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A Prospective Study of Pre-Operative Predictors of Difficult Laparoscopic Cholecystectomy

Dr.Anandaravi B.N[1], Dr.Vijaya Bhaskara Reddy
[1](Associate Professor In Dept Of Gen Surgery MMC & RI Mysore)
[2](MMC & RI Mysore)

Abstract:
Background*: Laparoscopic cholecystectomy (LC) is considered the gold standard treatment for most of the Gallbladder diseases. The advantages are many though at times LC will become difficult. It is very difficult to predict preoperatively, whether it is going to be easy or difficult.*
Materials and Methods*: This is a prospective study conducted over a period of 12 months among the patients aged 16 to 60 years, presenting with symptoms and signs of Cholelithiasis /Cholecystitis and diagnosed by USG examination. The study was aimed to assess various preoperative predictors {history/ clinical/ imaging} and develop a scoring method for difficult laparoscopic cholecystectomy.*
Results*: A study of 75 patients to understand the pre-operative predictors of difficult laparoscopic cholecystectomy revealed that most of them were females (65.3%, n=49). Higher BMI, GB thickness >4mm, previous history of hospitalization, female gender, and pericholecystic collection are associated with difficult and very difficult grading of scores with significant correlation.*
Conclusion: *Many risk factors make laparoscopic surgery difficult like old age, male sex, attacks of acute cholecystitis and pancreatitis, obesity, previous abdominal surgery, palpable gall bladder, and certain ultrasonographic findings i.e. thickened gall bladder wall, pericholecystic fluid collection, impacted stone, etc.*
Key Word*: Cholelithiasis; Laparoscopic cholecystectomy; Open cholecystectomy*.

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I. Introduction

Cholecystectomy was considered the surgical procedure for gall stone disease (cholelithiasis) in 1882, when its pioneer Carl Johann August Langenbuch, performed the first cholecystectomy in a patient who suffered from cholelithiasis. Laparoscopic cholecystectomy(LC) is considered the gold standard treatment for most of the gallbladder diseases. The advantages of LC are an earlier return of bowel function, less post-operative pain, cosmetic, shorter duration of hospital stay and also earlier return to full activity.

At times LC has become difficult. It takes a longer duration even with bile/stone spillage and occasionally it requires conversion to open cholecystectomy (OC). It is very difficult to predict preoperatively, whether it is going to be easy or difficult. The degree of difficulties in LC is again impossible to predict. At present, there is no standard scoring system available to predict the degree of difficulty preoperatively. This study aims to assess various preoperative predictors (history/ clinical/ imaging), develop a scoring method for difficult laparoscopic cholecystectomy and to correlate preoperative predictive factors with intraoperative difficulty in lap cholecystectomy. Thus identifies the factors that can predict difficulty in LC, hence complications can be prevented beforehand.

II. Material And Methods

This prospective study was conducted in the Department of General Surgery, Mysore Medical College and Research Institute from AUGUST 2018 TO JULY 2019 for the study period of 12 months.
Study Design: Prospective observational study
Study Location: This was a tertiary care teaching hospital based study done in Department of General Surgery, Mysore Medical College and Research Institute, Mysore
Study Duration: AUGUST 2018 TO JULY 2019 for the study period of 12 months.
Sample size: 75 patients.
Sample size calculation: The study population was drawn from consecutive patients who presented to Department of General Surgery, Mysore Medical College & Research Institute *presenting with symptoms and signs of Cholelithiasis /Cholecystitis and diagnosed by USG examination* from AUGUST 2018 TO JULY 2019. 75 cases were selected after applying inclusion and exclusion criteria

Inclusion criteria:
Patients aged between 16 and 60 years presenting with symptoms and signs of Cholelithiasis / Cholecystitis, diagnosed by USG examination and undergoing laparoscopic cholecystectomy in a single unit during the study period were included.

Exclusion criteria:
Patients with obstructive jaundice, CBD calculus, dilated CBD, where CBD exploration was needed and those not willing to be part of the study were excluded.

