Original Research Article

Intraoperative scoring system for grading severity of cholecystitis at laparoscopic cholecystectomy

Shefa Tanwir Ansari, Karamjot Singh Bedi, Shantanu Kumar Sahu*

Department of General Surgery, Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand, India

*Correspondence:
Dr. Shantanu Kumar Sahu,
E-mail: lntshantanu@yahoo.co.in

ABSTRACT

Background: Various studies had been carried out to evaluate the risk of preoperative conversion in laparoscopic cholecystectomy. However, there was no grading or scoring of operative findings during surgery at present, making it difficult to compare the publications citing outcomes, including the conversion to open surgery. Sugrue in 2015 devised a scoring system based upon the intraoperative findings in Laparoscopic cholecystectomy. Aim of the study was to grade the severity of cholecystitis during laparoscopic cholecystectomy using intraoperative scoring system, to evaluate the spectrum of cholecystitis in cases of laparoscopic cholecystectomy in a tertiary center using the grades of intraoperative scores and to validate the scoring system devised by Michael Sugrue.
Methods: This prospective cross sectional observatory study of 200 patients admitted for laparoscopic cholecystectomy was conducted in the Department of Surgery, Himalayan Institute of Medical Sciences, Dehradun, Uttarakhand, India over a period of 12 months. All patients directly planned for open cholecystectomy and carcinoma gall bladder were excluded from the study. Patients were subjected to the intra operative grading system for cholecystitis severity as devised by Micheal Sugrue and the grades were classified with a score of <2 - mild; 2 to 4 - moderate, 5– 7- severe and 8 to 10 – extreme.
Results: The operative grading system showed a positive correlation with the severity of cholecystitis.
Conclusions: Use of this intra-operative scoring system will help us to provide a trigger for a prompt early conversion to avoid intra-operative complications associated with difficult laparoscopic cholecystectomy.

Keywords: Laparoscopic cholecystectomy, Operative grading system, Severity score

INTRODUCTION

The first cholecystectomy is credited to John Strong Bobbs on June 15 1867.[1] In 1987, France, Professor Mouret of Lyon performed the first laparoscopic cholecystectomy, while completing a gynaecologic laparascopy on a woman suffering from symptomatic gall stones. He opted for the keyhole laparoscopic approach, instead of performing an open cholecystectomy. In 1989, Dr. Eddie Reddick recorded a hundred cases of laparoscopic cholecystectomy. The classical four port technique of laparoscopic cholecystectomy as defined by Reddick became the most extensively accepted technique. Laparoscopic cholecystectomy was considered to be at its peak since its outset in the early 1990s and is also done by 2 and 3 ports now. Only simple gall stone disease was considered as an indication in the beginning. The competence of the surgeon, experience in laparoscopic techniques and comprehensive knowledge of the risk factors are important determinants for laparoscopic management of gall stone disease in challenging situations without increasing the morbidity.[2]

It has been noticed that the surgeons faced difficulty while performing laparoscopic cholecystectomy in presence of dense adhesions at calot's triangle, fibrotic

and contracted gallbladder, an acutely inflamed or gangrenous gall bladder and in cases of cholecystoenteric fistula etc. The risk factors associated with laparoscopic surgery which make it difficult to operate are old age, male sex, attacks of acute cholecystitis with fever and leucocytosis, obesity, previous abdominal surgery, clinical signs of acute cholecystitis, and ultrasonographic findings i.e. thickened gall bladder wall, distended gall bladder, pericholecystic fluid collection, impacted stone etc.[3]

Various studies had been carried out to evaluate the risk of preoperative conversion. Different scoring techniques have been recommended using different criteria's which further add to the controversy. In many broad series, and meta-analyses the patient demographics and imaging findings have been documented in detail.[4]

Enhancing patient care and clinical pathways require comprehending the underlying disease.[5] The natural history of gallbladder diseases alter with patient cohorts and surgical findings can often be surprising, with unanticipated extents of surgical difficulty or ease.[6] Due to the changeable operative findings, it is one of the most uncertain operations in general surgery. At times laparoscopic cholecystectomy 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. There was no grading or scoring of operative findings during surgery at present, making it difficult to compare the publications citing outcomes,

including the conversion to open surgery although a number of preoperative scoring systems are recorded.[7,8]

Sugrue in 2015 devised a scoring system based upon the intraoperative findings in Laparoscopic cholecystectomy. The key aspects of the score include: Access to the gallbladder; Patient body mass index (BMI); the degree of pericholic and right upper quadrant adhesions particularly in patients who have had previous abdominal surgery; the presence of complicated cholecystitis and the time taken by the surgeon to achieve the triangle of safety with identification of the cystic artery and duct. With this scoring system: score of <2 would be considered- mild; 2 to 4 -moderate, 5– 7- severe and 8 to 10 – extreme.[9]

To grade the severity of cholecystitis during laparoscopic cholecystectomy using intraoperative scoring system. To evaluate the spectrum of cholecystitis in cases of laparoscopic cholecystectomy in a tertiary center using the grades of intraoperative scores. To validate the scoring system devised by Michael sugrue.

