Original Research Article

Predicting difficulty in laparoscopic cholecystectomy preoperatively using a scoring system

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC), one of the most commonly performed surgical procedures worldwide. Preoperative assessment of difficulty is needed for frequent procedures such as LC in order to avoid complications, preparedness and to guarantee an efficient course of surgery . But there is no scoring system available to predict the difficulty preoperatively.
Methods: In our study we have tried to predict a difficult LC preoperatively using a modified scoring system proposed by Randhawa et al. Patients diagnosed to have GB stones requiring LC were evaluated with following factors age, gender, duration of illness, h/o previous GB disease, underwent ERCP, BMI, abdominal scar whether infra umbilical or supraumbilical, palpable gallbladder, sonographic findings - gall bladder wall thickness, pericholecystic collection, impacted stone. Various clinical and radiological and intra-operative parameters were scored. Procedure is graded based on individual surgeon's opinion as easy/difficult/very difficult. The parameters were analyzed to find their correlation to predicting difficult LC. Degree of difficulty was analyzed.
Results: Preoperative scoring system proposed by Randhawa et al that we modified was found to be appropriate for predicting operative outcome in LC, having overall p value for the scoring system of <0.001, with sensitivity of 90.9, specificity of 73.1% and area under RoC of 0.876. In present study, palpable gall bladder, history of previous cholecystitis, and the radiological parameters i.e. GB wall thickness, pericholecystic fluid and impacted stone to be statistically significant.
Conclusions: Present modified Randhawa and Pujahari scoring system is valuable and appropriate for predicting operative outcome in laparoscopic cholecystectomy. This, in turn, facilitates better preparedness.

Keywords: Difficult, Lap cholecystectomy, Prediction, Scoring

INTRODUCTION

Laparoscopic cholecystectomy (LC), is accepted as the gold standard in the treatment of symptomatic gallstones and commonly performed surgery.

Erich Mühe, introduced laparoscopic cholecystectomy in 1987. Laparoscopic cholecystectomy has replaced open cholecystectomy as the standard of treatment, as the advantages include decreased morbidity, reduced hospitalization, short recovery time, better cosmesis and overall less cost.

At times LC becomes difficult. It takes longer time even with bile/stone spillage and occasionally it requires conversion to open cholecystectomy. It is very difficult to say preoperatively whether it is going to be easy or difficult. The degree of difficulties is again impossible to

predict. But there is no scoring system available to predict the difficulty of LC preoperatively.

In case of laparoscopic cholecystectomy, preoperative complexity estimation helps surgeons deciding whether to proceed with a minimally invasive approach, perform an open procedure or make a referral to a more experienced surgeon. It may also be useful for explaining the various risks of laparoscopic and open procedures.[1] Although laparoscopic cholecystectomy has generally a low incidence of morbidity and mortality and of conversion rate to open surgery, its outcome is particularly affected by the presence and severity of inflammation.

Laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreatography (ERCP) with endoscopic sphincterotomy (ES) for combined choledochocystolithiasis is more difficult with prolonged procedure than in uncomplicated gallstone disease with a longer post-operative hospital stay.[2]

The purpose of my prospective study is to predict a difficult laparoscopic cholecystectomy preoperatively by the use of a scoring system and to validate the scoring system.

METHODS

This non-randomized prospective observational study admitted from November 2016 to November 2018 for laparoscopic cholecystectomy in department of surgery at JSS Hospital. 100 patients, who underwent laparoscopic cholecystectomies were studied during the period.

Inclusion criteria

- All patients above 18 years diagnosed to have cholelithiasis and
- Posted for laparoscopic cholecystectomy and willing to be part of the study.

Exclusion criteria

- Suspected malignant gall bladder disease
- Laparoscopic cholecystectomy with Common Bile Duct (CBD) exploration.

Patients diagnosed to have GB stones requiring cholecystectomy were evaluated with following factors age, gender, duration of illness, h/o previous GB disease, concurrent systemic illness, underwent ERCP, BMI (obesity), abdominal scar whether infra umbilical or supraumbilical, upper abdominal tenderness, palpable gallbladder, sonographic findings- gall bladder wall thickness, pericholecystic collection, size and number of calculi, anatomical anomalies (Table 1).

The scoring system is adopted from the study done by authors Randhawa JS et al.[1]

Table 1: Present modified Randhawa et al, scoring system.

