopic cholecystectomy. The parameters which defined pre operative scoring as well as parameters which defined intra operative scoring were recorded and based on the total score, the difficulty level was assessed preoperatively and confirmed intraoperatively. The efficacy of preoperative scoring was determined by comparing it with intra operative scoring.
Results: History of previous hospitalization, Palpable gall bladder, impacted stone and USG wall thickness/pericholecystic collection were significant preoperative factors. The overall diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was 80%. Sensitivity was 94.44%, the specificity was 84.38%, positive predictive value was 77.27%, negative predictive value was 96.43%, likelihood ratio of a positive test was 6.044, and likelihood ratio of a negative test was 0.06584. Thus it can be said that the efficacy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was very good.
Conclusions: The efficacy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was very good.

Keywords: Cholecystectomy, Difficult, Effectiveness, Pre-operative scoring

INTRODUCTION

It has been said that the gall stones are the disease of the modern society. But the history reveals that the gall stones used to occur around 1000 BC as it has been found in the Egyptian mummy's gall bladder. Thus we can say that the gall stones are well known to our ancients. This issue affects the people around the globe. Prevalence may vary from one area to the other area but it affects the people around the globe. It can affect any age group. As the age increases, the chances of gall stone disease increases. The prevalence of gall stone disease is around 25% in women aged above sixty years of age. Now a day, the gall stone disease is becoming more and more common. Symptoms are generally not seen in most of the cases of the gall stone disease. But it has been estimated that 10-20% of the cases will show symptoms after 5-20 years of development of the gall stones. Thus it is clear

that the risk of becoming symptomatic in the case of gall stone disease is less and estimated at about 2-2.6% per year.[1,2]

In the present era, the treatment of choice for the gall stone disease is the laparoscopic cholecystectomy. But all cases are not so fortunate. Some cases need open cholecystectomy. This is attributed to certain difficulties encountered during the surgery due to various factors that lead to such kind of conversion. This conversion rate has been estimated to be around 2-15%.[3]

The use of laparoscopic cholecystectomy started in the year of 1987. It proved to be a boon to the patients. It has now acquired a dimension of standard treatment of choice. It has many advantages compared to open cholecystectomy. The patient has to stay for a short period of time in hospital, there is decreased incidence of morbidities, the patient can return to work very fast, the cosmesis is also better in laparoscopic cholecystectomy compared to open cholecystectomy. There are few or very minimum changes in the biochemical and physiologic responses. But the major disadvantages of the laparoscopic cholecystectomy are the increased chances of bile duct injury.[4]

Ultrasonography before the surgery can be useful for the surgeons to determine whether the laparoscopic cholecystectomy is going to be easy or difficult or extremely difficult. This should aim at reduced complications. Previous history of cholecystitis or previous history of pancreatitis and also the chronic disease presence and other some factors can land the patient in the difficult type of laparoscopic surgery or they need open cholecystectomy. There is also more likelihood of the injury to the bile duct or other nearby organs.[5]

To reduce the complications and conversion rate among the patients undergoing laparoscopic cholecystectomy, preoperative scores have been developed based upon the experience of surgeons and experience of the surgeries. Certain pre operative factors are thought to predict the difficult or extremely difficult laparoscopic cholecystectomy. Studies have shown the utility of the pre operative scoring to predict the difficult or extremely difficult laparoscopic cholecystectomy.

Hence present study was carried out to study the effectiveness of pre operative scoring in predicting the difficult and extremely difficult laparoscopic cholecystectomy

METHODS

Present study was hospital based cross sectional diagnostic evaluation study carried out among 50 patients in the department of General surgery, Katuri Medical College from July 2016 to December 2018 who were posted for laparoscopic cholecystectomy. The parameters which defined pre operative scoring as well as parameters which defined intra operative scoring were recorded and based on the total score, the difficulty level was assessed pre operatively and confirmed intra operatively. The efficacy of pre operative scoring was determined by comparing it with intra operative scoring.

Inclusion criteria

- Patients undergoing laparoscopic cholecystectomy,
- Patients willing to participate in the present study.

