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Assessment of predictive risk factors in difficult laparoscopic cholecystectomy: A single center study from central India

Nilesh Jagne[1], Shagufta Naaz Ansari[2], Mahendra Chauhan[3], Pankaj Goyal[4], Sachin Rahangdale[5], Rahul Rathod[6]

[1]Assistant Professor, [3]Professor, Department of Trauma and Emergency, [2]Research Scientist-I, Department of Surgery, All India Institute of Medical Sciences, Nagpur, Maharashtra, [5]Former Lecturer, [6]Assistant Professor, Department of Surgery, N.K.P. Salve Institute of Medical Sciences and Research Centre, Nagpur, Maharashtra, [4]Senior Resident, Department of Pediatric Surgery, Sawai Man Singh Hospital, Jaipur, Rajasthan, India

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) has become the most common procedure for the management of symptomatic cholelithiasis. Based on the difficulty faced during the procedure the outcome of LC could vary from partial cholecystectomy to conversion into open cholecystectomy. Thus, for surgeons, it would be important to assess predictive factors and conversion preoperatively. **Aims and Objectives:** The objective of the present study was to assess various demographic, pre-operative, and intra-operative factors of difficult LC. **Materials and Methods:** The present study is a hospital-based observational study. A total of 119 patients having symptomatic cholelithiasis who underwent elective LC were included in the present study. **Results:** It was found that among all the pre-operative factors gallbladder (GB) wall thickness, obesity, and impacted stones in Hartmann's pouch were found to be significantly associated with difficult LC. Furthermore, among the intra-operative factors GB adhesion, omental adhesions, gall extraction, duct, and clipping were found to be significantly associated with difficult LC. **Conclusion:** The present study recommends that both pre-operative and intra-operative factors should be regularly used as a protocol for the prediction of difficult LC. With a little extra attention, the procedure-related complications could be further reduced to an acceptable level in LC.

Key words: Gallbladder stone; Pre-operative factors; Intra-operative factors; Complications

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INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the first choice for the management of symptomatic gallstone diseases.[1] This procedure has proven to have multiple advantages such as minimal operative trauma, faster return to full activity, short hospital stay, less post-operative analgesia requirement, and better cosmesis has resulted in its popularity among surgeons worldwide.[2] Although LC has been common in high-income countries recently there has been a rather slow increase in low-income countries.[3] There is very limited data available from lower-middle countries such as India regarding complications related to LC.[4] A possible reason for this state could be attributed to the fact that a majority of LCs are being performed in private hospitals in India.[5] Furthermore, there are very few medical colleges (with the exception of postgraduate institutions) which have a structured training program for the residents or have the facility for LC in general.[6]

Depending on factors such as patient's demographics (such as age, gender, and body weight) along with pre-operative and intraoperative factors the possibility of conversion into open surgery can be predicted. Moreover, the understanding of pre-operative prediction for difficult LC would be helpful not only in setting a suitable management

Address for Correspondence:
Dr. Mahendra Chauhan, Professor, Department of Trauma and Emergency, All India Institute of Medical Sciences, Nagpur, Maharashtra, India. **Mobile:** +91-8007208862. **E-mail:** drmahendrak@rediffmail.com

plan but also in arranging available resources to confront difficult LC.

Aims and objectives

The aim of the present study was to assess the various pre-operative and intraoperative predictive risk factors that determine difficult LC.

MATERIALS AND METHODS

The current study was a hospital-based observational study that was conducted for the duration from November 2019 to January 2023. A total of 119 patients having symptomatic cholelithiasis were included in the present study. Patients aged between 18 and 80 years (both males and females) were recruited in the present study. All the recruited patients have gone through elective LC. Patients who were below 18 years of age, those patients who were not willing to operative procedures, and those who presented with obstructive jaundice with common bile duct calculus were excluded from the study. Ethical clearance was taken from the institutional ethical committee before the beginning of the study. Furthermore, informed written consent was taken from all the recruited patients. The procedures used were in accordance with the Helsinki Declaration of 1975 as revised in 1983.