History	FINDING (SCORE)		Maximum score
Age	<60 (0)	>60 (1)	1
H/o previous attacks of cholecystitis	No (0)	Yes (2)	2
Post ERCP /stenting	No (0)	Yes (2)	2
BMI wt (kg)/m²	<25 (0)	25-27.5 (1) >27.5 (2)	2
Abdominal scar	No (0)	Infra umbilical (1) supra umbilical (2)	2
Palpable gall bladder	No (0)	Yes (2)	2
Wall thickness	<4mm (0)	>4 (2)	2
Pericholecystic collection	No (0)	Yes (1)	1

Table 2: Easy /difficult present study criteria.

Surgeon 's opinion	Criteria
Easy	Time taken <60 mins.
	No bile spillage.
	No injury to duct or artery
Difficult	Time taken 60-120 mins.
	Bile/stone spillage.
	Injury to duct.
	No conversion.
Very difficult	Time taken >120 mins.
	Conversion to open.

Individual parameters are allocated appropriate scores, which were derived based on statistical analysis, and based on the final scores after adding the scores of individual parameters, LC was divided by authors as easy, difficult and very difficult with scores being 0- 5, 6- 10, 11-15 respectively (Table 2). These predictions were compared by the authors with intraoperative findings that whether the surgery which was predicted to be easy, difficult and very difficult were the same intraoperatively. The factors which were taken by authors to grade the surgery as easy, difficult and very difficult being time taken for the surgery, any injury to cystic artery, cystic duct and CBD, any spillage of bile and gall stones and conversion of surgery to open (Table 2).

In present study authors modified Randhawa JS et al, score (Table 1) by removing gender as factor in predicting difficulty as studies conducted by Almuhim AA et al, Rhezhii D et al, and Randhawa JS et al, and in present study there is no statistical significance in gender associated with gender. Authors have also taken h/o ERCP studies conducted by JSK Reinder et al, and Mann

K, patient there is difficulty in lap cholecystectomy for patient after ERCP.[3]

Table 3: Scoring system by Randhawa et al.[1]

History	Fact		Max score
Age	<50Y	>50 Y (1)	1
Gender	Female (0)	Male (1)	1
H/O hospitalization	No (0)	Yes (4)	4
Clinical			
BMI	<25(0)	25.1-27.5(1) >27.5(2)	2
Palpable gall bladder	No (0)	Yes (1)	1
Abdominal scar	No (0)	Infra-umbilical (1) supra-umbilical (2)	2
Sonographical			
Wall thickness	Thin (0)	Thick >4mm (2)	2
Peri cholecystic collection	No	Yes (1)	1
Impacted stone	No (0)	Yes (1)	1

Total maximum score - 15

Among all these scoring systems authors have chosen scoring system proposed by Randhawa et al, (Table 3), as it has following advantages

- Done in Indian population.
- Does not require tests other than what are regularly done.
- Does not require special equipment.
- Easily understood and adopted.
- The original scoring system used by Randhawa et al, is shown in Table 3.

Statistical analysis

Summary statistics was done by means of proportions for categorical/binary variables and mean, median, Standard deviation for continuous variables. Inferential statistics was done by using chi square test, independent t test, multivariate logistic regression by enter method and Area under curve with ROC curve. All the statistical methods were done using SPSS 21.0 version for windows. $P<0.05$ was considered statistically significant.

Chi square test/fisher exact test are used comparing two or more independent proportions. Fisher exact is used when the number of expected numbers in >25% cells is <5. Independent t test was used to compare means between independent groups/mutually exclusive groups.

RESULTS

Gall stone disease was found to be most common in 4th and 6th decades in our study. Oldest patient was 74 years, youngest was 22 years. Even though as the age advances the difficulty in surgery increases but not statistically significant in our study. Gall stone disease was found to be more common in females than males. No. of females - 56 (56%), No. of males - 44 (44%).

Total 24 patients have h/o cholecystitis and 8 patients has underwent ERCP prior to the procedure (Table 4). In these patients intra operative adhesions found frequently, there is difficulty in skeletonising cystic duct and cystic artery. On analysis h/o hospitalization and ercp was found strongly significant in predicting difficult LC both in univariate and multivariate analysis.

Table 5 shows distribution of other clinical parameters like BMI, Abdominal scar, Palpable gallbladder in relation to surgery. 65 patients have BMI <25 and BMI of 25-27.5 were 29 and >27.5 were 16. Authors found difficulty in operating high BMI patient. 4 patients have supraubilical scar and 34 patients has infra umbilical scar. Most of the infra umbilcal scars are tubectomy scar. Adhesion were more in supra umbilical scar patients Presence of abdominal scar not found to be significant in predicting difficult LC (P value 0.7). Clinically gall bladder palpable in 14 patients. Intra operatively we distended gall bladder, mucocele with impacted stone, adhesions between gallbladder, omemtum, stomach in few cases. Palpable GB was found to be strongly significant in predicting difficult LC with P value of <0.01.

