ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 8, Issue – 1, January - 2025, Page No. : 85 – 94

A Study To Determine Predictive Factors For Difficult Laparoscopic Cholecystectomy Using Clinico- Radiological Criteria

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How to citation this article: Dr. Anil Degaonkar, Dr. V. P. Kelkar, Dr. Poorvi Veera, "A Study To Determine Predictive Factors For Difficult Laparoscopic Cholecystectomy Using Clinico- Radiological Criteria", IJMACR- January - 2025, Volume – 8, Issue - 1, P. No. 85 – 94.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Difficult laparoscopic cholecystectomy occurs in 5–7% of cases of symptomatic gallstone disease and has implications that affect both the patient and surgeon, including conversions to an open approach, longer operating times, and a greater risk of complications and readmission rates. In addition, these cases account for approximately 40% of residual bile stones.

Aims and Objective

Aim of the study: To study predictive factors for difficult laparoscopic cholecystectomy using clinico radiological criteria.

Primary objectives: To study predictive factors for difficult laparoscopic cholecystectomy using clinico radiological criteria.

Secondary objective

- To study the various causes of acute cholecystitis.
- To study associated risk factors of acute cholecystitis.
- To study intraoperative difficulties during laparoscopic cholecystectomy.

Material and Method

Study Design: An Observational study. (Prospective)

Study Site: The study will be carried out at a tertiary care center, in Maharashtra.

Study Duration: 18 Months and The study were done

between July 2022 to November 2023.

Sample Size: The sample size is equal to 100.5, but 100 Patients were included in the study.

Result: Out of 100 patients included in this study Male 26 (26%) and Female 74 (74%). This data suggests a statistically significant association (p-value = 0.001) between the level of difficulty for the procedure and the age of the participants. Participants under 55 years old were significantly more likely to undergo an easy procedure compared to those over 55 years old.

Discussion: The Preoperative identification of patients at higher risk for Potential contributing factors, understanding the association between surgical difficulty and operating time has significant implications for surgical planning, resource allocation, and patient counselling improving outcomes in laparoscopic cholecystectomy.

Keywords: Aberrant Anatomy, Bile Duct Injuries, Bile Leakages, Hematoma, Gallbladder

Introduction

Cholecystectomy is a surgical procedure to remove the gallbladder as a result of stone or inflammation. Laparoscopic cholecystectomy is considered the gold standard surgical procedure for the management of patients with symptomatic gallstones. It offers many advantages over open cholecystectomy, such as minimal postoperative pain, better cosmesis, shorter hospital stays, and early recovery. The difficulty is considered in cases of dense adhesions at Calot‟s triangle, history of upper abdominal surgery, acutely inflamed and gangrenous gallbladder, empyema of the gallbladder, Mirizzi‟s syndrome, previous cholecystostomy, and cholecystic- gastric or cholecystic-duodenal fistula.

The specific complications of laparoscopic cholecystectomy were hemorrhage, gallbladder perforation, bile leakages, bile duct injuries, perihepatic collection, and others, such as external biliary fistula, wound sepsis, hematoma, foreign body inclusions, adhesions, metastatic port-site deposits, and cholelitho-ptysis.

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Study Duration:

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- The study was done between July 2022 to November 2023

Sample Size: – is calculated using the formula for observational study:

$$N = \frac{(\sigma_1^2 - \sigma_2^2/k)\,(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

Where,

σ1= standard deviation of Group 1=37.96 + 10.49 (Age group mean)

σ^2= standard deviation of Group 2= 35.0 + 14= (Second group Age means) (Ref Dhiraj Agrawal)

Δ = Difference in group means N = sample size of Group 1 K = ratio = n2/n1

$Z_{1-\alpha/2}$ = two-sided Z value $Z_{1-\beta}$= power

$$N = \frac{(\sigma_1^2 - \sigma_2^2/k)(Z_{1-\alpha/2} + Z_{1-\beta})^2}{\Delta^2}$$

=100.5

The sample size is equal to 100.5, but 100 Patients were included in the study.

Data Collection:

Data regarding demographics including age, sex, occupation, and documentation of patients which includes clinical findings, diagnostic tests such as CXR, abdominal ultrasound and CT abdomen, operative procedure, and operative findings and complications intraoperatively will be recorded in the proforma prepared.

