Comparative Study between Pre and Intraoperative Score of Difficult Laparoscopic Cholecystectomy in Al-Jumhory Teaching Hospital in Mosul

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ABSTRACT

Background: Laparoscopic cholecystectomy is the standard treatment of symptomatic gallstones. Difficult laparoscopic cholecystectomy is faced frequently. Different score systems were developed to predict difficult laparoscopic cholecystectomy and possibility of conversion to open.

Objectives: To predict preoperative difficult laparoscopic cholecystectomy and possible conversion to open depending on pre-operative score system compared with intraoperative scoring system.

Methods: A randomized prospective study from June 2021 to June 2022 in which questionnaire form containing both score systems filled by surgeons. Sample size was 100 cases. Data analyzed by SPSS program for statistical analysis.

Results: The study showed that both preoperative and intraoperative score systems were significant in predicting difficult laparoscopic cholecystectomy. But intraoperative score system was more accurate. Female 73% and male 27%, preoperative score is 54% while intraoperative score is 43%.

Conclusion: Preoperative assessment of hospitalization due to biliary problem, male gender, BMI > 27.5 and ultrasonographic factors such as gallbladder wall thickness, pericholecystic collection, and impacted stone in the neck of gallbladder when all are present the chance of difficulty will increase.

Keywords: Laparoscopic cholecystectomy, Preoperative score system, Intraoperative score system, Conversion to open.

Cholecystectomy was established as the surgical treatment for gallstones in 1882, when Carl Johann August Langenbuch performed the first cholecystectomy in a 43-year-old woman who was complaining of gallstone disease for 16 years[1]. This procedure was first described in 1989, since when it has been adopted by the surgical community with enthusiasm. Laparoscopic cholecystectomy was an unacceptably by the surgical community during the early years of its use[1]. Laparoscopic cholecystectomy has become the treatment of choice for gallstones[2]. It is one of the most common laparoscopic procedures being performed by general surgeons around the world[3]. Preoperative prediction of the risk of conversion or difficulty of operation is an important factor in planning laparoscopic surgery[1].

The indications of laparoscopic cholecystectomy is the same as the open cholecystectomy which is symptomatic cholelithiasis, gallbladder polyps and tumors, biliary dyskinesia, acalculus cholecystitis[4].

Advantages of laparoscopic cholecystectomy are less pain postoperatively, a lower incidence of chest infection and pulmonary complications, early discharge from hospital and return to normal life activity.

On the other hand, laparoscopic cholecystectomy may increase the rate of bile duct injuries[3].

Iatrogenic bile duct injuries increased 2-4 folds with an odds ratio (open to laparoscopic) of 1.79[5].

Absolute contraindications to laparoscopic cholecystectomy include hemodynamic instability, uncontrolled coagulopathy, or frank peritonitis. In addition, patients with severe obstructive pulmonary disease (COPD) or congestive heart failure (e.g. cardiac ejection fraction < 20%) might not tolerate the increased intra-abdominal pressures of pneumoperitoneum with carbon dioxide and may require open cholecystectomy. Conditions formerly believed to be relative contraindications such as acute cholecystitis, gangrene and empyema of the gallbladder, biliary-enteric fistulae, obesity, pregnancy, ventriculo-peritoneal shunts, cirrhosis, and previous upper abdominal procedures are now considered risk factors for a potentially difficult cholecystectomy, but they do not preclude an attempt at laparoscopy[6].

Conversion to an open operation should always remain an option, and it is not a failure. Conversion to open may be necessary if the patient is unable to tolerate pneumoperitoneum, a complication occurs that cannot be fixed laparoscopically (bleeding), important anatomic structures cannot be clearly identified, or when no progress is made over a set period of time[6].

Difficult laparoscopic cholecystectomy can be defined as those operations need an operative time more than 2 hours and needs to convert to open method and if there is significant bleeding which need conversion to open method and those with vascular and biliary injures[7].

