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Factors Predicting Difficult Laparoscopic Cholecystectomy

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I. Introduction

Laparoscopic cholecystectomy (LC) is a widely performed surgical procedure for the removal of the gallbladder, renowned for its minimally invasive nature and reduced recovery times compared to open surgery. However, the success and ease of this procedure can vary significantly among patients, influenced by several factors that predict the difficulty of the operation. Identifying these factors is crucial for preoperative planning, patient counseling, and ensuring optimal surgical outcomes.

Various patient-related and anatomical factors have been implicated in predicting the complexity of laparoscopic cholecystectomy. These include but are not limited to the presence of acute cholecystitis, previous abdominal surgeries, obesity, anatomical variations such as aberrant bile ducts or vascular structures, and underlying medical conditions such as liver cirrhosis. Understanding these predictors allows surgeons to tailor their approach, potentially opting for alternative techniques or making informed decisions during surgery to mitigate challenges.

This review aims to explore the significant factors associated with difficult laparoscopic cholecystectomy, emphasizing their clinical implications and the evidence supporting their predictive value. By elucidating these factors, this study seeks to contribute to improved patient selection, enhanced surgical planning, and ultimately, better outcomes in the management of gallbladder disease.

II. Methodology

- **Study Design**

Prospective study of factors for difficult laparoscopic cholecystectomy

- **Study Setting**

SNMC General Surgery and Superspeciality Department

- **Place of study**

Dept. of General Surgery, Sarojini Naidu medical college, Agra

- **Period of Study**

October 2022 to August 2024.

- **Sample Size:**

All patients admitted in ward for a period of 12 months according to inclusioncriteria from October 2022 to September 2023

- **Control:** Not Required.

Inclusion Criteria:

The patients aged between 20 and 50 years presenting with symptoms and signs of Cholelithiasis / Cholecystitis and diagnosed by USG examination inour unit, department of general surgery, Sarojini Naidu Medical College, Agra.

Exclusion Criteria:

a) Patients below 20 years of age and above 50 years of age.
b) Patients with CBD calculus, dilated CBD, where CBD explorationwas needed.
c) Patients with features of obstructive jaundice.
d) Patients not willing for laparoscopic cholecystectomy.
e) Patients with significant comorbidities or systemic illnesses affecting surgicaloutcomes.
f) Emergency cholecystectomy cases for acute conditions such as acute cholecystitis with severe complications.
g) Patients undergoing simultaneous surgical procedures along with cholecystectomy, potentially confounding the analysis of factors specificallyrelated to LC difficulty.
h) Cases with intraoperative conversions from laparoscopic to open cholecystectomy due to factors unrelated to surgical difficulty (e.g., unforeseenintraoperative complications).

III. Result:

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Data had been summarized as mean and standard deviationfor numerical variables and count and percentages for categorical variables. Two-sample t-tests for a difference in mean involved independent samples or unpaired samples.

Paired t-tests were a form of blocking and had greater powerthan unpaired tests. One-way analysis of variance (one-way ANOVA) was a technique used to compare means of three or more samples for numerical data (using the F distribution). A chi-squared test ($\chi 2$ test) was any statistical hypothesis test wherein the sampling distribution of the test statistic is a chi- squared distribution when the null hypothesis is true. Without other qualification, 'chi-squared test' often is used as short forPearson's chi-squared test. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate.

Explicit expressions that can be used to carry out various t- tests & chi square test are given below. In each case, the formula for a test statistic that either exactly follows or closelyapproximates a t-distribution under the null hypothesis is given. Also, the appropriate degrees of freedom are given in each case. Each of these statistics can be used to carry out either a one-tailed test or a two-tailed test. Once a p value is determined, a p-value can be found using a table of values from Student's t-distribution. If the calculated p-value is below the threshold chosen for statistical significance (usually the 0.10, the 0.05, or 0.01 level), then the null hypothesis is rejected in favour of the alternative hypothesis.

P-value ≤ 0.05 was considered for statistically significant

Table 1: relationship between History of Acute Cholecystitis with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
HISTORY OF ACUTECHOLECYSTITIS	N	57	0	57
	Y	28	5	33
Total		85	5	90

Chi square value = 9.144 p-value = 0.002Significant relation

Table 2: relationship between History of Upper Abdominal Surgery with BileSpillage

		BILE SPILLAGE		
		N	Y	Total
HISTORY OF UPPER ABBDOMINAL SURGERY	N	79	5	84
	Y	6	0	6
Total		85	5	90

Chi square value = 0.378 p-value = 0.539No Significant relation

Table 3: relationship between Increased Gb Wall Thickness (>4mm) and GBcontracted with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
INCREASED GB WALL THICKNESS	N	69	1	69

(>4MM) and GB contracted	Y	16	4	20
Total		85	5	90

Chi square value = 10.225 p-value = 0.001Significant relation

Table 4 : relationship between Pericholecystic Collection with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
PERICHOLECYSTIC COLLECTION	N	82	3	85
	Y	3	2	5
Total		85	5	90