Radiological findings were analysed as shown in Table 6. Wall thickness <4mm seen in 75 cases and >4mm seen in 25 cases. Patients with h/o cholecystitis has thickened wall, intra operated we found difficulty. But bladder puncture and bile spillage also seen in very thin wall gall bladder. Wall thickness (p value - 0.01) is important parameter in predicting difficulty. Pericholecystic collection seen in 6 cases and impacted stone seen in 7 cases. Presence of pericholecystic fluid (P value <0.006) and impaction of stone (P value of <0.001) was found to be strongly significant in preoperative assessment.

The below Table 7 shows score distribution in relation to intraop surgeon's opinion.

Of the 100 patients studied:

- 78 scored preop easy, of which 69 were found easy intra op, 7 were difficult and 2 very difficult.
- 19 scored preop difficult, of which 7 were difficult intra op, 9 easy and 3 very difficult.
- 3 scored preop very difficult, 2 were very difficult,1 is difficult.

Table 4: History of previous hospitalisation due to gall stone disease and post ercp status in relation to surgery.

Risk factors	Level	Easy		Difficult			OR	
		N	Row N %	N	%	P	UV	MV
HO_cholecystitis	No	69	90.8	7	9.2	<0.01	Ref	Ref
	Yes	9	37.5	15	62.5		16.4	3.708
Post ercp	No	76	82.6	16	17.4	<0.01	Ref	Ref
	Yes	2	25.0	6	75.0		14.3	8.971

Table 5: BMI, abdominal scar, palpable gallbladder in relation to surgery.

Risk factors	Level	Preoperative outcome						
		Easy		Difficult			OR	
		N	Row N %	N	%	P	UV	MV
BMI category	<25	43	78.2	12	21.8	0.6	Ref	Ref
	25-27.5	24	82.8	5	17.2		0.74	0.424
	>27.5	11	68.8	5	31.3		1.63	1.216
Abdominal scar	NO	49	79.0	13	21.0	0.9	Ref	Ref
	Infra umbilical	26	76.5	8	23.5		1.2	3.411
	Supra umbilical	3	75.0	1	25.0		1.3	1.340
Palpable gallbladder	Not palpable	75	87.2	11	12.8	<0.01	Ref	Ref
	yes	3	21.4	11	78.6		25	3.905

Table 6: Wall thickness, pericholecystic collection, Impacted stone in relation to surgery.

Risk factors	Level	Difficulty						
		Easy		Difficult			OR	
		N	Row N %	N	%	P	UV	MV
Wall thickness mm	<4 MM	68	90.7	7	9.3	<0.01	Ref	Ref
	>4 MM	10	40.0	15	60.0		14.57	6.973
Pericholecystic Collection	No	76	80.9	18	19.1	0.006	Ref	Ref
	Yes	2	33.3	4	66.7		8.4	2.695
Impacted stone	No	76	81.7	17	18.3		Ref	Ref
	Yes	2	28.6	5	71.4	0.001	11.2	1.571

Table 7: Score distribution in relation to surgeon's opinion.

Preoperative score	Surgeon opinion (intra-OP assessment)			Total
	Easy	Difficult	Very difficult	
0-5 (easy)	69 (88.4%)	7 (46.6%)	2 (28.5%)	78 (78%)
6-10 (difficult)	9 (11.6%)	7 (46.6%)	3 (43%)	19 (19%)
11-15 (very difficult)	0 (0%)	1 (6.6%)	2 (28.5%)	3 (3%)
Total	78 (100%)	15 (100%)	7 (100%)	100 (100%)

On further analysing the results

Of the 78 found intra-op easy, 69 were score pre-op easy, but 9 scored difficult. Of the 15 found intra- op difficult, 7 scored pre-op difficult, but 7 scored easy. Of the 7 found intra- op very difficult, only 2 were scored pre-op very difficult. Preoperative scoring system proposed by Randhawa et al, that we modified was found to be appropriate for predicting operative outcome in LC, having overall p value for the scoring system of <0.001, with sensitivity of 90.9, specificity of 73.1% and area

under RoC of 0.876 (Figure 1) indicating 87.6% correct classification of true positive and true negatives.