Exclusion criteria

- Patients undergoing open cholecystectomy initially,
- Patients not willing to participate in the present study.

The preoperative parameters were defined as following. Age less than 50 years the score was zero and age more than 50 years, the score was one. Male sex had score of one while female sex had score of zero.

History of previous hospitalization had score of four while no such history had been given zero score. Body mass index (BMI) less than 25 kg/m^2 was given zero score while BMI 25-27.5 kg/m^2 was given score of one, and BMI >27.5 kg/m^2 was given a score of two. Palpable gall bladder had score of one while non palpable had zero score. Impacted stone had score of one while zero was considered if no such thing was found on USG.

The intraoperative parameters were defined as follows. Gall bladder adhesions less than 50% were given a score of one while gall bladder adhesions more than 50% were given a score of three.

Distended and contracted gall bladder was given a score of one while none such thing was scored as zero.

If previous adhesions were present then the score was one while if previous adhesions were not present then the score was zero. If Unable to grasp gall bladder wall then the score was one and if able to grasp gall bladder wall then the score was zero.

If impacted stone >1 cm then the score was one and less than one cm was zero. Perforated gall bladder/empyema was given a score of one while normal was scored as zero. If time to dissect calots >90 min then the score was one while less than 90 min was scored as zero.

All the scores were properly recorded in the study questionnaire. Patient information was kept confidential. Only total scores were used. All surgical protocols were followed from patient admission to the discharge.

Statistical analysis

Initially the data was entered in the Microsoft Excel worksheet. Proportions were calculated for descriptive

variables. Open Epi statistical software version 3.01 was used for the statistical analysis. Yates corrected chi square with two tailed p value was used to study the differences in the proportions. Using the same software, the receptor operative curve was constructed and the area under the curve as well as sensitivity, specificity, diagnostic accuracy etc was calculated.

RESULTS

32 patients were aged less than 50 years of age. Females were more than males. 21 had history of previous hospitalization. Majority i.e. 52% had BMI 25-27.5 kg/m^2. Only three patients were found to have palpable gall bladder. Similarly only three were found to have impacted stone in the gall bladder. 13 had USG wall thickness/pericholecystic collection. In the intraoperative parameters, 21 had gall bladder adhesions. 34 had distended and contracted gall bladder.

Only two had previous adhesions. In 16 patients it was not possible to grasp the gall bladder wall. In 9 patients the impacted stone had size of more than one cm. perforated gall bladder or empyema was seen in three patients. In 11 patients, time to dissect calots was more than 90 min (Table 1).

Table 1: Distribution of study subjects as per parameters which define difficulty levels.

Parameters			Number	%
Preoperative parameters	Age	<50	32	64
		>50	18	36
	Sex	Male	17	34
		Female	33	66
	History of previous hospitalization	Yes	21	42
		No	29	58
	BMI (kg/m^2)	<25	13	26
		25-27.5	26	52
		> 27.5	11	22
	Palpable gall bladder	Yes	03	06
		No	47	94
	Impacted stone	Yes	06	12
		No	44	88
	USG wall thickness/pericholecystic collection	Yes	13	26
		No	37	74
Intraoperative parameters	Gall bladder adhesions	< 50%	29	58
		> 50%	21	42
	Distended and contracted gall bladder	Yes	34	68
		No	16	32
	Previous adhesions	Yes	02	04
		No	48	96
	Unable to grasp gall bladder wall	Yes	16	32
		No	34	68
	Impacted stone >1 cm	Yes	09	18
		No	41	82
	Perforated gall bladder/empyema	Yes	03	06
		No	47	94
	Time to dissect calots >90 min	Yes	11	22
		No	39	78

Age >50 years was able to predict the difficult pre-operative score in only 50% of the cases while sex could predict 41.1% of the preoperative score. Palpable gall bladder and impacted stone were the only parameters which was able to predict the difficulty level in all the cases i.e. 100%. History of previous hospitalization predicted the difficulty level in 85.8% of the cases correctly and very closed followed by the USG wall thickness/pericholecystic collection which predicted the difficulty level in 84.6% of the cases correctly. BMI, age and sex were found to be poor predictors (Table 2).