Chi square value = 11.971 p-value = 0.001Significant relation

Table 5: relationship between Stone At Neck/ Cystic Duct with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
STONE AT NECK/ CYSTIC DUCT	N	82	0	82
	Y	3	5	8
Total		85	5	90

Chi square value = 54.265 p-value < 0.001 (Highly significant)Significant relation

Table 6: relationship between Operative Time (Min) with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
OPERATIVE TIME (MIN)	50-100	84	1	85
	>100	1	4	5
Total		85	5	90

Chi square value = 55.918 p-value < 0.001 (Highly significant)Significant relation

Table 7: relationship between Intra Operative Findings with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
INTRA OPERATIVE FINDINGS	Clear anatomy	61	0	61
	Dense adhesions around calot's	1	2	3
	Dense omental adhesions	0	3	3
	Filmsy Adhesions	5	0	5
	Some omental adhesion	18	0	18
Total		85	5	90

Chi square value = 77.294 p-value < 0.001 (Highly significant)Significant relation

Table 8: relationship between Conversion to Open with Bile Spillage

		BILE SPILLAGE		
		N	Y	Total
CONVERSION TO OPEN	N	84	3	87
	Y	1	2	3
Total		85	5	90

Chi square value = 22.089 p-value < 0.001 (Highly significant)Significant relation

Table 9 : relationship between Acute Cholecystitis with Conversion to Open

		CONVERSION TO OPEN		
		N	Y	Total
HISTORY OF ACUTECHOLECYSTITIS	N	57	0	57
	Y	30	3	33
Total		87	3	90

Chi square value = 5.361 p-value = 0.021Significant relation

Table 10: relationship between History of Upper Abdominal Surgery withConversion to Open

		CONVERSION TO OPEN		
		N	Y	Total
HISTORY OF UPPER ABBDOMINAL SURGERY	N	81	3	84
	Y	6	0	6
Total		87	3	90

Chi square value = 0.222 p-value = 0.638No Significant relation

Table 11: relationship between Increased Gb Wall Thickness (≫4mm) and GBcontracted with Conversion to Open

		CONVERSION TO OPEN		Total
		N	Y	
INCREASED GB WALL THICKNESS (>4MM) and GB contracted	N	69	1	70
	Y	18	2	20
Total		87	3	90

Chi square value = 3.547 p-value = 0.060No Significant relation

Table 12: relationship Pericholecystic Collection with Conversion to Open

		CONVERSION TO OPEN		
		N	Y	Total
PERICHOLECYSTICCOLLECTION	N	83	2	85
	Y	4	1	5
Total		87	3	90

Chi square value = 4.564 p-value = 0.033Significant relation

Table 13: relationship between Stone At Neck/ Cystic Duct with Conversion toOpen

		CONVERSION TO OPEN		
		N	Y	Total
STONE AT NECK/ CYSTIC DUCT	N	81	1	82
	Y	6	2	8
Total		87	3	90

Chi square value = 12.792 p-value < 0.001 (Highly significant)Significant relation

Table 14: relationship between Operative Time (Min) with Conversion to Open

		CONVERSION TO OPEN		
		N	Y	Total
OPERATIVE TIME (MIN)	50-100	85	0	85
	>100	2	3	5

Total	87	3	90

Chi square value = 12.792 p-value < 0.001 (Highly significant)Significant relation

Table 15 : relationship between Intra Operative Findings with Conversion toOpen

		CONVERSION TO OPEN		
		N	Y	Total
	Clear anatomy	61	0	61
INTRA OPERATIVEFINDINGS	Dense adhesions aroundcalot's	0	3	3
	Dense omental adhesions	3	0	3
	Filmsy Adhesions	5	0	5
	Some omental adhesion	18	0	18
Total		87	3	90

Chi square value = 90.000 p-value < 0.001 (Highly significant)Significant relation

Table 16: relationship between Bile Spillage with Conversion to Open

		CONVERSION TO OPEN		
		N	Y	Total
BILE SPILLAGE	N	84	1	85
	Y	3	2	5
Total		87	3	90

Chi square value = 22.089 p-value < 0.001 (Highly significant)Significant relation

IV. DISCUSSION

Roheena Z Panni,[20] Et al made a study has shown that when performing laparoscopic cholecystectomy for acute cholecystitis the chief reason for conversionfrom laparoscopic cholecystectomy is inflammation. While other causes for conversion exist, inflammation and its consequences are the reason for conversion in the large majority of cases. Therefore, it can be concluded that conversion is a good marker for operative difficulty due to inflammation in laparoscopic cholecystectomy for acute cholecystitis. It may also be concluded that in patients with acute cholecystitis, preoperative identification of risk factors predictive of conversion will also predict operative difficulty due to inflammation. In the past thishas largely been assumed but now it is shown explicitly. This is of importance since such risk factors have been used to build severity grading systems for acute cholecystitis such as The Tokyo Guidelines.

