ORIGINAL ARTICLE

Difficult Laparoscopic Cholecystectomy and Its Conversion to Open Cholecystectomy Using Intra-Operative Scoring System

Syed Shams ud Din[1], Waleed Akbar[2], Inayat ullah Baig[3], Mirza Tassawar Hussain[4], Abdullah Sadiq[5], Talha Humayun[6], Tayyaba Ghulam[7], Aqsa Syed[8]

ABSTRACT

Objective: To determine the frequency of conversion of laparoscopic cholecystectomy to open cholecystectomy using proposed intra-operative scoring system and to check the validity of the scoring system.

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: The study was conducted in the Department of Surgery, Federal Government Polyclinic Hospital (FGPC) Islamabad from 1st February 2019 to 31st July, 2019.

Materials and Methods: This study enrolled 197 patients of either gender with age ranging between 20-60 years planned for laparoscopic cholecystectomy (LC). All the recruits were assessed intraoperatively using proposed objective intraoperative scoring-system for difficult LC. The conversion rate of LC to open cholecystectomy was recorded in correlation with demographic data and co-morbidities. Data was entered and analyzed using SPSS version 25.0.

Results: Out of 197 enrolled patients, 64% were females. The mean age of study population was 42.7 ± 12.1 years. Forty six percent (46%) patients had co-morbidities with fifty-nine (n=59) being diagnosed as hypertensive and thirty-two (n=32) as diabetic. A total of 8.1% (n=16/197) patients underwent conversion to open cholecystectomy. The overall mean objective intra-operative score was 3.6 ± 1.73; which was significantly higher in patients who underwent conversion to open cholecystectomy compared to those who did not undergo conversion (7.19 ± 0.83 vs 3.28 ± 1.39; p-value = 0.001). Conversion rate was significantly more in the patients who were above 40 years, hypertensive, and diabetic. ($p<0.05$ in all cases).

Conclusion: The intra-operative scoring system can be used as a valuable predictor of difficult LC and conversion to open surgery to improve clinical outcome for the patients indicated for LC.

Key Words: *Cholelithiasis, Complications, Conversion to Open Surgery, Laparoscopic Cholecystectomy, Surgical Procedure.*

Introduction

Gallstone disease poses a widespread global concern, with an estimated prevalence of 10-15% worldwide.[1] Approximately 1-3% of the cases progress to acute calculus cholecystitis.[2] In Pakistan, gallstone disease extensiveness is no-exception with a reported prevalence of around 10.2%.[3] The way gall stone disease is managed has dramatically changed over time. One of the most frequent reasons for cholecystectomy is gallstone disease and laparoscopic cholecystectomy (LC) has gained the status of standard surgical intervention for symptomatic gallstone disease.[4,5] LC has significant advantage over traditional open cholecystectomy in terms of early and quick recovery, decreased postoperative pain, and a brief hospital stay.[6] The conversion of a LC, however, may occasionally be necessary because of access or dissection issues.[7,8] LC conversion is nothing more than a straightforward and secure procedure to prevent pointless difficulties and guarantee patient safety.[9]

In the early stages of laparoscopic technique development, a steep learning curve led to a notable occurrence of bile duct injuries and complications. Over time, the incidence of significant lesions decreased from 0.08% to 0.12%, accounting for 1.5% of all lesions. The challenges associated with cholecystectomy have been linked to these

[1,3,4,5,6,7]*Department of General Surgery*
Federal Government Polyclinic Hospital, Islamabad,
[2,8]*Department of General Surgery*
Akbar Niazi Teaching Hospital, Islamabad

Correspondence:
Dr. Syed Shams Ud Din
Associate Surgeon General Surgery
Federal Government Polyclinic Hospital, Islamabad
E-mail: drshamsfgpc@gmail.com

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complications.[8] There are various preoperative grading methods that have been presented to predict difficult cholecystectomy to reduce complications associated with LC.[9] The authors pinpointed preoperative factors correlated with extended operative time and conversion rate, including gallbladder wall thickening, C-reactive protein levels, body temperature, age, BMI, history of previous abdominal surgery, and ultrasonographic findings.[8,10] The assessment of these factors may differ between the perception of a surgeon and another. Therefore, it is crucial to employ a unified intraoperative difficulty scale that describes the findings during the procedure. The chosen scale should be grounded in intraoperative observations to consistently define the complexity of LC, ensuring consistency regardless of the operating surgeon.[11] Considering the mentioned limitations in predicting challenging cholecystectomy through objective evaluation, Sugrue M *et al*., primed in conducting a study where they devised and validated a system based on intra-operative variables to anticipate the complexity of LC.[12] Ever-since then, several studies have been conducted in validating this intra-operative grading system and its outcome in predicting difficulty LC. Our research will contribute an additional milestone to validate the predictability of the proposed grading system which in turn will help in building local guidelines to further reduce the complication rate of LC and improve the patient healthcare outcome while improving cost effectiveness.