Decision of conversion depends on risk factors of the patient the level of skills of the surgeon; other technical factors will play a role such as anatomical variations, adhesions and equipment errors[6].

Conversion rate for elective laparoscopic cholecystectomy may be as 5% whereas the conversion rate in case of acute cholecystitis may be up to 30%. Nowadays it is estimated that 90% of cholecystectomies are operated by laparoscopy[3].

One of the causes that necessitate conversion is anatomical variations in cystic duct and cystic artery[3].

Many scoring systems were developed to predict difficult laparoscopic cholecystectomy pre and intraoperatively. We used the preoperative score used in Nikhil Agarwal study[4], which depended on both clinical and sonographic parameters, it predicted a score of ≤ 5 easy, 6-10 difficult and >10 are very difficult[4]. And the modified intraoperative grading system used by Yarub Momtaz Tawfeek Al Hakeem et al study[5], which depended on factors seen during the operation of total score of 10 and classified the categories as mild < 2, difficult 2-4 and very difficult 5-10[5].

Other scoring modalities regarding preoperative scoring systems deals with sonographic parameters only as seen in Bhagavan et al study[1].

Others concentrates only on clinical aspect as seen in Tika Ram Bhandari et al study[7] and some studies used parameters as WBC, TSB, SGPT, SGOT, ALP, CRP, CT scan of abdomen features seen preoperatively in predicting difficulty as seen in Giuseppe Di Buono et al study[8].

We tried to choose a score system that is easy to apply and depends on both clinical and sonographic factors which is as we think would be more accurate.

And regarding the intraoperative scoring systems also there are several scores developed which depends on factors seen during the operation like feasibility of grasping and other score systems add the time required to reach the critical view of safety as a factor so we choose the modified score developed by Yarub Momtaz Tawfeek et al study[5]. Because it is easy to apply and contain most of the important factor encountered during operation.

─────────────Methods

A verbal and written consent was taken from every person participated in this study. A randomized prospective study was performed at Al Mosul training center of the

Arab Board of General Surgery after getting the Arab Board ethical clearance for period of one year from June 2021 to June 2022.

Using questionnaire form containing the two score systems shown in tables (1 and 2) as filled by surgeons according to the findings in each case pre and intraoperatively. Statistic data analysis by SPSS program was used.

Sample size was 100 cases of different age groups and both genders.

We exclude equipment failure and emergency surgeries such as gallbladder perforation from the study.

Surgery was done two to seven days after sonographic examination laparoscopic cholecystectomy was performed using the standard four-ports technique with two 5 mm and two 10 mm ports.

Table 1: Preoperative scoring system[4].

Scoring factors	Minimum	Maximum	Total
History			
Age	<50 years (0)	>50 years (1)	1
Sex	Female (0)	Male (1)	1
History of hospitalization for acute cholecystitis	No (0)	Yes (4)	4
Clinical			
BMI weight (kg)/height (m²)	<25 (0)	25.0–27.5 (1)>27.5 (2)	2
Abdominal scar	No (0)	Infra-umbilical (1)	1
		Supra-umbilical (2)	2
Palpable GB	No (0)	Yes (1)	1
Sonography			
Wall thickness	Thin (0)	Thick > 4 mm (2)	2
Pericholecystic collection	No (0)	Yes (1)	1
Impacted stone	No (0)	Yes (1)	1

Total maximum score=15. BMI: Body mass index, GB: Gallbladder

Table 2: Intraoperative scoring system[5].

Intraoperative findings	0 point	1 point	2 points
Color of gallbladder Wall	Gray-blue and shiny	Dull yellow	**Red congested**
Amount of adhesions	No adhesion	Involve the neck and body	**Covered the gall bladder**
Feasibility of grasping the fundus	Grasp with ease	Difficult grasp	**Inability to grasp without decompression**
Presence of anatomical variations	No	Minor	**Major**
Ability to achieve critical view of safety	Three elements achieved	Two elements achieved	**One element achieved**

──────────────Results

Table 3: Demographic distribution of patients.