Intra-operative parameters like Gall bladder adhesions, Impacted stone > 1 cm, previous adhesions, Unable to grasp, gall bladder wall, perforated gall bladder/ empyema, Time to dissect calots > 90 min predicted with 100% accuracy of the intra-operative score. These parameters were found to be statistically significant also except previous adhesions and perforated gall

bladder/empyema which were not found to be statistically significant. Distended contracted gall bladder could predict the difficulty level in only 64.7% of the cases but was found to be a significant predictor (Table 3).

Table 2: Risk factors predicting preoperative score.

Risk factors		Preoperative score				Chi square	P value
		Difficult and very difficult		Easy			
		Number	%	Number	%		
Age (years)	>50	9	50	9	50	1.53	0.107
	<50	9	28.1	23	71.9		
Sex	Male	7	41.1	10	58.9	0.05	0.406
	Female	11	33.3	22	66.7		
History of previous hospitalization	Yes	18	85.8	3	14.2	35.21	< 0.001
	No	0	0	29	100		
Body mass index (kg/m^2)	>25	17	45.9	20	54.1	4.56	0.032
	<25	1	7.7	12	92.3		
Palpable gall bladder	Yes	3	100	0	0	3.103	0.039
	No	15	31.9	32	68.1		
Impacted stone	Yes	6	100	0	0	9.17	0.001
	No	12	27.3	32	72.7		
USG wall thickness / pericholecystic collection	Yes	11	84.6	2	15.4	15.28	< 0.001
	No	7	18.9	30	81.1		

Table 3: Risk factors predicting intraoperative score.

Risk factors		Intraoperative score				Chi square	P value
		Difficult and very difficult		Easy			
		Number	%	Number	%		
Gall bladder adhesions	>50%	21	100	0	0	42.25	< 0.001
	<50%	1	3.4	28	96.6		
Distended contracted gall bladder	Yes	22	64.7	12	35.3	15.95	< 0.001
	No	0	0	16	100		
Previous adhesions	Yes	2	100	0	0	0.812	0.183
	No	20	41.7	28	58.3		
Unable to grasp gall bladder wall	Yes	16	100	0	0	26.7	< 0.001
	No	6	17.6	28	82.4		
Impacted stone >1 cm	Yes	9	100	0	0	11.33	< 0.001
	No	13	31.7	28	68.3		
Perforated gall bladder/empyema	Yes	3	100	0	0	2.004	0.078
	No	19	40.4	28	59.6		
Time to dissect calots >90 min	Yes	11	100	0	0	15.15	< 0.001
	No	11	28.2	28	71.8		

Table 4: Efficacy of preoperative scores in predicting difficult laparoscopic cholecystectomy.

Intra operative scoring levels	Preoperative scores				Total	
	Difficult and very difficult		Easy			
	Number	%	Number	%	Number	%
Easy	1	3.6	27	96.4	28	56
Difficult	8	66.7	4	33.3	12	24
Extremely difficult	9	90	1	10	10	20
Total	18	36	32	64	50	100

Table 4 shows the efficacy of pre-operative score in predicting difficult laparoscopic cholecystectomy. As per the intraoperative scoring there were total 10 cases which were extremely difficult out of which 90% were accurately predicted as extremely difficult by pre-operative scoring.

Out of 12 difficult cases as per the intraoperative scoring, the preoperative scoring was able to predict 66.7% accurately. In the easy cases the accuracy was 96.4%. Thus the preoperative scoring was found to be a good tool in predicting the difficulty.

Table 5: Diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy.