The aim of this study was to determine the reliability of the suggested intra-operative grading system and to forecast the conversion of LC to traditional open cholecystectomy.

Materials and Methods

A descriptive cross-sectional study was carried out at Department of Surgery, Federal Government Polyclinic Hospital (FGPC) for a period of 6 months from 1st February 2019 till 31st July 2019. The study was approved from the ethical and research review committee of Federal Government Polyclinic Hospital (Reg. No. 1/2017-E/C-64) on 4th June 2018. Before participating in the research study, informed written consents were obtained; anonymity and confidentiality were maintained throughout the study period. The study included patients with symptomatic gallstone disease between the ages of 20 and 60, of either gender, who were candidates for LC. Jaundice, malignancy, hepatitis B or C infected patients, LC with common bile duct (CBD) exploration, and pregnancy were the exclusion criteria. Using non-probability convenience sampling; a total of 197 patients meeting the selection criteria were recruited for the study (CI=95%, anticipated population proportion=6.7%, absolute precision=3.5%)[19]. Necessary pre-operative examinations and assessments were completed, and LC was performed using the traditional four port approach.

A structured questionnaire was used to capture pertinent medical history, including demographic information (such as age and gender), individual-level anthropometrical computations (such as weight, height, and BMI), and co-morbidities (such as hypertension and diabetes mellitus). Utilizing the proposed intraoperative grading method, all the patients who underwent LC were assessed. The gallbladder (GB) appearance and adhesions, gallbladder (GB) distention/contraction, access during the procedure, local or septic complications, and time needed to identify cystic duct and cystic artery are the five aspects that make up the operative grading system proposed by Sugrue M et al., described in Table I.[12] The interpretation of the grading scale is broken down into four categories: easy (scoring less than 2), moderate (score 2 to 4), very difficult (score 5-7), and extreme (score 8 to 10). Data was entered and analyzed with SPSS version 25.0. Age, body mass index, intraoperative scores, and other quantitative data were expressed by mean and standard deviation. Qualitative information including gender, age groups, the existence of diabetes and hypertension, conversion status, etc. was represented by frequency(n) and percentage. Using an independent t-test, the mean scores from the intraoperative grading system were compared between the conversion and non-conversion groups. The chi square test was used to compare the categorical variables between two groups. A p-value of 0.05 or lower was deemed significant.

Results

One hundred and ninety-seven patients who were scheduled for LC were enrolled in the current study. The study's participants' mean (SD) age was 42.7 ±

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12.1 years. Around 49% of the participants were above the age of 40 years. Also, a higher percentage of women (64%) were recruited for this study. Significantly, the study's enrolled individuals had higher body mass indices, with a mean ± SD of 30.1 ± 3.2 kg/m^2. Additionally, no comorbidity was recorded in more than half of the patients. Co-morbidities were detected in around 46% of individuals, with fifty-nine individuals (29.9%) being hypertensive and thirty-two individuals (16.2%) being diabetic as shown in Table II.

Sixteen (n=16) individuals (8.1%) of the total 197 participants in the research study underwent conversion to open surgery. The patient's age and co-morbidities (such as diabetes and hypertension) also made a substantial impact in whether the LC was later switched to open surgery. All the patients who underwent conversion to open surgery (n=16) were above the age of 40 years. Approximately twenty percent (n=12) of the total patients diagnosed with hypertension, and twenty eight percent (n=9) diagnosed with diabetes underwent conversion to open cholecystectomy. Table-III compares the intra-operative findings between recruits converted to open surgery with those who were not, using the new score system. The gall bladder's appearance was observed to differ significantly. In comparison to around 24.9% (n=45) of patients who were not converted to open, all 16 patients who underwent conversion; their gall bladders were buried due to adhesions (p-value=0.001). Additionally, a great percentage of participants had a distended or contracted gallbladder (100% Vs. 61.3%; p-value = 0.025), GB not been able to grasp (100% Vs. 53.6%; p-value = 0.009), had stones equal or larger than 1.00 cm in diameter lodged in Hartman's pouch (62.5% Vs. 23.2%; p-value = 0.027), had local complications (100% Vs. 24.3%; p-value < 0.001) and time needed for cystic duct and cystic artery identification greater than 90 minutes (75% Vs. 9.9%; p-value < 0.001).