Demographic distribution		No.	Percent	Total
Age	< 50 years	49	49	100
	> 50 years	51	51	
Sex	Male	27	27	100
	Female	73	73	

Table 4: Total preoperative classification frequency.

Categories	Frequency	Percent
Easy	54	54
Difficult	44	44
Very difficult	2	2
Total	100	100

In this table, we predicate the state of laparoscopic cholecystectomy depending on pre-operative score.

Table 5: Total intraoperative classification frequency.

Intraoperative	Frequency	Percent
Easy	43	43%
Difficult	18	18%
Very difficult	39	39%
Total	100	100%

This table showed real operative state, which we faced it during laparoscopic cholecystectomy.

Table 6: Distribution of patients according preoperative variables on its categories of difficulty and its statistical analysis.

Preoperative score variables	Description	Easy	Difficult	Very difficult	Total	Percent from total number of patients	P value
Age	>50	24	25	2	51	51%	0.179
	<50	30	19	0	49	49%	
Sex	Male	12	13	2	27	27%	0.046
	Female	42	31	0	73	73%	
History of hospitalization due to gall bladder problem	Yes	11	37	2	50	50%	0.000
	No	43	7	0	50	50%	
BMI	<25	14	13	0	27	27%	0.000
	25 – 27.5	30	5	2	37	37%	
	>27.5	10	26	0	36	36%	
Abdominal scar	No	54	41	2	97	97%	0.140
	Supra umbilical	0	3	0	3	3%	
	Infra umbilical	0	0	0	0	0%	
Palpable gallbladder	Yes	0	0	0	0	0%	Non
	No	54	44	2	100	100%	
Wall thickness	Normal	49	23	0	72	72%	0.000
	>4mm	5	21	2	28	28%	
Pericholecystic collection	Yes	8	26	2	36	36%	0.000
	No	46	18	0	64	64%	
Impacted stone	Yes	18	39	2	59	59%	0.000
	No	36	5	0	41	41%	

p-value for all are significant

Regarding age we classified them less and more than 50 years and it was equal in number. Regarding gender distribution we notice that female to male ratio was 2.7:1 all of them were easy. Moreover, no patient seen under difficult category whose gender is female and easy category accounts 57% from female patients in the study.

History of hospitalization due to biliary cause we find that distribution mainly on the categories difficult and very difficult which account 78%.

Regarding BMI factor as we saw that the BMI of <27 was mainly distributed on the easy category and only 27% from the patients with BMI of >27 was distributed under category easy. Most of the patient with no abdominal scar distributed on easy and difficult categories and only three patients with supra-umbilical type fall on category difficult and no patients seen with infra-umbilical type.

No patients with palpable gallbladder were encountered in our study sample (emergency surgeries were excluded from our study). We find a 72% of patients with thin wall were under easy category surgery. We saw 64% of patients with no pericholecystic collection were easy. Patients with impacted stone were difficult and very difficult in 71% of them.

Table 7: Intraoperative variables distributed on its total categories of difficulty and p value for each.

Intraoperative variable	Description	Easy	Difficult	Extremely difficult	Total	Percent	P value
Color of gallbladder	Gray blue and shiny	31	0	0	31	31%	0.000
	Dull yellow	12	17	0	29	29%	
	Red congested	0	29	11	40	40%	
Amount of adhesions	No adhesions	24	0	0	24	24%	0.000
	Involve the neck and body	17	23	0	40	40%	
	Cover the gallbladder	2	23	11	36	36%	
Feasibility of grasping the fundus	Grasp with ease	41	3	0	44	44%	0.000
	Difficult grasp	2	28	6	36	36%	
	Inability to grasp without decompression	0	15	5	20	20%	
Presence of anatomical variations	No	29	32	0	61	61%	0.000
	Minor	14	8	0	22	22%	
	Major	0	6	11	17	17%	
Ability to achieve critical view of safety	3 elements achieved	35	24	0	59	59%	0.000
	2 elements achieved	8	16	3	27	27%	
	1 element achieved	0	6	8	14	14%	

p-value for all are significant

Patients with gray\blue gallbladder were easy in 100% of them while with red congested gallbladder were difficult and very difficult in 87% of them.