Parameters	Estimate	Lower-upper 95% CI	Method
Sensitivity	94.44%	74.24-99.01	Wilson score
Specificity	84.38%	68.25-93.14	Wilson score
Positive predictive value	77.27%	56.56-89.88	Wilson score
Negative predictive value	96.43%	82.29-99.37	Wilson score
Diagnostic accuracy	88%	76.19-94.38	Wilson score
Likelihood ratio of a positive test	6.044	4.057-0.4738	-
Likelihood ratio of a negative test	0.06584	0.009151-0.4738	-
Diagnostic Odds	91.8	9.859-854.7	-
Cohen's kappa (unweighted)	0.7517	0.4783-1.025	-
Entropy reduction after a positive test	11.75%	-	-
Entropy reduction after a negative test	49.93%	-	-
Bias index	0.08	-	-

Table 5 shows diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy. The overall diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was 80%. Sensitivity was 94.44%, the specificity was 84.38%, positive predictive value was 77.27%, negative predictive value was 96.43%, likelihood ratio of a positive test was 6.044, and likelihood ratio of a negative test was 0.06584. Thus it can be said that the efficacy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was very good.

Table 6: Diagnostic accuracy of preoperative scoring in predicting extremely difficult laparoscopic cholecystectomy.

Parameters	Estimate	Lower-upper 95% CI	Method
Sensitivity	50%	29.03-70.97	Wilson score
Specificity	96.88%	84.26-99.45	Wilson score
Positive predictive value	90%	59.58-98.21	Wilson score
Negative predictive value	77.5%	62.5-87.68	Wilson score
Diagnostic accuracy	80%	66.96-88.76	Wilson score
Likelihood ratio of a positive test	16	1.813-141.2	-
Likelihood ratio of a negative test	0.5161	0.4143-0.643	-
Diagnostic odds	31	3.451-278.5	-
Cohen's kappa (un-weighted)	0.5192	0.2634-0.7751	-
Entropy reduction after a positive test	32.83%	-	-
Entropy reduction after a negative test	12.03%	-	-
Bias index	-0.16	-	-

Table 6 shows diagnostic accuracy of preoperative scoring in predicting extremely difficult laparoscopic cholecystectomy. The overall diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was 80%. Sensitivity was 50%, the specificity was 96.88%, positive predictive value was 90%, negative predictive value was 77.5%, likelihood ratio of a positive test was 16, and likelihood ratio of a negative test was 0.5161. Thus it can be said that the efficacy of preoperative scoring in predicting extremely difficult laparoscopic cholecystectomy was very good.

Figure 1 shows receiver operator characteristic (ROC) Curve. X axis shows the false positive rate and the Y axis shows true positive rate. The comparison is between the three cut off points of intraoperative score compared to the preoperative scoring. The area under the receiver operator characteristic curve was found to be very good i.e. 0.9184027 with 95% of confidence interval of 0.8327183 to 1.0040872. Thus it can be interpreted from the above curve that the preoperative scoring is useful in the predicting of difficult and extremely difficult laparoscopic cholecystectomy.

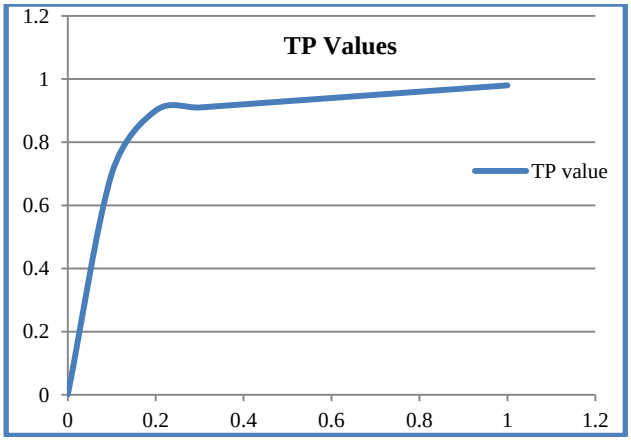

Figure 1: Receiver operator characteristic (ROC) curve.

TP - True positive rate, FP - False positive rate, Area under the ROC curve= 0.9184027 (0.8327183 - 1.0040872).

Table 7: Conversion rate.