METHODS

This prospective cross sectional observatory study was conducted in the Department of Surgery, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India over a period of 24 months. All the cholecystitis patients admitted for laparoscopic cholecystectomy were included in the study after obtaining written informed consent and approval of the study from ethics committee. All patients directly planned for open cholecystectomy and carcinoma gall bladder were excluded from the study.

Table 2 Operative Grading System for Cholecystitis Severity		
Gallbladder appearance		
Adhesions < 50% of GB		1
Adhesions burying GB		3
	Max	*3*
Distension/Contraction		
Distended GB (or contracted shrivelled GB)		1
Unable to grasp with atraumatic laparoscopic forceps		1
Stone ≥1 cm impacted in Hartman's Pouch		1
Access		
BMI >30		1
Adhesions from previous surgery limiting access		1
Severe Sepsis/Complications		
Bile or Pus outside GB		1
Time to identify cystic artery and duct >90 minutes		1
	Total Max	*10*
Degree of difficulty		
A Mild	<2	
B Moderate	2–4	
C Severe	5–7	
D Extreme	8–10	

Figure 1: Operative grading system for cholecystitis severity.

A minimum sample size of 171 by convenient sampling method from all eligible study subjects reporting during the study period were considered. (n=171, n=Z2 d/2Pq, L2, where, p=50 % and q=50%, L=15% relative error, d=5% level of significance). All the patients were subjected to the intra operative grading system for cholecystitis severity devised by Micheal Sugrue with this scoring system the patients were classified with a score of <2 - mild; 2 to 4 -moderate, 5 to 7- severe and 8 to 10 – extreme. The data were analyzed with SPSS software version 22.0 and Microsoft excel with interpretation of the clinical profile, biochemical parameters, severity of cholecystitis and assessment with scoring system was carried out using descriptive statistics.

RESULTS

This prospective study was conducted from January 2017 to December 2018 in the Department of Surgery, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Dehradun, Uttarakhand, India. Total number of 200 patients were included in the study.

Table 1: Total leukocyte count (n=200).

TLC Level	Frequency	Percentage
<4	2	1.00
4-11	176	88.00
>11	22	11.00
Total	200	100.00

Table 2: Total bilirubin levels (n=200).

T.Bil levels	Frequency	Percentage
0-1.5	182	91.00
1.51-2.5	14	7.00
2.51-3.5	2	1.00
>3.5	2	1.00
Total	200	100.00

Table 3: Serum alkaline phosphate levels (n=200).

ALP levels	Frequency	Percentage
0-120	168	84.00
121-240	26	13.00
241-360	4	2.00
>360	2	1.00
Total	200	100.00

In around 88% patients, the Total Leukocyte count level was between 4-11 thousand per cumm. Total bilirubin levels were between 0-1.5 mg/dl in 182 patients (91%). Serum Alkaline Phosphate levels were less than 120 in 168 patients (84%) while it was between 121-240 in 26 patients. (Table 1, 2, 3)
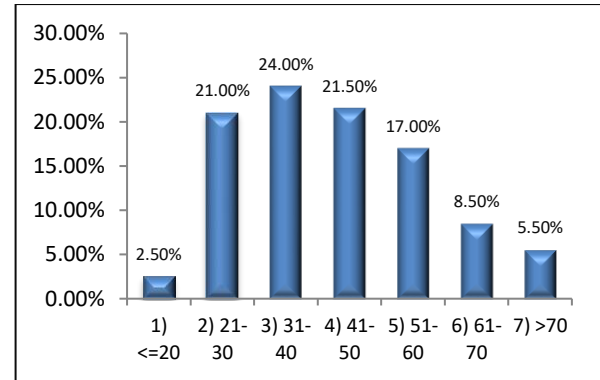