Patients with no adhesion 100% of them distributed under category easy and 63% of patients with gallbladder covered with omentum distributed under difficult and 30% were extremely difficult category.

Gallbladder grasped easily 93% of them distributed under the easy category and 75% of patient in which the gallbladder was difficult to grasp without decompression

distributed under the difficult and 25% were extremely difficult category.

Patients who had major anatomical variations 35% of them seen to be distributed on difficult and 64% on extremely difficult category.

Patient in whom three elements (cystic duct, cystic artery and inferior 1/3 of gallbladder wall) in critical view of safety was achieved 59% of them distributed under the easy category and 42% under difficult category and 57% under extremely difficult category.

Table 8: Total preoperative and total intraoperative distribution and statistical analysis.

Total intraoperative	Easy	43	0	0	43	0.000
	Difficult	3	15	0	18	
	Extremely difficult	8	29	2	39	
Total		54	44	2	100	

Patients who were easy 79% in the preoperative score system but were 100% easy in the intraoperative score system.

Patients who were difficult 34% in preoperative scoring system but were 83% in the intraoperative scoring system.

Patients who were very difficult account 100% in preoperative scoring system but were 5% extremely difficult in intraoperative scoring system.

──────────**Discussion**

In this study, the preoperative categories of difficulty which were distributed in 54% under easy category, 44% under difficult category and 2% under very difficult category. Unlike Dr. Bhagavan BC et al study[1] in which patients under difficult category was only 27% and it may be it is due to small sample size (30 patients) in his study compared to the sample size in our study (100 patients) in which results was more precise and accurate.

Regarding results in total intraoperative classification (Table 5) which shows that

18% of patients shown to be under difficult while in Dr. Bhagavan BC et al study[1] which was only 16%.

Age distribution has no predominance of one on another and p value regarding this risk factor was 0.179 which was not significant in predicting difficulty and this the same as Dr. Bhagavan BC et al study[1], Tika Ram Bhandari et al study[7] but seen to significant in Giuseppe di buono et al study[9] and may be is because the sample of his study did not include patients < 50 of age as in the current study

Female gender accounted 73% of the current study sample. The female male ratio was 2.7:1, and 43% as easy for female patient and the only 2 under very difficult category were males. The p value of this risk factor was 0.046 which significant in predicting difficulty and this is also seen in Tika Ram Bhandari et al study[7] and not significant in Dr. Bhagavan BC et al study[1] and Giuseppe di buono et al study[8].

History of hospitalization shown to be significant in our study as that its p value was 0.000 And this is also seen in Tika Ram

Bhandari et al[7] and Nikhil Aragwal et al[4] and Surgrue et al[9] studies.

Body mass index was significant in predicting difficulty in the current study the p value was 0.000 and patients with BMI of >27.5 was 73% were difficult as seen Ghadhban BR et al[10] unlike Tika Ram Bhandari et al[7] and Nikhil Aragwal et al[4] studies in which BMI was not significant and may be because differences in populations. Abdominal scar seen to be not significant in prediction of difficult laparoscopic cholecystectomy p value was 0.140 but if we look to the results we will find that we have three patients with supra-umbilical scar (2 midline and 1 Kocher incisions) and all of them found to be difficult. One of those three patients was converted to open so it should be important factor in prediction but in our study was not significant statistically because the small number of patients having this risk factor in the current study unlike Nikhil Aragwal et al study[4] in which it was significant. No patients with palpable gallbladder encountered in the current study, so in the current study it statistically was unanalyzable but seen to be significant in Nikhil Aragwal et al study[4].