Table-IV provides specifics on the intra-operative scores assigned to the participants recruited using the new scoring system in a categorical way. The new intra-operative scoring classification's overall mean ± SD was 3.6 ± 1.73. Ninety-five individuals (48.2%) of the total fell into the moderate group, with very difficult (25.9%), mild (19.8%), and extreme (6.1%) following. The intraoperative scores showed a significant difference in participants who underwent conversion having a mean ± SD score of 7.19 ± 0.83 as opposed to those who did not convert who had a mean ± SD score of 3.28 ± 1.39. Moreover, a significantly large percentage of participants in the extreme-category underwent conversion to open surgery (62.5% Vs. 1.1%; p-value = 0.001).

Discussion

As surgical technology progresses, there is a growing demand and expectation from patients and their families to consider LC in most cases.[13] In our research, we employed an intraoperative scoring or grading system, based on the work of Sugrue et al., to assess the level of difficulty in LC.[12] However, alternative intraoperative scoring or grading systems for evaluating the difficulty of LC, such as the one introduced by Vivek et al., also exist.[14] Interestingly, certain operative predictors in Vivek et al.'s system were found to be similar to those in our present study. In our research, we found that the conversion rate was 8.1%. All patients who experienced a conversion to open surgery were above the age of 40 years. Approximately 20% of individuals diagnosed with hypertension and 28% diagnosed with diabetes underwent a conversion from LC to open surgery. When compared to other studies, the conversion rate from laparoscopic to open cholecystectomy varied between 7% and 35%.[13,15,16]

In our study, the primary factor leading to the conversion is the presence of densely adherent tissues or challenges in distinguishing anatomy. Similar reasons for converting from laparoscopic to open cholecystectomy are identified in other studies as well.[9,17]

In our research, the intraoperative grading system employed to assess the difficulty of LC included an operative predictor i.e. distended gallbladder/ unable to grasp. All the cases which underwent conversion had distended gallbladders which were difficult to grasp with atraumatic laparoscopic forceps (*p-value= 0.025).* Other studies have also highlighted this predictor as a significant factor contributing to heightened difficulty during LC.[18,19]

Another important operative predictor which significantly increased the chance of conversion from laparoscopic to open cholecystectomy is the stone ≥1 cm impacted at Hartman's pouch.

Approximately 63% of the cases with stone ≥1 cm impacted at Hartman's pouch were converted to open cholecystectomy (*p-value=0.027)*. Our results are consistent with other studies which have reported similar significance of the individual predictor.[20,21]

Another understated operative factor for prediction of difficulty and conversion is the time required for identification of Calot's triangle. In our study, approximately 75% of the cases which required more than 90 minutes to laparoscopically identify the cystic artery and duct ended up being converted to open surgery *(p-value=0.001).* The results are consistent with other independent studies identifying the same predictor as significant.[22,23]

Existing literature indicates that the conversion rate to open surgery falls within the range of 1% to 13%.[24] In our study, the conversion rate was 8.1%, aligning quite closely with the figures reported in the available literature. Among the sixteen cases that underwent conversion to open cholecystectomy in our study, 62.5% were classified as 'extreme difficulty', while 37.5% fell into the category of 'very difficult' intraoperative grade. The mean intraoperative conversion score was 7.19 ± 0.83. Notably, none of the patients in the mild and moderate intraoperative grade experienced a conversion to open cholecystectomy. Thus, the conversion rate to open cholecystectomy was significantly higher in cases classified as difficult according to intraoperative grade compared to those categorized as easy.

Conclusion

The intra-operative scoring system can be used as a valuable predictor of difficult LC and conversion to open surgery to improve clinical outcome for the patients indicated for laparoscopic cholecystectomy.