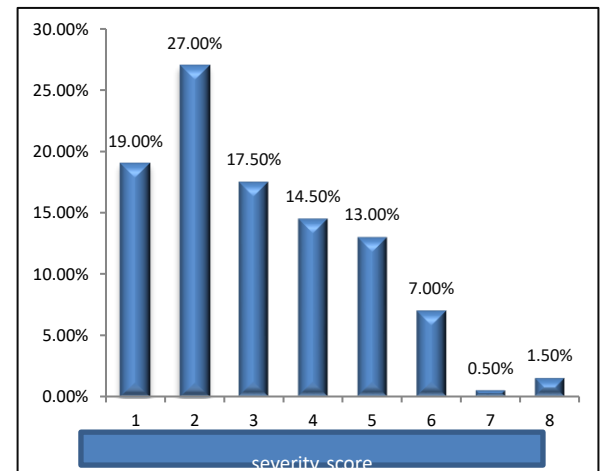**Figure 2: Age wise distribution (n=200).**

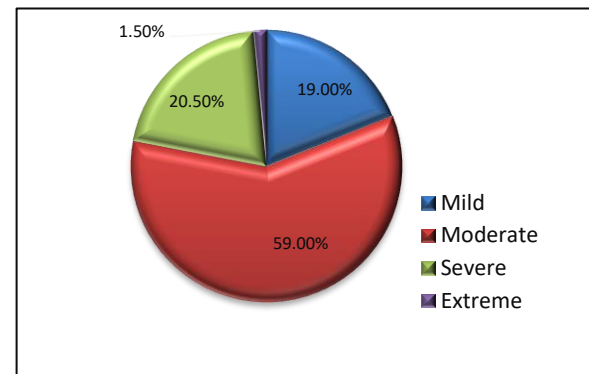**Figure 3: Operative grading system as per score (n=200).**

Figure 4: Operative grading system as per severity (n=200).

The maximum numbers of patients were found in the grade 2 sections of severity scoring. Out of 200 patients, severity was moderate in 118 patients (59%), while it was mild in 38 patients (20.5%). It was severe in nature in 41 patients and extreme in severity in 3 patients. (Figure 2, 3) In our study, a total of 19 cases were converted to open surgery, 2 patients with score of 8 were converted to open; 1 patient with score of 7 were converted to open.

Table 4: Conversion to open with relation to score (n=200).

	Operative grading system								P value
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	
Converted (n=19)	1 5.26%	3 15.79%	4 21.05%	3 15.79%	3 15.79%	2 10.53%	1 5.26%	2 10.53%	
Not converted (n=181)	37 20.44%	51 28.18%	31 17.13%	26 14.36%	23 12.71%	12 6.63%	0 0.00%	1 0.55%	0.001
Total (n=200)	38 19.00%	54 27.00%	35 17.50%	29 14.50%	26 13.00%	14 7.00%	1 0.50%	3 1.50%	

Table 5: Conversion to open with relation to severity (n=200).

	Operative Grading System				P value
	Extreme	**Mild**	**Moderate**	**Severe**	
Converted (n=19)	2 (10.53%)	1 (5.26%)	10 (52.63%)	6 (31.58%)	
Not converted (n=181)	1 (0.55%)	37 (20.44%)	108 (59.67%)	35 (19.34%)	0.002
Total (n=200)	3 (1.50%)	38 (19.00%)	118 (59.00%)	41 (20.50%)	

Table 6: Total leucocyte counts in relation to the grading severity.

TLC Count	Mild	Moderate	Severe	Extreme	Total
<4000	1 (50.00%)	1 (50.00%)	0 (0.00%)	0 (0.00%)	2 (100%) P value: 0.68
4-11000	33 (18.75%)	103 (58.52%)	38 (21.59%)	2 (1.14%)	176 (100.00%) P value: 0.52
>11000	4 (18.18%)	14 (63.64%)	3 (13.64%)	1 (4.55%)	22 (100.00%) P value:0.53
Total	38 (19.00%)	118 (59.00%)	41 (20.50%)	3 (1.50%)	200 (100.00%)

Table 7: Total Bilirubin in relation to the grading severity.