Depending on the patient's history, laboratory, and radiological examinations the diagnosis of symptomatic cholelithiasis was obtained. Data pertaining to demographic details along with the pre-operative risk factors (such as obesity status, palpable gallbladder (GB), abdominal scar, pericholecystic collection, GB thickness, and impacted stone) were collected from all the recruited patients. Furthermore, data pertaining to various intra-operative factors (such as duct and artery clipping, GB adhesions to the bowel and an adjacent structure, extraction of GB, and omental adhesions) were collected from all the recruited patients. Further, all patients receive standard post-operative care and follow-up. All data were analyzed on SPSS (SPSS Inc. Chicago IL.) analysis software. Further, descriptive and inferential statistics were used. Categorical data has been expressed as a number (percentage). Furthermore, percentages of categorical data were compared using Pearson's (χ^2) test, whereas the continuous data were compared using Student's t-tests. Further, for all evaluations, a P=0.05 was considered statistically significant.

RESULTS

In the present study, a total of 119 patients who had symptomatic cholelithiasis and who all underwent elective LC were included. The most recruited patients were females (n=88). Furthermore, the mean age of the recruited patient was 47 years (standard deviation±13.92). A total of 48 patients underwent difficult LC. In the present study, the demographic factors (such as age and gender) were not found to be statistically associated with difficult LC (Table 1). Furthermore, it was found that among all the studied pre-operative factors, obesity status (over weight=25% and Obese=56.25%), GB thickness (45.85%), pericholecystic collection (22.19%), and impacted stone (47.19%) were found to be statistically associated with difficult LC (Table 1).

Further, among all the studied intraoperative factors, GB adhesions (75.1%), omentum (70.84%), GB extraction (81.25%), and duct and artery clipping (85.41%) were found to be statistically associated with difficult LC (Table 2).

Out of 48 difficult laparoscopic cholecystectomies, around 28 (58.3%) were converted to open cholecystectomies. The attributed reasons for these conversions were empyema of GB, dense adhesions with multiple calculi, Type 1 Mirzzi syndrome, and frozen clots (Table 3).

DISCUSSION

LC has become the first choice for the management of symptomatic gallstone diseases.[6] However, open surgery has various advantages over LC, especially in difficult cases, as it allows surgeons to apply manual compression, experience better tactile feedback, have a wide range of exposure and movements, and also there is no restricted number of instruments in the operative field.[7] Furthermore, early identification of patients with difficulties that lead to conversion to open surgery could decrease the drastic outcomes of prolonged surgical procedures by decreasing the time spent on the trial of laparoscopic examination.[8] The present study was conducted to assess various pre-operative and intraoperative risk factors for difficult cases of LC.

Various risk factors were found to be associated with difficult LC. Mostly, the operative procedure becomes difficult in older patients and conversion is comparatively higher with increasing age due to recurrent attacks.[9] However, in the present study age and gender were not found to be significantly associated with difficult LC. A small sample size could be the reason for this variation from the literature.

Further, obesity was another factor that significantly predicted the risk of conversion to open cholecystectomy. In the current study, a body mass index of >25 kg/m^2 was found to be a significant risk factor for difficult cholecystectomy

Table 1: Comparison of demographic and pre-operative patients' findings with easy/difficult criteria for laparoscopic cholecystectomy

Predictive factors	Patients categorized into difficult cases (n=48) n (%)	Patients categorized into easy cases (n=78) n (%)	P-value
(A) Demographic factors	44.78±14.29	47.85±14.24	0.2
(i) Age (mean±standard deviation)			
(ii) Gender			
Male	16 (33.3)	22 (28.20)	0.63
Female	32 (66.7)	56 (71.79)	
(B) Pre-operative factors			
(i) Obesity status			
Normal weight (BMI=18.5–24.9)	9 (18.75)	62 (79.49)	**0.001**
Overweight (BMI=25–29.9)	12 (25)	9 (11.57)	
Obese (BMI>30)	27 (56.25)	7 (8.97)	
(ii) Abdominal scar			0.39
No scar	8 (16.67)	65 (83.3)	
Infraumbilical	16 (33.3)	11 (14.10)	
Supraumbilical	24 (50.0)	2 (2.56)	
(iii) Palpable gallbladder	8 (16.67)	2 (2.5)	0.32
(iv) Gallbladder thickness			**0.03**
Up to 4 mm	27 (56.25)	71 (91.02)	
>4 mm	22 (45.85)	7 (12.2)	
(v) Pericholecystic collection	11 (22.91)	5 (6.41)	0.6
(vi) Impacted stone	23 (47.91)	2 (2.56)	**0.004**