Limitations and Future Prospects:

Firstly, the percentage adhesion of gall bladder was subjectively assessed. Secondly, the study had limited sample size of only one hundred and ninety-seven patients being recruited from a single study site. Considering the smaller sample binary logistic regression with outcome as conversion to open (yes/no) was not performed. The results of the binary logistic regression would have provided valuable clinical information of independent role of each of the risk factors. Thus, in future multicenter study with adequate sample size should be conducted to identify the validity and predictive capability of intra-operative scoring system for conversion to open surgery.

Table I: Intra-Operative Scoring System for Laparoscopic Cholecystectomy

Operative Grading System	Score
Gallbladder appearance No Adhesions	0
Adhesions < 50% of GB	1
Adhesions burying GB	3
Maximum	3
Distension/Contraction Distended Gall bladder or	1
Contracted shrivelled GB Unable to grasp with atraumatic	1
laparoscopic forceps Stone ≥1 cm impacted in Hartman's Pouch	1
Access BMI >30	1
Adhesions previous surgery limiting access	1
Severe Sepsis/Complications Bile or Pus outside GB	1
Time to identify cystic artery	1
and duct >90 minutes Total Maximum	10

Table II: Demographic and other Parameters of the Study Individuals

Parameters	n (%) or Mean ± SD
Age (years)	42.7 ± 12.1
Age Categories ≤ 40 years	100 (50.8%)
> 40 years	97 (49.2%)
Gender Male	71 (36.0%)
Female	126 (64.0%)
Body Mass Index (Kg/m2)	30.1 ± 3.2
Co-morbidities No	106 (53.8)
Hypertension	59 (29.9)
Diabetes	32 (16.2)

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Table III: Comparison of Intraoperative Parameters Among Conversion and Non-Conversion Individuals

Intra Operative Parameters	Converted	Not Converted	Total	*p-value
	(n = 16)	(n = 181)	(n = 197)	
Gallbladder appearance No Adhesions	0 (0)	78 (43.1)	78 (39.6)	0.001
Adhesions < 50% of GB	0 (0)	58 (32.0)	58 (29.4)	
Adhesions burying GB	16 (100)	45 (24.9)	61 (31.0)	
Distension/Contraction **Distended/ Contracted GB** Yes	16 (100)	111 (61.3)	127 (64.5)	0.025
No	0 (0)	70 (38.7)	70 (35.5)	
Unable to Grasp Yes	16 (100)	97 (53.6)	113 (57.4)	0.009
No	0 (0)	84 (46.4)	84 (42.6)	
Stone ≥1 cm impacted in Hartman's Pouch Yes	10 (62.5)	42 (23.2)	52 (26.4)	0.027
No	6 (37.5)	139 (76.8)	145 (73.6)	
Access BMI >30 Yes	6 (37.5)	42 (23.2)	48 (24.4)	0.297
No	10 (62.5)	139 (76.8)	149 (75.6)	
Adhesions previous Surgery Yes	4 (25)	35 (19.3)	39 (19.8)	0.502
No	12 (75)	146 (80.7)	158 (80.2)	
Severe Sepsis/Complications **Bile or Pus outside GB** Yes	16 (100)	44 (24.3)	60 (30.5)	0.001
No	0 (0)	137 (75.7)	137 (69.5)	
Time to identify cystic artery and duct >90 minutes. Yes	12 (75)	18 (9.9)	30 (15.2)	0.001
No	4 (25)	163 (90.1)	167 (84.8)	

p ≤ 0.05 was considered statistically significant.

Table-IV: Comparison of Categories Based on Intra-Operative Parameters

Intra Operative Scores/ Categories	Converted	Not Converted	Total	*p-value
	(n = 16)	(n = 181)	(n = 197)	
Scores	7.19 ± 0.83	3.28 ± 1.39	3.6 ± 1.73	0.001
Categories Less than 2 (Mild)	0 (0)	39 (21.5)	39 (19.8)	0.001
2 – 4 (Moderate)	0 (0)	95 (52.5)	95 (48.2)	0.001
5 – 7 (Very difficult)	6 (37.5)	45 (24.9)	51 (25.9)	0.001
8 – 10 (Extreme)	10 (62.5)	2 (1.1)	12 (6.1)	0.001

p ≤ 0.05 was considered statistically significant.

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CONFLICT OF INTEREST

Authors declared no conflicts of Interest.

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DATA SHARING STATMENT

The data that support the findings of this study are available from the corresponding author upon request.