	Mild	Moderate	Severe	Extreme	Total
0-1.5	36 (19.78%)	107 (58.79%)	37 (20.33%)	2 (1.10%)	182 (100%) p-value: 0.41
1.51-2.5	2 (14.29%)	8 (57.14%)	3 (21.43%)	1 (7.14%)	14 (100.00%) p-value: 0.33
2.51-3.5	0(0.00%)	2 (100.00%)	0 (0.00%)	0 (0.00%)	2 (100.00%) p-value:0.70
>3.5	0 (0.00%)	1 (50.00%)	1 (50.00%)	0 (0.00%)	2 (100.00%) p-value:0.72
Total	38 (19.00%)	118 (59.00%)	41 (20.50%)	3 (1.50%)	200 (100%)

Highest conversion was seen in score of 3, which was 4 cases, 3 patients each were converted to open in score of 4 and 5. (Table 4) In our study, 10 patients of moderate group were converted to open surgery, 6 patients of severe group were converted to open surgery and 2 patients of extreme group were converted to open surgery. (Table 5)

Patients in moderate group had maximum patients of Total leucocyte count more than 11,000 cumm; while in the extreme group it was more than 11,000 cumm in 5% cases. (Table 6)

Table 8: ALP levels in relation to the grading severity.

	Mild	Moderate	Severe	Extreme	Total
0-120	34 (20.24%)	97 (57.74%)	35 (20.83%)	2 (1.19%)	168 (100.00%) p-value: 0.602
121-240	4 (15.38%)	17 (65.38%)	4 (15.38%)	1 (3.85%)	26 (100.00%) p-value:0.595
241-360	0 (0.00%)	3 (75.00%)	1 (25.00%)	0 (0.00%)	4 (100.00%) p-value: 0.788
>360	0 (0.00%)	1 (50.00%)	1 (50.00%)	0 (0.00%)	2 (100.00%) p-value: 0.729
Total	38 (19.00%)	118 (59.00%)	41 (20.50%)	3 (1.50%)	200 (100.00%)

In the extreme group, total bilirubin was between 1.5-2.5 mg/dl in 7 % cases, and it was same in 57% of the moderate group. (Table 7)

ALP levels were of range, 241-360 in 75% of the moderate grade and 25% of the severe grade; ALP levels were normal in 58% moderate cases, 20% of mild cases, 21% severe cases and 1% of the extreme case. (Table 8)

DISCUSSION

Cholecystectomy is presently one of the most common laparoscopic surgery performed worldwide and there is a very high incidence of variations and intraoperative difficulties which have been documented and reported and thereby scoring systems can be used to assess the difficulty level. At times, it has been seen that the degree of difficulty is difficult to predict and there has been numerous documentations of various pre-operative scoring methods but no study has been done for intra-operative scoring system like done by Michael Sugrue and our study is been done with a hypothesis to validate the finding of this study.[9]

As per the operative grading system used by Michael Sugrue, in 38 patients the grading score was 1; in 54 patients the grading score was 2; 35 patients were included in grade 3, 29 patients in grade 4, 26 in grade 5, 14 cases in grade 6, 1 case in grade 7 and 3 cases in grade 8. While evaluating the grading score and comparing it with the chances of surgery conversion to open, we found that 2 cases of grade 8 out of 3 were converted to open, 1 case of grade 7. In our study, conversion rate was 9.5% and we found that the conversion to open in severe group was 31.58% of the total, while in the moderate group was 52.63% and in extreme group was 10.53% and after the statistical analysis, the correlation of the increasing severity with increased chances of conversion was found to be statistically significant in our study.

On comparing the TLC counts with the severity grading, we found that in our study, when TLC count was less than 4000/cumm, there were 2 patients, one in mild group

and one in moderate group. With TLC count between 4-11,000/cumm, there were a total of 176 patients, with 33 in mild group, 103 in moderate group, 38 in severe group and 2 in extreme group and the relationship was not statistically significant (p-value: 0.522). with TLC count more than 11,000/cumm, there were 22 patients, 4 in mild group, 14 in moderate group, 3 in severe group and 1 in extreme group (p=0.533).

On comparing the T. Bil levels with the severity of the grading, in T. Bil range of 0-1.5, there were 36 patients in mild group, 107 in moderate group, 37 in severe group and 2 in extreme group and the relation was statistically not significant. With T. Bil between 1.5-2.5, there were 14 cases with 3 severe and 1 extreme and this relation was statistically not significant. In cases of T. Bil between 2.51-3.5 and T. Bil >3.5, the relationship was not statistically significant.

