

## PRE-OPERATIVE PREDICTIVE FACTORS FOR DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY AT TERTIARY CARE CENTRE

Santosh Mishra,<sup>1</sup> Rajesh Poudel,<sup>1</sup> Sagun Thapa,<sup>1</sup> Nabin Pokhrel,<sup>1</sup> Gaurav Kshetri,<sup>1</sup> Sanjay Shrestha<sup>1</sup>

### ABSTRACT

#### INTRODUCTION

Gallstones are present in 10 to 15% of general population and asymptomatic in more than 80% cases. Laparoscopic cholecystectomy is a gold standard treatment for cholelithiasis. The rate of conversion from laparoscopic cholecystectomy to open is about 1-13%. Predicting the difficulty of laparoscopic cholecystectomy is essential to optimize patient outcomes. The levels of difficulties during laparoscopic cholecystectomy can be predicated based on certain preoperative clinical, laboratory or radiological parameters. The main aim of the study was to find out the pre-operative predictive factors for difficult laparoscopic cholecystectomy at a tertiary care centre.

#### MATERIAL AND METHODS

This was an observational cross-sectional study that included sixty nine patients who underwent elective laparoscopic cholecystectomy in UCMS. Preoperative predictive parameters such as age, gender, BMI, previous abdominal surgery, gallbladder condition, and ultrasound findings were assessed. A scoring system developed by Randhawa and Pujahari was used to predict difficulty in laparoscopic cholecystectomy, and intraoperative criteria were used to categorize cases as easy or difficult.

#### RESULTS

History of acute cholecystitis ( $p=0.026$ ), previous abdominal scar ( $p=0.024$ ), thick gallbladder wall ( $p=0.012$ ), impacted stone ( $p=0.057$ ), pericholecystic fluid collection ( $p<0.001$ ) and increased BMI were considered as the significant factors that predict difficult laparoscopic cholecystectomy. Sensitivity and specificity for easy - difficult cut off of the scoring method were 75.6% and 67.16%, respectively, with the area under the ROC curve being 0.524.

#### CONCLUSION

The difficult laparoscopic cholecystectomy and conversion to open surgery can be predicted preoperatively based on preoperative scoring system.

#### KEYWORDS

Cholecystitis, laparoscopic cholecystectomy, open surgery, predictive factors

1. Department of Surgery, Universal College of Medical Sciences, Bhairahawa, Nepal

<https://doi.org/10.3126/jucms.v11i03.61377>

#### For correspondence

Dr. Santosh Mishra  
Department of Surgery  
Universal College of Medical Sciences  
Bhairahawa, Nepal  
Email: shashibhardwaj918@gmail.com

## INTRODUCTION

Cholelithiasis, a recurring chronic hepatobiliary condition, results from abnormal cholesterol, bile acid, and bilirubin metabolism.<sup>1</sup> Typical symptoms include upper-right quadrant pain exacerbated by fatty foods.<sup>2</sup> In Nepal, it's a significant cause of hospital admissions, ranking 10th in prevalence.<sup>3</sup> Laparoscopic cholecystectomy (LC) is the standard treatment, although 1-13% may require conversion to open surgery.<sup>4</sup> LC offers benefits like reduced pain, quicker recovery, and shorter hospital stays.<sup>5</sup>

Various factors impact the complexity of LC, such as age, gender, obesity, prior cholecystitis, previous surgeries, and ultrasound findings. Surgeon experience also influences complication likelihood and the need for conversion.<sup>6</sup>

Evaluating the procedure's difficulty is crucial for surgeon preparation, ensuring a competent team, and informing patients about potential challenges<sup>7</sup>. This study aimed to identify pre-operative predictive factors for difficult laparoscopic cholecystectomy.

## MATERIAL AND METHODS

This was an observational cross-sectional study conducted among sixty nine patients, who underwent laparoscopic cholecystectomy on the elective basis at the department of surgery of UCMS-TH, Nepal from April 2023 to September 2023. The study was carried out with ethical clearance from Institutional review committee of UCMS-TH with reference number UCMS/IRC/005/23.

The convenience sampling was used. We included only those patients who were planned for elective LC and has given written informed consent and excluded patients with acute calculus cholecystitis, empyema of gall bladder, obstructive jaundice, and common bile duct stone.