Procedure methodology
Preoperative risk factors assessed were history (age, sex, previous hospitalization for abdominal surgeries/cholecystitis/ pancreatitis), clinical (BMI, Abdominal scar- infraumbilical or supraumbilical, palpable gall bladder) and radiological (Gall bladder wall thickness, pericholecystic collection, impacted stone) as shown in table 1.

FACTORS			SCORE (MAX =15)
AGE	<50 (0)	>50(1)	1
SEX	FEMALE(0)	MALE(1)	1
H/O HOSPITALISATION	NO(0)	YES(4)	4
BMI	<25 (0)	>25-27.5 (1) , >27.5(2)	2
ABDOMINAL SCAR	NO (0)	INFRAUMBILICAL(1) ,SUPRAUMBILICAL(2)	2
PALPABLE GB	NO (0)	YES ((1)	1
GB WALL THICKNESS	THIN (<4mm) (0)	THICK(>4mm) (2)	2
PERICHOLECYSTIC COLLECTION	NO (0)	YES (1)	1
IMPACTED STONE	NO (0)	YES (1)	1

Table 1: Variables used for preoperative scoring

TOTAL SCORE :

GRADING : EASY **(<5)**
DIFFICULT **(6-10**)
VERY DIFFICULT **(11-15)**

Following an evaluation, the patient will be subjected to laparoscopic cholecystectomy with attention on the operative time taken from incision to port closure, bile /stone spillage, bleeding during surgery, injury to duct/artery and need for conversion regarding upon the difficulty of the case. Based upon these factors the study population will be graded as easy, difficult and very difficult .

Easy:
- Time taken <60 min
- No bile spillage
- No injury to duct, artery

Difficult :
- Time taken 60–120 min
- Bile/stone spillage
- Injury to duct
- No conversion

Very difficult:
- Time taken >120 min
- Conversion

Statistical analysis

Data recording was done in a predesigned proforma. All the data was entered into Microsoft Excel. For analysis purposes, all predictors were stratified into two groups i.e. age <50yrs and >50yrs, BMI <25, 25-27.5 and >27.5. A chi-square test was used to derive the p-value of the difference between two strata of predictors. A p-value of <0.05 was taken as significant. The correlation coefficient along with the p-value was calculated to find the relationship between risk factor and type of intraoperative difficulty.

III. Result

AGE

38 out of 75 patients in the study were in the age group of <50 years (50.6%) and remaing 37 were above 50 years (figure 1)

GENDER

In the present study of 75 patients, the majority of them were females (65.7% n=49). Among the 49 females 31 were less than 50 years of age group. Of the 26 male patients, 19 belong to >50 years age group (figure 1).

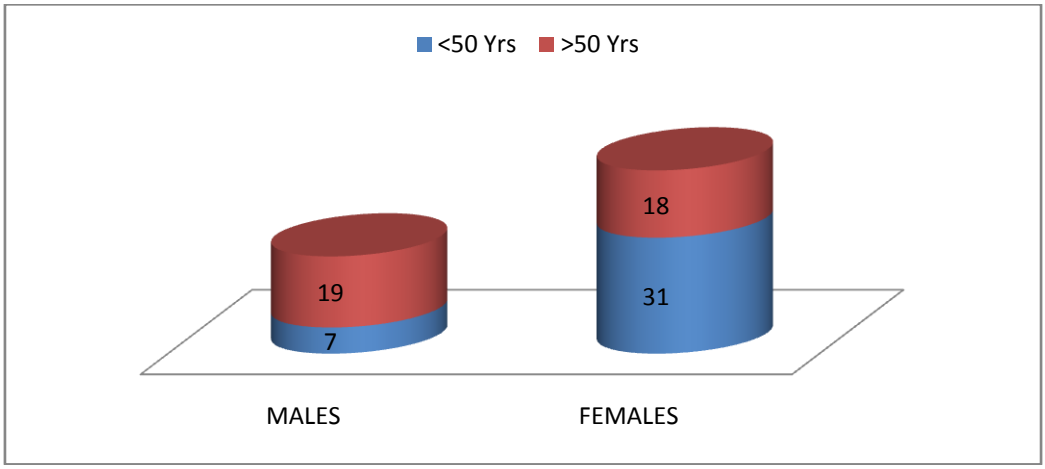

Figure 1: Age and Gender of the study group

HISTORY OF HOSPITALISATION

Only 9.8% (n=4) of them had a history of hospitalization (figure 2).