Converted to open cholecystectomy	Number	%
Yes	04	08
No	46	92
Total	50	100

Table 7 shows the conversion rate of patients from laparoscopic cholecystectomy to the open cholecystectomy. Out of 50 cases operated in the present study using laparoscopic approach the conversion rate was 8% i.e. four cases needed conversion to open surgery due to difficulty while performing the laparoscopic cholecystectomy. Remaining 46 cases i.e. 92% of the cases did not require the conversion to the open surgical method. They could be managed by laparoscopic surgery only. All cases which needed conversion were all difficult as per the preoperative and intraoperative scoring methods.

DISCUSSION

Thus it is evident from the present study that the preoperative scoring system is a very good predictor of the difficult and extremely difficulty laparoscopic cholecystectomy. In accordance to the scores, only four cases required conversion.

Gupta et al found in their study that adverse clinical factors were significantly associated with outcome.[6] But the adverse radiological predictors were not. They also noted that previous history of acute cholecystitis, being obese were significantly associated with the outcome. We also found similar association. The author found that age >50 years and being male was not significant and this is also in accordance with the present study. Thickened gall bladder, contracted gall bladder, impacted stone were not significant but we found them significant.[6]

Agrawal et al noted that the prediction accuracy for easy was 76.4% and for difficult was 100%.[7] They also noted that gall bladder palpability, prior hospital admission, impacted stone, presence of scan on the abdomen were significant predictors and these are in accordance with the present study.

Mohanty et al observed in their study that age and sex were not significant but other factors were significant like BMI, impacted stone etc. these findings are as per the findings of the present study.[8]

Takegami et al concluded from their study that preoperative scoring system was a very good predictor of difficult and extremely difficult laparoscopic cholecystectomy.[9] We also found similar observations. [9]

Meshikhes et al studied 260 patients. Out of these 260 patients, the conversion was required in 28 patients due to a number of reasons.[10] In our study we found the conversion rate as 8%. The authors concluded that laparoscopic cholecystectomy is safe and effective and conversion is less.[10]

Fried et al studied the prediction of the conversion and the risk factors for it.[11] They found that the conversion was required in 5.4% of the cases which is lower compared to the present study of 8% but almost comparable. They noted that the risk factors were being male, advancing age, acute cholecystitis, being obese and thickened wall of the gall bladder were significant. The authors concluded that these factors can predict the need for open cholecystectomy.[11]

Bataitis et al observed a very high conversion rate of 19.04% which is more than double compared the present study.[12] They noted that age more than 65 years, being male, empyema, past history of surgery, presence of fever were the prominent risk factors responsible for conversion. The operative time was also significantly associated. They concluded that laparoscopic cholecystectomy requires highly skilled equipments and personnel but is more effective.[12]

Sudhir et al noted that the sensitivity of the preoperative scoring was 95.17%, specificity was 50%, positive predictive value was 81.71%, and negative predictive value was 83.3% with a diagnostic accuracy of 82%.[13] We also found similar results. The overall diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was 80%. Sensitivity was 50%, the specificity was 96.88%, and Positive predictive value was 90%. The authors concluded that preoperative scoring can be used to predict the difficulty of laparoscopic cholecystectomy.

Randhawa et al noted that the preoperative score was able to predict easy cases in 88.8% of the cases and 92% of the difficult cases.[14] We also found that preoperative score was able to predict easy cases in 96.4% of the cases

and 90% of the difficult cases. They also noted that being overweight and obese, history of previous hospitalization, gall bladder being palpable and ultrasound showing thickened gall bladder were significant predictors of the difficult laparoscopic cholecystectomy. We also noted similar observations in the present study. The authors concluded that preoperative scoring system was good and can be used.[14]

CONCLUSION

The overall diagnostic accuracy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was 80%. Sensitivity was 94.44%, the specificity was 84.38%, positive predictive value was 77.27%, negative predictive value was 96.43%, likelihood ratio of a positive test was 6.044, and likelihood ratio of a negative test was 0.06584. Thus it can be said that the efficacy of preoperative scoring in predicting difficult laparoscopic cholecystectomy was very good.

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