The patients confirmed by USG examination were evaluated for LC with different factors like age, sex, history of previous abdominal surgery and acute calculus cholecystitis, BMI and sonographic findings (wall thickness, peri-cholecystic collection and impacted stone). Routine hematological and biochemical investigations were done including LFT. These pre-operative predictive parameters were considered in the study in order to stratify the risk factors in evaluation of the procedure using a scoring system. A scoring system was developed which was a modification of scoring system proposed by Randhawa and Pujahari<sup>8</sup> which included history, clinical and sonography findings, as shown in Table 1.

**Table 1. Modified Randhawa and Pujahari scoring system for pre-operative prediction of difficult LC**

| Pre-operative predictive factors |                                   | Score |   |
|----------------------------------|-----------------------------------|-------|---|
| Age                              | <50 years                         | 0     |   |
|                                  | ≥50 years                         | 1     |   |
| Sex                              | Male                              | 1     |   |
|                                  | Female                            | 0     |   |
| BMI                              | <24.9                             | 0     |   |
|                                  | ≥24.9                             | 1     |   |
| Previous Surgery                 | Yes                               | 1     |   |
|                                  | No                                | 0     |   |
| Palpable GB                      | Yes                               | 1     |   |
|                                  | No                                | 0     |   |
| LFT deranged                     | Yes                               | 1     |   |
|                                  | No                                | 0     |   |
| USG findings                     | Wall thickness(>4mm)              | ≥4mm  | 1 |
|                                  |                                   | <4mm  | 0 |
|                                  | Peri-cholecystic fluid collection | Yes   | 1 |
|                                  |                                   | No    | 0 |
|                                  | Impacted stones                   | Yes   | 1 |
|                                  |                                   | No    | 0 |

The pre-op maximum score is 9. Scoring 5-9 were considered as difficult laparoscopic cholecystectomy.

In addition to the above scoring system, presence of at least one of the following intraoperative findings i.e time taken for the operation is more than or equal to 60 minutes (Time taken was noted from first port site incision till last port closure), bile/stone spillage, injury to the duct/artery, conversion to open cholecystectomy was considered as difficult LC.

Statistical analysis of data was carried out using SPSS version 23. Categorical variables were expressed as frequency and percentage and numerical data were expressed as Mean±Standard Deviation. Chi-square test was used to find an association between dependent and independent variables. P value <0.05 is considered as a statistically significant.

## RESULTS

There were 69 cases with 59 (85.5%) females and 10 (14.5%) males. The age ranged from 20 years to 78 years with mean age  $47.23 \pm 15.85$ . Majority of the patients were in the age group of 41-50 years of age. 50.7 % patients were under 50 years and 49.3% were above 50 years.

**Table 2. Socio-demographic variables of the participants**

| Characteristics   | Group                                  | Frequency (n) | Percentage (%) |
|-------------------|--|---------------|----------------|
| Gender            | Male                                   | 10            | 14.5           |
|                   | Female                                 | 59            | 85.5           |
| Age group (years) | <50                                    | 35            | 50.7           |
|                   | ≥50                                    | 34            | 49.3           |
|                   | <b>Mean ± SD = 47.23 ± 15.85 years</b> |               |                |
| BMI               | <24.9                                  | 38            | 55.1           |
|                   | ≥25                                    | 31            | 44.9           |
|                   | <b>Mean ± SD = 25.13 ± 4.34</b>        |               |                |

Out of 69 cases, 59 (85.5%) were females and 10 (14.5%) were male with mean age was  $47.23 \pm 15.85$  years. The mean BMI was found to be 25.13. (Table 2).