DISCUSSION

Laparoscopic cholecystectomy (LC) has become the procedure of choice for the management of symptomatic gall stone disease. At times it is easy and can be done quickly. Occasionally it is difficult and takes longer time. But there is no scoring system available to predict the difficulty of LC preoperatively.
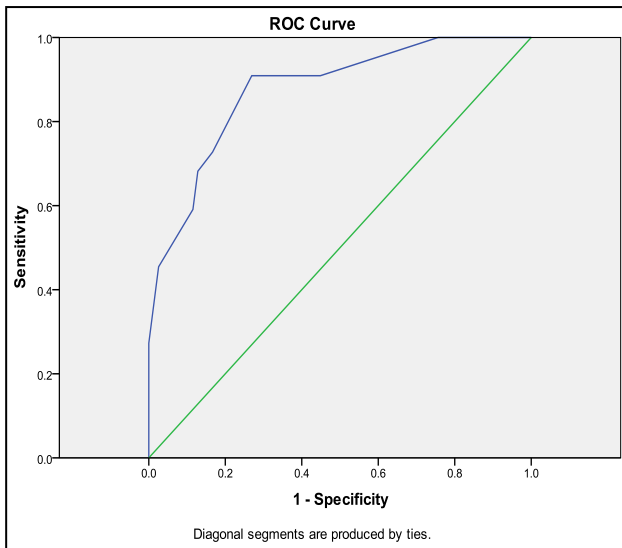
Figure 1: ROC curve and its area under curve for predicting the operative outcome based on preoperative scores.

This is a prospective observational study. The aim of present study is to predict a difficult LC based on scoring system proposed by Randhawa et al, and to analyze the individual parameters - epidemiological, clinical and radiological used in the scoring system.[1]

In present study authors modified Randhawa JS et al, score by removing gender as factor in predicting difficulty as studies conducted by Al-Mulhim AA and Rhezhii et al, even in present study shows no association in predicting difficulty.[2] Authors also taken h/o ERCP as in our hospital good number of patients undergoes ERCP and studies conducted by Reinder JSK et al, and Mann K there is difficulty in lap cholecystectomy for patient underwent ERCP previously.[3,4]

Based on the analysis of the results of our study, we have arrived on following observations which are discussed here by. Nidoni R et al, and Rhezhii D et al, in their studies have found cholelithiasis most common in age group between 30-50 years, similar age distribution pattern was found in patients with cholelithiasis in my study with 30-50 years being most common age group.[5,6]

Kama NA et al, in their study have found age >60 years significant for conversion from laparoscopic to open cholecystectomy, however in present study age has been adjusted to more than 60 years unlike more than 50 years in Randhawa et al but was not found significant, similar to Randhawa et al, Agarwal et al, study.[1,7,8]

Kankala V et al, and Lipman JM et al, in their studies found male gender as significant risk factor for conversion of LC to open surgery.[9,10] On the contrary in our study gender was not found to be significant (p value - 0.5).

Dhanke PS et al, and Nachnani J et al, in their study found BMI of more than $27.5 kg/m^2$ and $30 kg/m^2$ respectively, significant in predicting a difficult LC.[11,12] Authors found difficult in operating few his BMI patients but in present study BMI of more than $27.5 kg/m^2$ is found not significant with p value of 0.6. Vivek MA et al, and Rhezhii D et al, in their study found history of previous hospitalizations due to acute cholecystitis attack, to make LC difficult and hence increasing the chances of conversion.[6,13] In present study history of previous attacks was found to be strongly significant with p value of <0.001. Akyurek N et al, and Schrenk P et al, in their study found that past history of surgeries particularly upper abdominal surgeries was significant in predicting difficult LC.[14,15] In present study history of previous surgeries was not found to be significant with p value of 0.9, similar to Randhawa JS et al, study.[1] This may be possibly due to increasing experience on adhesiolysis and advanced laparoscopic skills and better instrumentation, most of our cases has infra umbilical scar and conversion is less often seen.

Gupta N et al, and Randhawa et al, in their study found palpable GB as statistically significant parameter in predicting difficult LC.[1,6] In this study authors have given more score to palpable gall bladder and palpable GB was found to be strongly significant in predicting difficult LC (p = 0.001).

Nachnani J et al, and Lal P et al, in their studies found thickened GB wall to be statistically significant parameter for difficult LC.[12,16,10,15] Gupta N et al, and Lal P et al, in their study found stone impacted at the neck of GB as statistically significant.[16]

In present study GB wall thickness of more than 4mm, presence of pericholecystic fluid, and impacted stone at the neck of GB were analyzed and found to predict difficult of LC and all of them were found to be significant with p values of 0.001, <0.006 and <0.001 respectively.

Studies done using similar scoring system are compared in Table 8. Present study results show the scoring system is more sensitive and less specific in predicting difficulty compared to Randhawa JS et al, study. Gupta N et al, found similar results in their study using the original Randhawa scoring.