P-value significant level at ≤0.05. BMI: Body mass index

Table 2: Comparison of intraoperative factors with easy/difficult criteria for laparoscopic cholecystectomy

Intra-operative factors	Patients categorized into difficult Cases (n=48) n (%)	Patients categorized into easy cases (n=78) n (%)	P-value
Gallbladder adhesion			
No adhesion	03 (6.25)	49 (62.82)	0.001
<50% Adhesion	09 (18.75)	27 (34.61)	
>50% Adhesion	36 (75.0)	02 (2.56)	
Duct and artery clipping			
Easy	07 (14.8)	75 (96.15)	0.004
Difficult	41 (85.41)	08 (3.85)	
Omentum			
Partially covered	24 (29.16)	76 (97.44)	0.001
Fully covered	32 (70.84)	02 (2.56)	
Gallbladder extraction			
Easy	09 (18.75)	74 (94.87)	0.001
Difficult	39 (81.25)	04 (5.13)	

P-value significant level at ≤0.05.

Table 3: Association between difficult laparoscopic cholecystectomy and conversion to open surgery

Conversion to open surgery	Patients categorized into difficult cases	Patients categorized into easy cases	Total patients	P-value
	21 (43.75%)	0	21 (17.64%)	0.004

P-value significant level at ≤0.05.

(P<0.001). Study shows the probable reason for this could be attributed to obesity, as it is known to harden the access to the peritoneal cavity, consequently increasing the requisite for conversion to open LC.[10] Port placement in an obese patient requires a longer time because the abdominal wall. Similar results were seen in various studies in the literature.[11,12]

In the present study, it was found that the thickness of GB wall (i.e., GB thickness of 4 mm or more) was a significant

risk factor in predicting difficult LC. The reason for the conversion to open was the dense adhesions between GB and adjacent structures such as the duodenum, colon, or omentum, resulting in a dense Calot's triangle.[13] This finding of the present study was similar to previous studies.[14,15] However, in a different study, Handaya et al.[16] reported contradictory results.

In the present study, it was found that the stone impaction in the gallbladder was associated with difficult LC. The possible reason could be that the impacted stone makes it difficult to hold the GB.[1] Similar results were found in the previous studies.[17,18]

In the present study, there were 21 (17.64%) patients that were converted to open cholecystectomy (Table 3). These conversions were due to Mirizzi syndrome, dense adhesions at Calot's triangle, uncontrolled bleeding, and inflamed GB (acute cholecystitis). Further, the conversion rate in the present study seems to be similar to previous studies.[19,20] However, various other centers have reported conversion rates between 4% and 19%.[21-23]

Limitations of the study

This study has some limitations. As a single-center study, it may have introduced potential bias due to the limited number of selected patients. Future research should replicate this study with a larger sample size to enhance generalizability and validity.

CONCLUSION

The change of LC to an open surgery seems to be dynamic and multifactorial in nature. The results of the present study suggested that the intraoperative and pre-operative factors are valuable for calculating the consequence of LC. These findings will be beneficial to both the patient and the surgeon. Furthermore, it will be helpful for the surgeons to counsel the patients, and decrease the complication rate and the whole medical burden. With a little extra caution, the surgery-related complications can be further reduced to an adequate level. More such studies with larger sample sizes regularly should be done to further evaluate the scoring systems.

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Authors' Contributions:
NJ- Definition of intellectual content, literature survey, prepared the first draft of the manuscript, implementation of the study protocol, data collection, and manuscript preparation; **SNA-** Manuscript preparation, editing, statistical analysis, and interpretation and submission of the article; **MC-** Implementation of study protocol literature survey, coordination, and manuscript revision; **PG-** Design of study, design, and clinical protocol; **SR-** Review manuscript; **RR-** Review manuscript.

Work attributed to:
Tertiary Care Center, Nagpur, Maharashtra, India.

Orcid ID:
Dr. Nilesh Jagne - https://orcid.org/0000-0002-3166-1499
Dr. Shagufta Naaz Ansari - https://orcid.org/0000-0003-1050-1506
Dr. Mahendra Chauhan- https://orcid.org/0000-0002-0173-5485

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