**Table 3. Clinical Variables of the participants**

| Characteristics                   | Group                                      | Frequency (n) | Percentage (%) |
|-----------------------------------|--|---------------|----------------|
| Previous Surgery                  | No   | 65            | 94.2           |
|                                   | Yes  | 4             | 5.8            |
| Previous History of Cholecystitis | No   | 61            | 88.4           |
|                                   | Yes  | 8             | 11.6           |
| S. Bilirubin                      | Increased                                  | 1             | 1.4            |
|                                   | Normal                                     | 68            | 98.6           |
| S.ALP                             | Increased                                  | 3             | 4.3            |
|                                   | Normal                                     | 66            | 95.7           |
| GB Wall                           | Normal                                     | 66            | 95.7           |
|                                   | Thickened                                  | 3             | 4.3            |
|                                   | Impacted Stone                             | 63            | 91.3           |
| Conversion                        | No   | 64            | 92.8           |
|                                   | Yes  | 5             | 7.2            |
| Duct or artery injury             | No   | 66            | 95.7           |
|                                   | Yes  | 3             | 4.3            |
| Duration of surgery (minutes)     | 1-60 minutes                               | 24            | 34.8           |
|                                   | 61-120 minutes                             | 33            | 47.8           |
|                                   | >120 minutes                               | 12            | 17.4           |
|                                   | Mean $\pm$ SD = 87.10 $\pm$ 45.270 minutes |               |                |
| Pre-operative score               | Mean $\pm$ SD = 1.52 $\pm$ 1.14            |               |                |
| Intra-operative Outcome           | Difficult                                  | 45            | 65.2           |
|                                   | Easy                                       | 24            | 34.8           |

The mean duration of surgery was 87.10  $\pm$  45.270 minutes, with mean pre-operative score of 1.52  $\pm$  1.14. The numbers of difficult LC cases were 45.

**Table 4. Association between conversion to open surgery and independent variables**

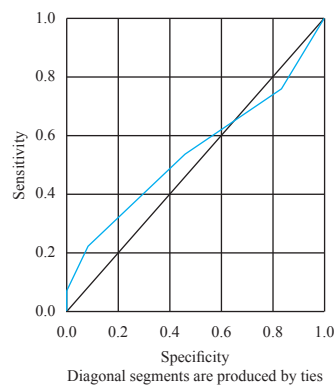
| Characteristics                  | Category  | Conversion |          | P value |
|----------------------------------|-----------|------------|----------|---------|
|                                  |           | No         | Yes      |         |
| Age                              | <50       | 34 (97.1)  | 1 (2.9)  | 0.198   |
|                                  | $\geq$ 50 | 30 (88.2)  | 4 (11.8) |         |
| Gender                           | Female    | 55 (93.2)  | 4 (6.8)  | 0.55    |
|                                  | Male      | 9 (90)     | 1 (10)   |         |
| BMI                              | <24.9     | 36 (94.7)  | 2 (5.3)  | 0.651   |
|                                  | $\geq$ 25 | 28 (90.3)  | 3 (9.7)  |         |
| Previous Abdominal Surgery       | No        | 62 (95.4)  | 3 (4.6)  | 0.024   |
|                                  | Yes       | 2 (50)     | 2 (50)   |         |
| S.Bilirubin Level                | Increased | 1 (100)    | 0 (0)    | 0.928   |
|                                  | Normal    | 63 (92.6)  | 5 (7.4)  |         |
| S.ALP                            | Increased | 2 (66.7)   | 1 (33.3) | 0.205   |
|                                  | Normal    | 62 (93.9)  | 4 (6.1)  |         |
| Pericholecystic fluid collection | No        | 62 (96.8)  | 2 (3.2)  | <0.001  |
|                                  | Yes       | 2 (40)     | 3 (60)   |         |
| Wall thickness                   | Normal    | 63 (95.5)  | 3 (4.5)  | 0.012   |
|                                  | Thickened | 1 (33.3)   | 2 (66.7) |         |
| Impacted Stone                   | No        | 60 (95.2)  | 3 (4.8)  | 0.057   |
|                                  | Yes       | 4 (66.7)   | 2 (33.3) |         |
| Previous H/O cholecystitis       | No        | 61 (96.8)  | 2 (3.17) | 0.125   |
|                                  | Yes       | 5 (62.5)   | 3 (37.5) |         |

Previous abdominal surgery, pericholecystic fluid collection, thickened GB wall and impacted stone were found significant and were associated with conversion to open surgery. (Table 4).