Sample Size:

Sample size will be determined by the complete enumeration method. All the patients meeting the inclusion criteria during the study period will be taken as a study sample.

Sampling Technique:

Purposive sampling

Statistical Analysis:

- Data will be analyzed using appropriate statistical software.
- Criteria for major and minor protocol violations.
- Any deviation from the submitted protocol.

Selection Criteria:

Inclusion criteria:

- All patients with symptomatic gallbladder disease admitted to tertiary care center will be included in the study.
- Those who are willing to give consent.

Exclusion criteria:

- Patients who are not willing to give consent
- Pediatric age group (up to 14 years of age)
- Those who are not fit for the procedure.

Result

Table 1: Age-Wise Distribution of Study Participants

Sn.	Age Groups	Frequency (N=100)	Percentage (%)
1	< 55	069	69.0
2	>55	031	31.0
	Total	100	100.0

The table summarizes the age-wise distribution of 100 study participants. It shows that 69% of the participants are under 55, while 31% are 55 or older.

Figure 1: Age-wise distribution of Study Participants

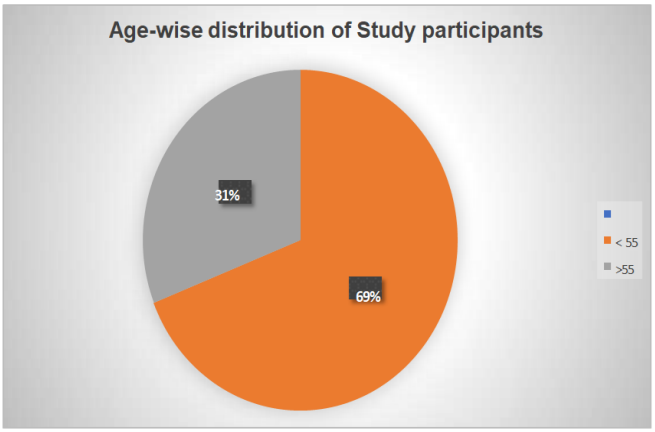

Table 2: Gender-wise distribution of Study Participants

Sn.	Gender	Frequency (N=100)	Percentage (%)
1	Male	026	26.0
2	Female	074	74.0
	Total	100	100.0

The table summarizes the gender-wise distribution of 100 study participants. It shows that 74% of the participants are female, while 26% are male.

Figure 2: Gender-wise distribution of Study Participants

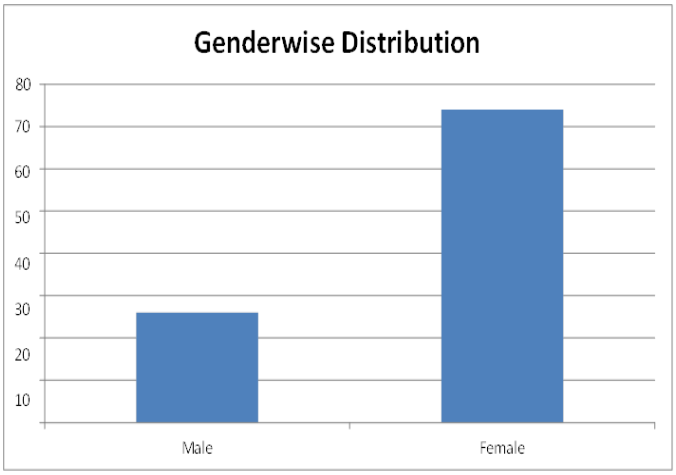

Table 3: Duration of symptoms-wise distribution of Study Participants

Sn.	Duration Of Symptoms	Frequency (N=100)	Percentage (%)
1	<1 Year	070	70.0
2	>1 Year	030	30.0
	Total	100	100.0

The table summarizes the duration of symptoms-wise distribution of 100 study participants. It shows that 70% of the participants have had symptoms for less than 1 year, while 30% have had symptoms for more than 1 year.