Patients with wall thickness of >4 mm were in 82% difficult. Therefore, this risk factor shown to be significant in prediction in the current study and the p value was 0.000. It is an important risk factor for difficult laparoscopic cholecystectomy because thick wall is difficult to be grasped and making dissection more difficult. It was significant in many studies as Tika Ram Bhandari et al[7] and Giuseppe di Buono et al[8] and Surgrue et al[9] studies and not in Nikhil Aragwal et al study[4] which may be due his small sample size.

Presence of pericholecystic collection indicates severe inflammation and it was found highly significant in our study in which 77% of patients fall under difficult and very difficult categories and the p value was 0.000 and also significant in Lipman et al study[11]. Patients with impacted stone (in neck and infundibulum) 69% of them found to fall under difficult and very difficult categories and was significant in predicting

difficult in which the p value was 0.000. The impacted stone makes infundibulum difficult to grasp and distorts the anatomy of cystic duct. This risk factor was also significant in many studies as Bhagavan BC[1] and Nikhil Aragwal[4] and Surgrue et al[9] studies. The factors used in the modified intraoperative grading system for a difficult laparoscopic cholecystectomy used in Yarub Momtaz Tawfeek Al Hakeem et al study[5] (color of gallbladder, amount of adhesions, feasibility of grasping, presence of anatomical variations and achieving critical view of safety) were all significant in predicting difficult laparoscopic cholecystectomy the p value was 0.000 in our study.

Total preoperative and total intraoperative scoring system and their statistical analysis, we found that patients in category difficult in the preoperative score account 34% and very difficult accounts 100% while patients in category difficult in intraoperative scoring system were 83% and extremely difficult accounts 5%. This indicates that intraoperative scoring system is more useful in detecting difficult categories and found that patients in preoperative scoring system under category easy were 79% while they appear to be 100% in the intraoperative score system which indicates that intraoperative system (p value 0.000) is better than preoperative score system (p value 0.002) in predicting both easy and difficult categories but they are both significant statistically in the prediction.

In conclusion, this study showed that both preoperative and intraoperative score systems were statistically significant in predicting difficult laparoscopic cholecystectomy. The intraoperative score system is more accurate. There are important preoperative clinical factors such as, history of hospitalization due to biliary problem, male gender, BMI >27.5 and ultra sonographic factors such as gallbladder wall thickness, pericholecystic collection, and impacted stone in the neck of gallbladder in which when they are present the chance of difficulty will increase.