**Table 5. Associations of Pre-op clinical variables with difficult Laparoscopic cholecystectomy**

| Characteristics                   | Group     | Difficult | Easy      | P value |
|-----------------------------------|-----------|-----------|-----------|---------|
| Gender                            | Female    | 38 (64.4) | 21 (35.6) | 0.729   |
|                                   | Male      | 7 (70)    | 3 (30)    |         |
| Age group(years)                  | <50       | 25 (71.4) | 10 (28.6) | 0.199   |
|                                   | $\geq$ 50 | 20 (58.8) | 14 (41.2) |         |
|                                   | BMI       | <24.9     | 25 (65.8) |         |
| $\geq$ 25                         | 20 (64.5) | 11 (35.5) |           |         |
| Previous Surgery                  | No        | 42 (64.6) | 23 (35.4) | 0.566   |
|                                   | Yes       | 3 (75)    | 1 (25)    |         |
| Previous History of Cholecystitis | No        | 37 (60.7) | 24 (39.3) | 0.026   |
|                                   | Yes       | 8 (100)   | 0 (0)     |         |
| S.Bilirubin                       | Increased | 1 (100)   | 0 (0)     | 0.652   |
|                                   | Normal    | 44 (64.7) | 24 (35.3) |         |
| S.ALP                             | Increased | 3 (100)   | 0 (0)     | 0.547   |
|                                   | Normal    | 42 (63.6) | 24 (36.4) |         |
| GB Wall                           | Normal    | 42 (63.6) | 24 (36.4) | 0.547   |
|                                   | Thickened | 3 (100)   | 0 (0)     |         |

None of the parameters were found statistically significant in relation to difficult LC according to preoperative score except previous history of cholecystectomy,  $p=0.026$  (Table no 5).

**Figure 1. ROC Curve predicting difficulty in LC**

The ROC curve shows that Preoperative score is satisfactory predictor of difficult in LC with AUC (0.542) with sensitivity of 75.6% and specificity of 67.16% (Figure 1).

## DISCUSSION

Predicting the difficulty of a laparoscopic cholecystectomy is an important aspect of surgical planning and patient safety. Identifying potentially challenging cases in advance offers several advantages for both surgeons and patients. This includes optimizing surgical scheduling, enhancing surgeon preparedness, reducing the risk of unexpected conversions to open cholecystectomy, and improving the allocation of operating room resources, all of which ultimately contribute to better patient safety.

In this study, age was not significant risk factor for difficult LC and conversion to open cholecystectomy with is consistent to the study done by Nidoni et al, Patil et al<sup>9,10</sup> In contrast, the study done Josephine Philip et al. showed that age more than 60 years is significant predictors of conversion and hence difficult LC.<sup>11</sup>

In the present study, out of 69 patients, 59(85.5%) were females and 10(14.5%) were male patients. The male:female ratio was 1:5.9. It was statistically significant with difficulties LC in relation to pre-op score i.e. male had difficult LC whereas found insignificant in terms of conversion. Vivek et al.<sup>12</sup> concluded that male had difficulties LC which can be due to intense inflammation or fibrosis in the Calot's triangle and the gallbladder bed which can result in a challenging dissection during a cholecystectomy in case of male with cholelithiasis.

Presence of previous abdominal surgery scar had been shown to be significant in predicting difficulty in LC and conversion in present study ( $p=0.024$ ). However, non-significant with the intra-operative outcome ( $p=0.155$ ). In study done by Randhawa and Pujahari et al<sup>8</sup> concluded that previous abdominal surgery did not show significant predictive value whereas various studies done by Vivek et al<sup>12</sup>, Cwik G et al<sup>13</sup> concluded that abdominal surgery had statistical significance in predicting difficulty in LC and conversion to open surgery.<sup>12,13</sup>

Increased serum bilirubin level and increased ALP had been found to be non-significant for difficult laparoscopic cholecystectomy in this study which is similar to the studies done by Adhikari et al<sup>14</sup> and Akhter et al.<sup>15</sup>

In our study we found that presence of pericholecystic collection, impacted stone and thick wall GB is significant in predicting difficult in LC and conversion which is similar to the studies done by Cwik G et al<sup>13</sup> and Akhter et al.<sup>15</sup>

In this study, there were 5 cases which were converted from LC to OC. The reasons for the conversion were arterial injury, frozen calot's triangle and unclear anatomy which were similar in other study conducted by Chauhan et al.<sup>16</sup> There was no statistically significant association with previous history of cholecystitis and conversion to open cholecystectomy but duration of surgery was found to be prolonged i.e >60min in patient who had history of cholecystitis which can be comparable to study done by Husain A et al<sup>17</sup> and Abd-El-Aal et al<sup>18</sup> who concluded that previous history of cholecystitis is significant predictor of difficult LC.