On comparing the ALP levels with the severity of the grading, In the ALP level <120, it was seen that 20% were mild cases, 58% were moderate cases, 2% cases were severe case and 1 % was extreme case out of the 168 cases and the relationship was not statistically significant. In the ALP range of 121-240, only 15% cases were mild, 65% cases were of moderate group, 15% cases were in severe group and 4% cases were in extreme group out of 26 cases, and relationship was not statistically significant. In the ALP range of 241-360, 75% cases were in the moderate group while only 25% were in the severe group. In the ALP levels, of more than 360, 50% cases were in the moderate group, while 50% cases were in the severe group with no statistical significance. On comparison of the ALP levels with the severity of the grading, the p-value was 0.729 and it was not found to be statistically significant.

Publications reporting outcomes, including conversion to open surgery, are hard to compare as currently there is no grading or scoring of operative findings at surgery and there are some well-reported models of grading and classification systems. Various studies have been done which have documented severity scoring systems but they have focused on prediction of outcomes from

clinical and preoperative investigations rather than operative findings.[10-16]

Intraoperative grading of operative findings at laparoscopic cholecystectomy in our study was found to be significant in predicting the severity of cholecystitis and difficult laparoscopic cholecystectomy. The study has a limitation of being conducted in a small series of patients. With multiple surgeon's involvement, the time taken for cystic duct identification may be subjective depending upon the experience of the surgeon.

CONCLUSION

The operative grading system as described by Michael Sugrue with higher the grading was associated with increasing severity of cholecystitis. Our study also found similar correlation and it was found to be statistically significant. Use of this intra-operative scoring system will help us to provide a trigger for a prompt early conversion to avoid intra-operative complications associated with difficult laparoscopic cholecystectomy.

REFERENCES

1. Glenn F, Grafe WR Jr. Historical Events in Biliary Tract Surgery. Arch Surg. 1966;93:848-52.
2. Hunter JG, Trus T. Laparoscopic cholecystectomy. In: Nyhus LM, Baker RJ, Fisher JE editors. Mastery of surgery. 3rd ed. Boston: Little brown and company. 1997;1098.
3. Abdel Baki NA, Motawei MA, Soliman KE, Farouk AM. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. JMRI. 2006;27(3):102-7.
4. Committee AT, Adler DG, Conway JD, Farraye FA, Kantsevoy SV, Kaul V, et al. Biliary and pancreatic stone extraction devices. Gastrointest Endosc. 2009;70:603-9.
5. Sheffield KM, Ramos KE, Djukom CD, Jimenez CJ, Mileski WJ, Kimbrough TD, et al. Implementation of a critical pathway for complicated gallstone disease: translation of population-based data into clinical practice. J Am Coll Surg. 2011;212:835-43.
6. Okamoto S, Nakano K, Kosahara K, Kishinaka M, Oda H, Ichimiya H, et al. Effects of pravastatin and ursodeoxycholic acid on cholesterol and bile acid metabolism in patients with cholesterol gallstones. J Gastroenterol. 1994;29:47-55.
7. Singh K, Ohri A. Difficult laparoscopic cholecystectomy: a large series from North India. Ind J Surg. 2006;68:205-8.
8. Gupta N, Ranjan G, Arora MP, Goswami B, Chaudhary P, Kapur A, et al. Validation of a scoring system to predict difficult laparoscopic cholecystectomy. Int J Surg. 2013;11:1002-6.
9. Sugrue M. Grading operative findings at laparoscopic cholecystectomy- a new scoring system World Journal of Emergency Surgery. 2015;10:14-21.
10. Randhawa JS, Pujahari AK. Preoperative prediction of difficult laparoscopic cholecystectomy: a scorring method. Indian J Surg. 2009;71:198-201
11. Sahu SK, Agrawal A, Sachan PK. Intraoperative Difficulties in Laparoscopic Cholecystectomy. Jurnalul de Chirurgie (Iaşi). 2013;2:149-55.
12. Vivek MA, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. Journal of minimal access surgery. 2014;10:62-7.
13. Nachnani J, Supe A. Pre-operative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. Indian J Gastroenterol. 2005;24:16-8.
14. Bat O. The analysis of 146 patients with difficult laparoscopic cholecystectomy. International Journal of Clinical and Experimental Medicine. 2015;8(9):16127-31.
15. Agrawal N, Singh S, Khichy S. Preoperative Prediction of Difficult Laparoscopic Cholecystectomy: A Scoring Method. Nigerian Journal of Surgery: Official Publication of the Nigerian Surgical Research Society. 2015;21(2):130-3.
16. Atmaram DC, Lakshman K. Predictive Factors for Conversion of Laparoscopic Cholecystectomy. The Indian Journal of Surgery. 2011;73(6):423-6.