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1. Bhagavan BC. Comparative study between preoperative ultrasonographic based scoring system and intraoperative scoring system for predicting difficult laparoscopic cholecystectomy. SAS J Surg 2021;6:309-13.
2. Kacey DJ. Zollinger's Atlas of Surgical Operations. JAMA 2011;305(18):1913-7.
3. Brunicardi F, Andersen D, Billiar T, Dunn D, Hunter J, Matthews J, Pollock R. Schwartz's Principles of Surgery 10th ed. McGraw-hill; 2019.
4. Agrawal N, Singh S, Khichy S. Preoperative prediction of difficult laparoscopic cholecystectomy: A scoring method. Nigerian Journal of Surgery 2015;21(2):130-3.
5. Shallaly GE, Cuschieri A. Nature, aetiology and outcome of bile duct injuries after laparoscopic cholecystectomy. HPB 2000;2(1):3-12.
6. Al-Hakeem YM. Implementing a modified intraoperative grading system for a difficult laparoscopic cholecystectomy. Annals of the College of Medicine, Mosul. 2021;43(1):91-9.
7. Farquharson M, Hollingshead J, Moran B, (editors). Farquharson's Textbook of Operative General Surgery 9th ed. CRC Press; 2005.
8. Bhandari TR, Khan SA, Jha JL. Prediction of difficult laparoscopic cholecystectomy: An observational study. Annals of Medicine and Surgery 2021;72:1030-60.
9. Di Buono G, Romano G, Galia M, Amato G, Maienza E, Vernuccio F, Bonventre G, Gulotta L, Buscemi S, Agrusa A. Difficult laparoscopic cholecystectomy and preoperative predictive factors. Scientific Reports 2021;11(1):1-6.
10. Sugrue M, Sahebally SM, Ansaloni L, Zielinski MD. Grading operative findings at laparoscopic cholecystectomy. A new scoring system. World Journal of Emergency Surgery 2015;10(1):1-8.
11. Ghadhban BR. Assessment of the difficulties in laparoscopic cholecystectomy among patients at Baghdad province. Annals of Medicine and Surgery 2019;41:16-9.
12. Lipman JM, Claridge JA, Haridas M, Martin MD, Yao DC, Grimes KL, Malangoni MA. Preoperative findings predict conversion from laparoscopic to open cholecystectomy. Surgery 2007;142(4):556-65.
13. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. Indian Journal of Surgery 2009;71(4):198-201.
14. Hussien M, Appadurai IR, Delicata RJ, Carey PD. Laparoscopic cholecystectomy in the grossly obese: 4 years experience and review of literature. HPB 2002;4(4):157-61.
15. Lal P, Agarwal PN, Malik VK, Chakravarti AL. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. JSLS: Journal of the Society of Laparoendoscopic Surgeons 2002;6(1):59.
16. Gupta N, Ranjan G, Arora MP, Goswami B, Chaudhary P, Kapur A, Kumar R, Chand T. Validation of a scoring system to predict difficult laparoscopic cholecystectomy. International Journal of Surgery 2013;11(9):1002-6.
17. Kuldip S, Ashish O. Difficult laparoscopic cholecystectomy: A large series from north India. Indian Journal of Surgery 2006;68(4):205-8.
18. Suliman E, Palade RȘ. Importance of cystic pedicle dissection in laparoscopic cholecystectomy in order to avoid the common bile duct injuries. Journal of Medicine and Life 2016;9(1):44.
19. Singh K, Singh R, Kaur M. Clinical reappraisal of vasculobiliary anatomy relevant to laparoscopic cholecystectomy. Journal of Minimal Access Surgery 2017;13(4):273.
20. Singh RL, Brunt LM. Critical view of safety—its feasibility and efficacy in preventing bile duct injuries. Ann Laparosc Endosc Surg 2018;3(2).
21. Altuntas YE, Oncel M, Haksal M, Kement M, Gundogdu E, Aksakal N, Gezen FC. Gallbladder perforation during elective laparoscopic cholecystectomy: Incidence, risk factors, and outcomes. Northern Clinics of Istanbul 2018;5(1):47.
22. Blohm M, Österberg J, Sandblom G, Lundell L, Hedberg M, Enochsson L. The sooner, the better? The importance of optimal timing of cholecystectomy in acute cholecystitis: data from the National Swedish Registry for Gallstone Surgery, GallRiks. Journal of Gastrointestinal Surgery 2017;21(1):33-40.
23. Chindarkar H, Dumbre R, Fernandes A, Phalgune D. Study of correlation between pre-operative ultrasonographic findings and difficult laparoscopic cholecystectomy. International Surgery Journal 2018;5(7):2605-11.
24. Daradkeh SS, Suwan Z, Abu-Khalaf M. Preoperative ultrasonography and prediction of technical difficulties during laparoscopic cholecystectomy. World Journal of Surgery 1998;22(1):75-7.
25. Vivek MA, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. Journal of Minimal Access Surgery 2014;10(2):62.
26. Atta HM. Prevention of peritoneal adhesions: a promising role for gene therapy. World Journal of Gastroenterology: WJG 2011;17(46):5049.