Limitations of the study were single center study, and due technical failure, instrumental failure and surgeon factors, many cases were shifted to difficult category due to the prolongation of surgery. So prolong duration can't only justify difficult LC.

## CONCLUSION

The difficult laparoscopic cholecystectomy and conversion to open cholecystectomy can be predicted preoperatively based on factors like previous surgery, USG finding of thickened GB, impacted stone and pericholecystic collection, increased BMI and previous history of cholecystitis.

## REFERENCES

- Bansal A, Akhtar M, Bansal AK. A clinical study: prevalence and management of cholelithiasis. *International Surgery Journal*. 2014;1(3):134-9.
- Thamil Selvi R, Sinha P, Subramaniam PM, Konapur PG, Prabha CV. A clinicopathological study of cholecystitis with special reference to analysis of cholelithiasis. *Int J Basic Med Sci*. 2011;2(2):68-72.
- Department of Health services DoHS-Annual Report-FY 075-076. Available from:<http://dohs.gov.np/dohs-annual-report-fy-2066077>.
- Ramírez-Giraldo C, Alvarado-Valenzuela K, Isaza-Restrepo A, Navarro-Alean J. Predicting the difficult laparoscopic cholecystectomy based on a preoperative scale. *Updates in Surgery*. 2022 Jun;74(3):969-77.
- Nidoni R, Udachan TV, Sasnur P, Baloorkar R, Sindgikar V, Narasangi B. Predicting Difficult Laparoscopic Cholecystectomy Based on Clinicoradiological Assessment. *J Clin Diagn Res*. 2015 Dec;9(12):PC09-12.
- Bhandari TR, Khan SA, Jha JL. Prediction of difficult laparoscopic cholecystectomy: An observational study. *Annals of Medicine and Surgery*. 2021 Dec 1;72:103060.
- Nassar AH, Hodson J, Ng HJ, Vohra RS, Katbeh T, Zino S, et al. Predicting the difficult laparoscopic cholecystectomy: development and validation of a pre-operative risk score using an objective operative difficulty grading system. *Surgical Endoscopy*. 2020 Oct;34:4549-61.
- Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. *Indian Journal of Surgery*. 2009;71(4):198-201.
- Nidoni R, Udachan TV, Sasnur P, Baloorkar R, Sindgikar V, Narasangi B. Predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment. *Journal of Clinical and Diagnostic Research: JCDR*. 2015;9(12):9-12.
- Patil S, Inamdar PS. Evaluation of preoperative predictive factors that determine difficult laparoscopic cholecystectomy. *International Surgery Journal*. 2016;3(2):825-30.
- Rothman JP, Burcharth J, Pommergaard H-C, Viereck S, Rosenberg J. Preoperative risk factors for conversion of laparoscopic cholecystectomy to open surgery-a systematic review and meta-analysis of observational studies. *Digestive Surgery*. 2016;33(5):414-23.
- Vivek MAK, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. *Journal of Minimal Access Surgery*. 2014;10(2):62-7.
- Cwik G, Skoczylas T, Wyroślak-Najs J, Wallner G. The value of percutaneous ultrasound in predicting conversion from laparoscopic to open cholecystectomy due to acute cholecystitis. *Surgical Endoscopy*. 2013;27(7):2561-8.
- Adhikari S, Acharya A. Preoperative Scoring System to Predict Difficult Laparoscopic Cholecystectomy. *Post-Graduate Medical Journal of NAMS*. 2015;12(01):45-50.

15. Akhter T, Lodhi JK, Malik A, Ahmad RS. Ultrasound Scoring System for Pre-Operative Anticipation of Difficult Laparoscopic Cholecystectomy. *Journal of Rawalpindi Medical College*. 2018;240-3.
16. Chauhan S, Masood S, Pandey A. Preoperative predictors of conversion in elective laparoscopic cholecystectomy. *Saudi Surgical Journal*. 2019;7(1):14-19.
17. Husain A, Pathak S, Firdaus H. Assessment of operative predictors for difficulty in laproscopic cholecystectomy. *Int J Contemp Med Res*. 2016;3(4):1232-4.
18. Abd-El-Aal AS, Abdallah HA. Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy in comparison with intraoperative parameters. *The Egyptian Journal of Surgery*. 2018;37(4):504-11.