Comparison between present study and similar studies

In present study authors observed that the current modified Randhawa scoring system is valuable and appropriate for use to pre-operatively predict difficult LC.

Authors observed palpable gall bladder, ho previous cholecystitis, post ERCP status and the radiological parameters i.e. GB wall thickness, pericholecystic fluid and impacted stone to be statistically significant.

But still authors find difficulty in predicting the cases that are intra operatively very difficult and that are converted to open.

CONCLUSION

Present modified Randhawa and Pujahari scoring system is valuable and appropriate for predicting operative outcome in laparoscopic cholecystectomy in JSS hospital. Advantage of this scoring system being, it takes into consideration tests that are regularly done, it does not require special equipment, easily understood and adopted. This scoring system is apt for teaching institutions with high patient output like JSS Hospital where surgeons of varied experience (from freshly graduated surgeons to surgeons of more than two decades experience) are performing laparoscopic cholecystectomy, i.e. it helps in allocating appropriate surgeries to appropriate surgeons based on prediction of difficulty by the scoring. This, in turn, facilitates better preparedness with adequate back-up of senior surgeon, anesthetist, operation theatre staff and appropriate operation theatre equipment. Patients can be better counselled pre-operatively for possible consequences based on their scores by this scoring system. But studies to allot scores for different parameters are needed.

REFERENCES

1. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. Indian J Surg. 2009 Aug 1;71(4):198-201
2. Al-Mulhim AA. Male gender is not a risk factor for the outcome of laparoscopic cholecystectomy: A single surgeon experience. Saudi J Gastroenterol. 2008 Apr;14(2):73-9.
3. Reinders JS, Gouma DJ, Heisterkamp J, Tromp E, van Ramshorst B, Boerma D. Laparoscopic cholecystectomy is more difficult after a previous endoscopic retrograde cholangiography. HPB. 2013 Mar 1;15(3):230-4.
4. Mann K, Belgaumkar AP, Singh S. Post–Endoscopic Retrograde Cholangiography Laparoscopic Cholecystectomy: Challenging but Safe. JSLS. 2013;17:371-5.
5. Nidoni R, Udachan TV, Sasnur P, Baloorkar R, Sindgikar V, Narasangi B. Predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment. JCDR. 2015 Dec;9(12):PC09.
6. Gupta N, Rajan G, Arora MP, Goswami B, Chaudhary P, Kapur A, et al. Validation of a scoring system to predict a difficult laparoscopic cholecystectomy. Int J Sur. 2013;11(9):1002-6.
7. Kama NA, Kologlu M, Doganay M, Reis E, Atli M, Dolapci M. A risk score for conversion from laparoscopic to open cholecystectomy. Am J Surg. 2001 Jun 1;181(6):520-5.
8. Agrawal N, Singh S, Khichy S. Preoperative prediction of difficult laparoscopic cholecystectomy: a scoring method. Nigerian J Surg. 2015;21(2):130-3.
9. Kanakala V, Borowski DW, Pellen MG, Dronamraju SS, Woodcock SA, Seymour K, et al. Risk factors in laparoscopic cholecystectomy: a multivariate analysis. Int J Surg. 2011 Jan 1;9(4):318-23.
10. Lipman JM, Claridge JA, Haridas M, Martin MD, Yao DC, Grimes KL, et al. Preoperative findings predict conversion from laparoscopic to open cholecystectomy. Surg. 2007 Oct 1;142(4):556-65.
11. Dhanke PS, Ugane SP. Factors predicting difficult laparoscopic cholecystectomy: A single-institution experience. Int J Students' Res. 2014 Jan 1;4(1):3.
12. Nachnani J, Supe A. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. Indian J Gastroenterol. 2005;24(1):16-8.
13. Vivek MA, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. J Minimal Access Surg. 2014 Apr;10(2):62-7.
14. Akyurek N, Salman B, Irkorucu O, Tascilar O, Yuksel O, Sare M, et al. Laparoscopic cholecystectomy in patients with previous abdominal surgery. JSLS. 2005 Apr 1;9(2):178-83.
15. Schrenk P, Woisetschläger R, Rieger R, Wayand WU. A diagnostic score to predict the difficulty of a laparoscopic cholecystectomy from preoperative variables. Surg Endoscopy. 1998 Feb 1;12(2):148-50.
16. Lal P, Agarwal PN, Malik VK, Chakravarti AL. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. J Soc Laparoendoscopic Surg. 2002 Jan;6(1):59-64.