Steven M Strasberg,[27] Et al on 2012 conducted a study on Extreme' vasculobiliaryinjuries: association with fundus-down cholecystectomy in severely inflamed gallbladders. They observed that Extreme vasculobiliary injuries comprise a small percentage of all vasculobiliary injuries. A recent analysis of literature identified 25 patients with such injuries, accounting for about 10% of all vasculobiliary injuries reported in literature. This figure corresponds closely to incidence of 8% estimated in this paper.

In present study, the average age of patients was 38.2 ± 9.23 years. Most of them were female 76.7 % . History of Acute Cholecystitis were present in 36.7 % . Conversion done in 3.3 % of the patients due to inflammation. This contradict the study done by Roheena Z Panni,[20] . They stated that when performing laparoscopic cholecystectomy for acute cholecystitis main cause for conversion to open cholecystectomy is inflammation. While other causes for conversion exist, inflammation and its consequences are reason for conversion in major number of cases. In the present study , Intra Operative Findings Clear anatomy 67.8 % , Denseadhesions around calot's 3.3% , Dense omental adhesions 3.3% , Some mental adhesions 5.6% and Some omental adhesion was 20% . Most of the studies found similar result regarding Intra operative findings. Operating time among the patients observed in the present study within 100 minutes 94.4% and more than 100 minuteswas only5.6 % . Among the patients, Stone At Neck/ Cystic Duct were present 8.9 % .J G Hunter, Et al on the article Avoidance of bile duct injury during laparoscopic cholecystectomy found similar result.

Gall bladder contents can be spilled during both in open and laparoscopic cholecystectomy, which are eliminated usually through direct removal, thorough irrigation and mopping in open surgeries. Right shoulder tip pain is a common shortterm complaint. In the present study only 3.3% Bile Spillage occurred. Bile spillageduring cholecystectomy, the surgical removal of the gallbladder, can occur for various reasons.

Gallbladder condition: If the gallbladder is inflamed or diseased, it may be more fragile and prone to rupture during surgery, leading to bile spillage.

Anatomy: Sometimes, the anatomy of the gallbladder and surrounding structures can be abnormal or difficult to navigate, increasing the risk of inadvertent bile spillage.

Technical factors: Inexperienced surgeons or difficult surgical cases may increase the likelihood of bile spillage. Additionally, factors such as excessive manipulation of tissues or inadequate visualization can contribute to bile leakage.

Adhesions**:** Scar tissue from previous surgeries or inflammation in the abdominal cavity can make dissection difficult and increase the risk of bile spillage.

Equipment failure: Rarely, equipment failure during surgery, such as instrument slippage or malfunction, can lead to unintended bile spillage.

While bile spillage is not ideal, it's a known complication of cholecystectomy and is usually managed intraoperatively by suctioning the spilled bile and irrigating the surgical field to minimize its effects. In most cases, bile spillage does not significantly impact patient outcomes, but it's essential for surgical team to take precautions to minimize complications and ensure patient safety.

In the present study there were no increase in Alkaline Phosphatase, Total Bilirubin and only one increase in WBC count. Regarding Pericholecystic collections develop after gallbladder perforation. Such collections have wide range of sonographic appearance ranging from anechoic to complex collections, and their internal characteristics seem to depend on the duration of pericholecystic process. In the present study only 5 (5.6 %) cases develop after gallbladder perforation. In present study, there were statistically significant relation found between age with History of Acute Cholecystitis, Increased gall bladder Wall Thickness (>4mm) And gallbladderContracted, Collection in pericholecystic region , Stone At Neck/ Cystic Duct, Operative Time (Min) , Intra Operative Findings, Conversion To Open9999l & Bile Spillage as the p-value was < 0.05 . But no statistically significant relation found with History of Upper Abdominal Surgery. A study done by Andall RG, Et al [23] found similar result.

V. CONCLUSION:

our study identifies several preoperative and intraoperative factors that predict the difficulty of laparoscopic cholecystectomy. Preoperative factors such as age, BMI, previous abdominal surgery, and imaging findings provide valuable insights into patient risk stratification and surgical planning. Intraoperative factors including anatomical variations, inflammatory changes, and technical challenges further contribute to the complexity of the procedure.

Understanding these predictive factors can aid surgeons in preoperative counselling, optimizing patient selection, and anticipating intraoperative challenges. Implementation of appropriate strategies, such as advanced imaging techniques, specialized equipment, and surgeon experience, may mitigate the risks associated with difficult cholecystectomies and improve patient outcomes.

Further research is warranted to validate our findings in larger cohorts and explore additional factors that may influence surgical difficulty. Ultimately, a comprehensive understanding of predictive factors will facilitate personalized approaches to laparoscopic cholecystectomy, ensuring safe and effective management of patients with gallbladder disease."

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