ABDOMINAL SCAR

The abdominal scar was noticed in 45 patients. Among these, 43 had infraumbilical scar and 2 of them supraumbilical scar. The majority of the patients with infraumbilical scars were females (42 out of 43).

PALPABLE GALLBLADDER Only one patient had palpable gall bladder

RADIOLOGY

Radiological evaluation showed gall bladder wall thickness of >4 mm in 10 patients (13%), pericholecystic collection in 6 patients and impacted stone in one case.

BMI

Majority (50.7%, n=38) had a BMI of <25.

GRADING OF TOTAL SCORE

Preoperatively, based on total score it went on to predict easy for 66 cases , difficult for 7 and very difficult for 2 cases respectively as shown in table 2.

Grading	Frequency	Percent (%)
Easy	66	88
Difficult	7	9.3
Very Difficult	2	2.6

Table 2: Grading of the total score

GRADING OF OPERATION TIME

During laparoscopic cholecystectomy time taken from port incision to closure is considered. It went on easy for 61 cases, difficult for 9 cases and very difficult for 5 cases as shown in table 3.

Operation Time in Minutes Grade	Frequency	Percent (%)
Easy	61	81.3
Difficult	9	12
Very Difficult	5	6.6

Table 3: Grading of operation time

Among the 5 very difficult cases, 4 had been converted in to open cholecystectomy and one surgery got prolonged for >120 minutes.

CORRELATION BETWEEN TOTAL SCORE AND OPERATION TIME

The total score is correlating with operation time in 93.3% of cases (70 cases) as shown in figure2.

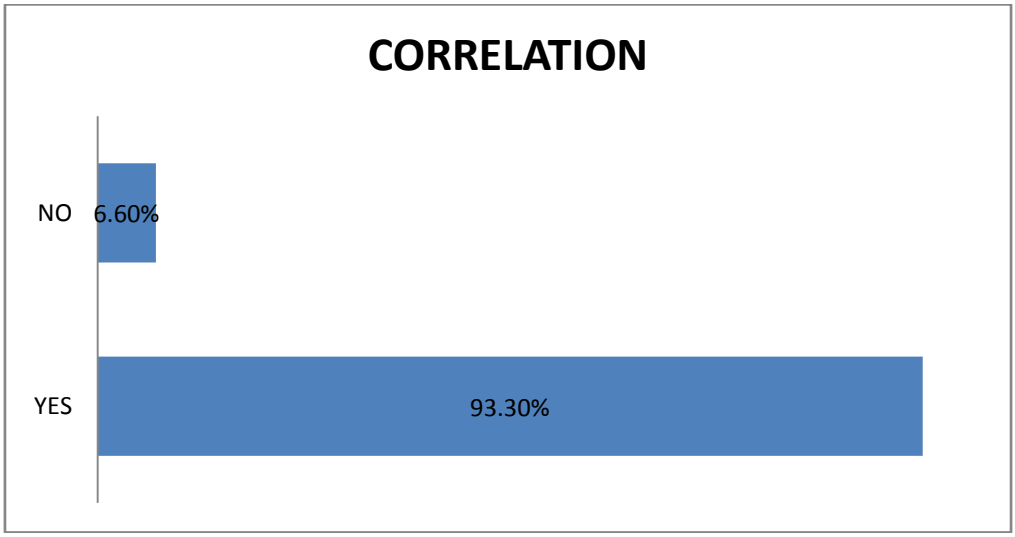

Fig 2: Correlation between total score and operation time

Outlier case analysis

Five cases did not fall into the correct prediction of outcome from scoring.

1) Two cases predicted as easy and one case with supraumbilical incision suspected to be difficult turned out to be very difficult and all 3 cases converted to open cholecystectomy due to adhesions & frozen calots

2) One 66 years old male with infraumbilical incision and another patient with previous acute cholecystitis were predicted as easy but turned out to be difficult as both surgery took time beyond 60 minute.