Figure 3: Duration of symptoms-wise distribution of Study Participants

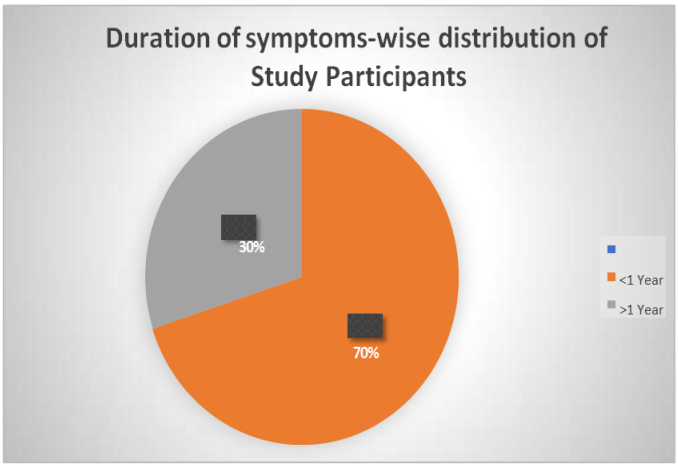

Table 4: Scar of previous surgery -wise distribution of Study Participants

Sn.	Scar	Frequency (N=100)	Percentage (%)
1	Absent	066	66.0
2	Present	034	34.0
	Total	100	100.0

The table summarizes the scar of the previous surgery-wise distribution of 100 study participants. It shows that 66% of the participants do not have scars of previous surgery, while 34% have scars of previous surgery.

Figure 4: Scar of previous surgery-wise distribution of Study Participants

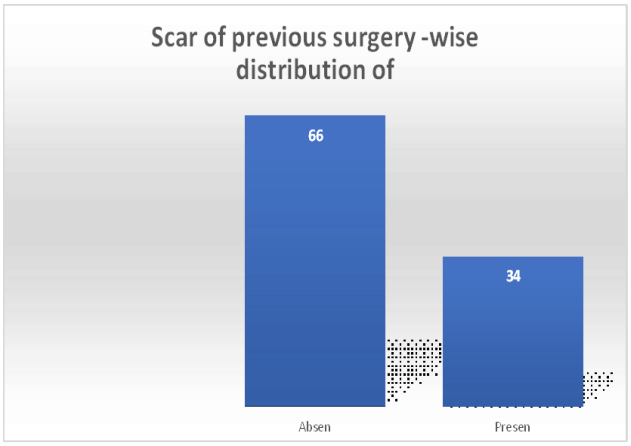

Table 5: Scar Position-wise distribution of Study Participants

Sn.	Scar Position	Frequency (N=100)	Percentage (%)
1	Absent	066	66.0
2	Infraumbilical	026	26.0
3	Supraumbilical	008	8.0
	Total	100	100.0

The table shows the distribution of scar positions among 100 study participants. It indicates that the majority (66%) of the participants have no scar, while 26% have an infraumbilical scar, and 8% have a supraumbilical scar.

Figure 5: Scar Position-wise distribution of Study Participants

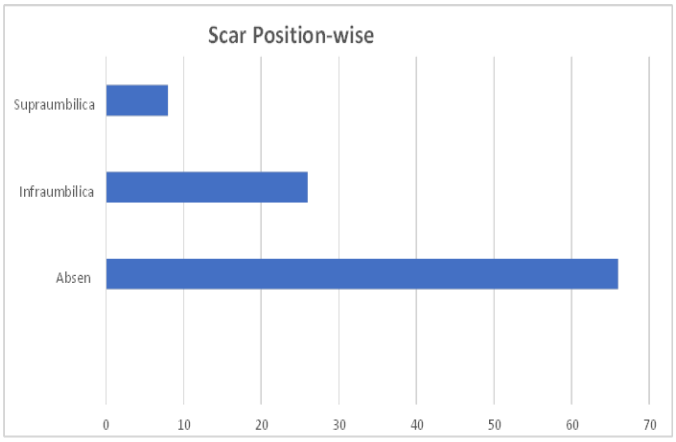

Table 6: Gall bladder thickness -wise distribution of Study Participants

Sn.	Gall bladder thickness	Frequency (N=100)	Percentage (%)
1	<3 mm	055	55.0
2	>3 mm	045	45.0
	Total	100	100.0

This table shows the distribution of participants based on their gallbladder thickness in a study of 100 participants. It indicates that slightly over half (55%) of the participants have a gallbladder thickness of less than 3 mm, while nearly half (45%) have a gallbladder thickness of greater than 3 mm.