IV. Discussion

- The gold standard treatment for gallbladder diseases especially for symptomatic cholelithiasis is laparoscopic cholecystectomy. But this treatment is not devoid of complications and require caution from the surgeon . The present study was aimed to assess the various preoperative predictors (history/ clinical/ imaging) and develop a scoring method for difficult laparoscopic cholecystectomy with a secondary objective of correlating preoperative predictive factors with intraoperative difficulty in lap cholecystectomy
- A study of 75 patients to understand the pre-operative predictors of difficult laparoscopic cholecystectomy revealed that most of them were females (65.3%, n=49) and there is no much difference in the age of presentation.
- In our study, the method employed was to develop a scoring system to preoperatively ascertain the difficulty in laparoscopic cholecystectomy based on clinical findings, history, and radiology. The grades were given as easy (<5), difficult (5-10) and very difficult (11-15).
- The scoring system was able to predict correctly in70 (93.3%) out of the 75 patients in consideration. Randhawa JS et al. in 2009 (88-92%, easy to difficult) and Dhanke PS et al. in 2014 (94.05-100%, easy to difficult) published similar findings. Only 5 cases did not correlate with the score due to adhesions.
- In this study higher BMI (>30), Gall bladder thickness >4mm, previous history of hospitalization, female gender, and pericholecystic collection are associated with difficult and very difficult grading of score with positive correlation with total score and operation time with significant p value. This result is in agreement with study done by Dhanke PS et al. in 2014 who reported that a history of prior hospitalization; high BMI and pericholecystic collection are predictors of the difficult laparoscopic cholecystectomy.
- In this study, 4 cases (6.7%) were converted into open due to omental adhesions and distorted calots anatomy. This is very different from study result of 17% by Randhawa JS et al. in 2009, 27.9% by Oymaci

et al, 2014, 11.4% by Nachnani J et al in 2005 and 5.7% by Bakos E et al, 2008. This variation can be accounted due to the difference in sample size, the underlying prognostic determinants of the individual, surgeon to surgeon variations and lack of uniform evaluating system. The low rate of complications can be attained by perfecting the surgical techniques along with the experience of the surgeons.

- In this study, there is a significant positive correlation between operation time and total score ($r=0.8$, $p<.001$), positive significant relationship between total score and abdominal scar , positive significant relationship between operation time and abdominal scar ($r=0.558$, $p<0.001$), positive significant relationship between total score and GB wall thickness ($r=0.845$, $p<0.001$), positive significant relationship between operation time and GB wall thickness ($r=0.873$, $p<0.001$), positive significant relationship between total score and Pericholecystic collection ($r=0.855$, $p<0.001$), positive significant relationship between operation time and Pericholecystic collection ($r=0.862$,$p<0.001$), positive significant relationship between total score and history of hospitalisation ($r=0.813$, $p<0.001$), and positive significant relationship between operation time and history of hospitalization ($r=0.771$, $p<0.001$).
- The current scoring system used in this study is very effective in predicting the difficulty of the laparoscopic cholecystectomy with very high sensitivity

V. Conclusion

- Laparoscopic Cholecystectomy is a minimally invasive surgery. What would look simple might not be simple all the time and in that case the consequences can be devastating. Hence there needs to be a way in which a difficulty could be anticipated preoperatively. The following conclusions can be drawn from the study;
- Surgeons encounter difficulty when there are dense adhesions in the calot's triangle, fibrotic and contracted GB, acutely inflamed GB, gangrenous gall bladder and cholecystoenteric fistula, etc.
- Parameters namely female sex, previous episode of cholecystitis, previous upper abdominal surgery, sonographically ascertained thick gallbladder wall, age >50 years and preoperative diagnosis of acute cholecystitis were found to have a significant effect on the risk of conversion on a statistical analysis.
- Preoperative prediction of the risk of conversion or difficulty of operation is an important aspect of planning laparoscopic surgery. Multiple studies and scoring systems have already been formulated in the past few years for pre operative prediction of difficulty.
- This study combined the pre operative clinical and radiological parameters for better prediction of difficult Laparoscopic Cholecystectomy. Thus provides a basis for further studies to validate in this aspect and also aids in formulating an efficient scoring system for prediction of difficult Laparoscopic Cholecystectomy and reducing the incidence of complications.

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