Figure 6: Gall bladder thickness -wise distribution of Study Participants

Table 7: Time taken for the surgery-wise distribution of Study Participants

Sn.	Time taken for the surgery (Min)	Frequency (N=100)	Percentage (%)
1	< 60 Minutes	056	56.0
2	>60 Minutes	044	44.0
	Total	100	100.0

The table shows the distribution of participants based on the time it took to complete their surgery in a study of 100 participants. It indicates that:

The majority of surgeries (56%) were completed within 60 minutes. 44% of surgeries took longer than 60 minutes.

Figure 7: Time taken for the surgery-wise distribution of Study Participants

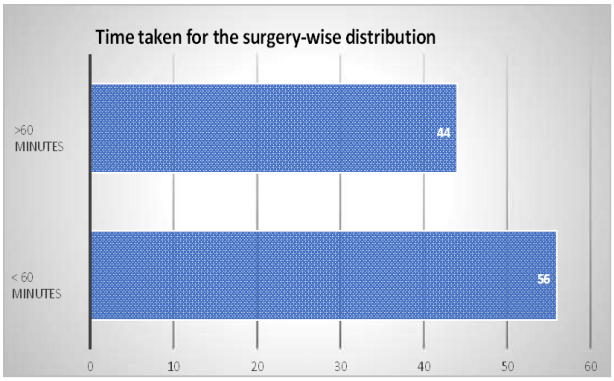

Table 8: Bile Spillage-wise Distribution of Study Participants

Sn.	Bile Spillage	Frequency (N=100)	Percentage (%)
1	Absent	082	82.0
2	Present	018	18.0
	Total	100	100.0

This table shows the distribution of participants based on the presence or absence of bile spillage during surgery in a study of 100 participants. Bile spillage is the accidental leakage of bile from the gallbladder or bile ducts during surgery. It indicates that the majority

(82%) of the participants did not experience bile spillage during surgery, while nearly one-fifth (18%) experienced bile spillage during surgery.

Figure 8: Bile Spillage-wise distribution of Study Participants

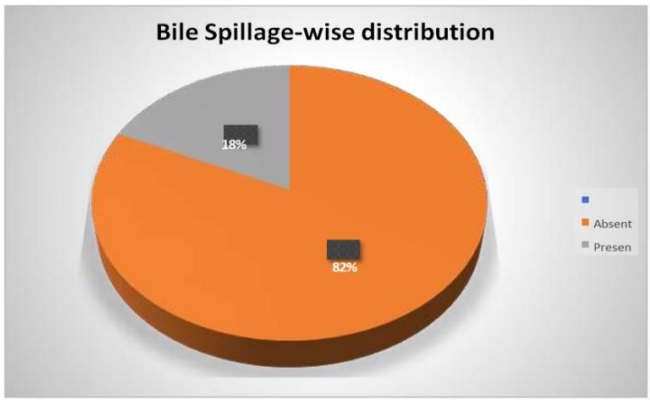

Table 9: Aberrant anatomy Status-wise distribution of Study Participants

Sn.	Aberrant Anatomy	Frequency (N=100)	Percentage (%)
1	Absent	096	96.0
2	Present	004	04.0
	Total	100	100.0

This table displays the distribution of participants based on the presence or absence of aberrant anatomy in a study of 100 participants. Aberrant anatomy refers to any abnormality or deviation from the normal structure of the body's organs or tissues.

Figure 9: Aberrant Anatomy Status-wise distribution of Study Participants

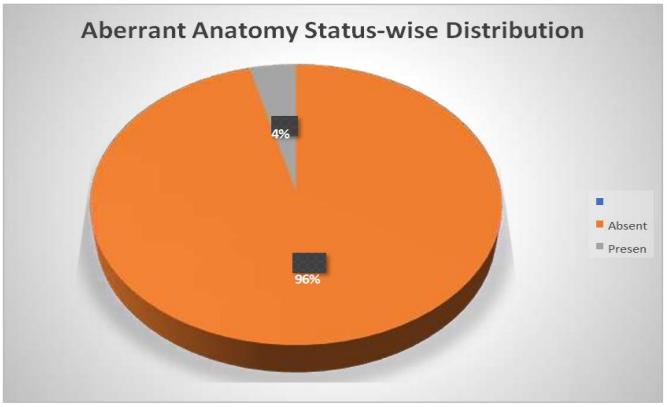

Table 10: Association between Level of Difficulty and Gender of Study Participants.

Gender	Easy Procedure	Difficult Procedure	Total	P-Value
Male	15 (57.7%)	11 (42.3%)	26 (100%)	0.599*
Female	47 (63.5%)	27 (36.5%)	74 (100%)	
Total	062 (62.0%)	38 (38.0%)	100 (100%)	

Note: Numbers in parenthesis are row-wise percentages.

*Pearson Chi-square X^2= 0.277, df = 1, P=0.599

Table 11: Association between Level of Difficulty and Duration of Symptoms of Study Participants.

Duration Of Symptoms	Easy Procedure	Difficult Procedure	Total	P-Value
<1 year	062 (88.6%)	008 (11.4%)	70 (100%)	0.001*
>1 year	000 (0.00%)	030 (100%)	30 (100%)	
Total	62 (62 %)	38 (38 %)	100 (100%)	

Note: Numbers in parenthesis are row-wise percentages.

*Pearson Chi-square X^2= 69.925, df = 1, P=0.001

Table 12: Association between Level of Difficulty and Scar of the Previous Surgery of the Study Participants

Duration Of Symptoms	Easy Procedure	Difficult Procedure	Total	P-Value
Absent	41 (62.2%)	25 (37.8%)	66 (100%)	0.972*
Present	21 (61.7%)	13 (38.3%)	34 (100%)	
Total	62 (62 %)	38 (38 %)	100 (100%)	

Note: Numbers in parenthesis are row-wise percentages.

*Pearson Chi-square X^2= 0.001, df = 1, P=0.972

Table 13: Association between Level of Difficulty and Body Mass Index of Study Participants.

Body Mass Index	Easy Procedure	Difficult Procedure	Total	P-Value
<25 kg/ m^2	000 (05.9%)	23 (100%)	23 (100%)	0.001*
>25 kg/ m^2	62 (14.28%)	15 (85.72%)	77 (100%)	
Total	62 (62%)	38 (38%)	100 (100%)	

Note: Numbers in parenthesis are row-wise percentages.

*Pearson Chi-square X^2= 48.735, df = 1, P=0.001

Table 14: Association between Level of Difficulty and Aberrant Anatomy in Study Participants

Aberrant Anatomy	Easy Procedure	Difficult Procedure	Total	P-Value
Absent	62 (69.4%)	36 (30.6%)	98 (100%)	
Present	00 (0%)	02 (100%)	2 (100%)	0.068*
Total	62 (62%)	38 (38%)	100 (100%)	

Note: Numbers in parenthesis are row-wise percentages.

*Pearson Chi-square X^2= 3.330, df = 1, P=0.068

Discussion

The present study shows a compelling observation: a statistically significant association exists between the presence of peri-cystic collections, as identified on ultrasound imaging (USG reports), and the difficulty of cholecystectomy procedures. While nearly nine in ten easy procedures (88.2%) lacked such collections, a substantial majority of difficult procedures (65.3%) exhibited them (p=0.001). This stark difference highlights the potential role of peri-cystic collections in influencing surgical complexity.

Compelling observation: A statistically significant association (p=0.001) exists between surgical difficulty and operating time. While the vast majority of easy procedures (85.7%) concluded within 60 minutes, a substantial proportion of difficult procedures (68.2%) exceeded that timeframe. This stark difference highlights the direct relationship between surgical complexity and prolonged operating times.

The presence of peri-cystic collections and surgical difficulty emerges while nearly nine in ten easy procedures (88.2%) lacked such collections, a substantial majority of difficult procedures (65.3%) exhibited them. This statistically significant difference (p=0.001) underscores the potential role of peri-cystic collections in influencing surgical complexity.

Conclusion

This study demonstrates a clear correlation between higher clinico- radiological risk factor scores and increased difficulty in performing laparoscopic cholecystectomies. This association suggests that these factors can serve as valuable indicators for pre-operative risk assessment and surgical planning.

The importance of considering not only clinical symptoms but also pre-operative imaging studies and patient history when evaluating surgical risk and planning laparoscopic cholecystectomies. By identifying patients with higher clinic- radiological risk factors, surgeons can better anticipate potential difficulties, optimize surgical strategies, and potentially improve patient outcomes.

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