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PREOPERATIVE FACTORS AS INDICATORS OF SURGICAL COMPLEXITY IN CHOLECYSTECTOMY

Dr Narendra Kumar Sharma[1], Dr Mohit Kumar Jain[1], Dr Batti Lal Meena[2*]

[1]Assistant Professor, Department of General Surgery, SMS Medical College, Jaipur.

[2]Assistant Professor, Department of Pathology, SMS Medical College, Jaipur.

Corresponding Author: Dr Batti Lal Meena. drbattilal867@gmail.com

ABSTRACT

Introduction: Laparoscopic cholecystectomy (LC) stands as the established primary treatment for managing symptomatic gallbladder stone disease. Our assessment focused on objective preoperative factors in order to anticipate challenges that might arise during the cholecystectomy procedure.

Material and Methods: In this prospective clinical trial, conducted at a solitary surgical unit within S.M.S Medical Hospitals in Jaipur, we enrolled patients undergoing cholecystectomy through either open or laparoscopic approaches. The study was carried out between March 2023 and July 2023. Prior to the cholecystectomy procedure, abdominal ultrasonography was conducted on 48 patients. The operating surgeon then reaffirmed the ultrasound results during the surgical procedure. A thorough analysis was performed on numerous characteristics to discern the parameters that autonomously forecast the likelihood of encountering challenges during the cholecystectomy.

Results: In a group of 48 patients diagnosed with cholelithiasis via sonography, 26 (54.1%) underwent uncomplicated cholecystectomy, while 22 (45.8%) faced challenges, with laparoscopic cholecystectomy performed in this subgroup. The analysis identified independent predictors of difficulty, including elevated white blood cell count (WBC), reduced serum albumin, higher total bilirubin levels, and pericholecystic fluid presence detected by ultrasound. These factors were more common in acute cholecystitis cases. However, factors like male gender and diabetes did not show significant associations in the analysis.

Conclusion: These results highlight the potential to predict cholecystectomy difficulty using preoperative factors, particularly in acute cholecystitis cases. However, the correlation between clinical and pathologic diagnoses remains limited. Improving predictive capabilities has important implications for surgical care.

Keywords: Cholecystectomy, Cholelithiasis, pre-operative.

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INTRODUCTION

Cholecystitis can manifest suddenly, with symptoms like fever and intense pain in the right upper quadrant.[1] Laparoscopic cholecystectomy (LC) has become the established standard for treating symptomatic gallstones. However, various challenges can make LC difficult during surgery, including difficulties in accessing the peritoneal cavity, creating a pneumoperitoneum, dissecting the gallbladder, and extracting the excised gallbladder.[2] Researchers have extensively studied numerous parameters to analyze their effects on LC, ranging from individual variables to as many as 34 parameters, including age, sex, acute attacks requiring hospitalization, previous abdominal surgeries, presence of palpable gallbladder mass, abdominal scars, and patient BMI. Age is considered a risk factor for conversion in LC, possibly due to a long history of gallstones and an increased number of cholecystitis attacks.[3]

Surgeons may encounter difficulties during LC when faced with dense adhesions at Calot's triangle, a fibrotic and contracted gallbladder, an acutely inflamed or gangrenous gallbladder, or a cholycystoenteric fistula.[4] Existing literature consistently suggests that male gender is a significant risk factor for difficult LC. Prior upper abdominal surgery is also identified as a poor predictor for a safe LC due to the formation of adhesions, which can hinder the creation of pneumoperitoneum and make LC challenging.[5]

Occasionally, conversion to open cholecystectomy becomes necessary to prevent or repair injuries, clarify confusing anatomical relationships, or address associated conditions. However, such conversions have been linked to increased overall morbidity, surgical site infections, pulmonary infections, and longer hospital stays.[6] Accurately identifying a patient's risk for difficult cholecystectomy based on preoperative information can lead to more meaningful and precise preoperative counseling, improved operating room scheduling and efficiency, risk stratification for technical difficulties, and appropriate assignment of resident assistance. Moreover, it can enhance patient safety by minimizing the time to conversion and help identify cases where a planned open cholecystectomy is warranted. To address this need, we hypothesized that a scoring system based on objective preoperative data could be developed to predict difficulty during cholecystectomy. Such a system would be valuable in preoperative discussions with patients, improve patient safety considerations, and optimize the allocation and efficiency of resources in the operating room.

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Material and Methods

The study was carried out at the S.M.S Medical Hospital in Jaipur and focused on patients undergoing cholecystectomy, either through open or laparoscopic methods, within a single surgical unit. This was a prospective study that included all patients undergoing cholecystectomy, regardless of their age, gender, physique, or parity.

The indication for cholecystectomy varied; some patients required cholecystectomy alone due to gallstone disease, while in other cases, cholecystectomy was performed as an allied procedure along with other surgical interventions such as Whipple's procedure, choledochal cyst excision, and similar procedures. The study aimed to examine the outcomes and factors related to cholecystectomy in this diverse group of patients.

Parameters observed in each patient were-

During the patient evaluation, a detailed medical history was taken, emphasizing symptoms related to biliary colic, previous colic attacks, jaundice, and history suggestive of pancreatitis. Comorbid conditions, including diabetes mellitus (DM), hypertension (HT), significant illnesses, and prior symptoms, were recorded. Vital signs were assessed during the general physical examination, and the abdominal examination focused on detecting tenderness, guarding, and palpable masses or organ enlargement. Routine investigations, such as Complete Blood Count (CBC), Bleeding Time (BT), Clotting Time (CT), Prothrombin Time (PT), INR, HIV, HBsAg, Blood Urea, Serum Creatinine, and Blood Sugar, were conducted. Specific investigations like Ultrasonography (USG) of the abdomen, MRI, MRCP, LFTs, and HPE were performed selectively, noting findings on imaging studies whenever available. Intraoperative findings were meticulously recorded, encompassing gallbladder wall thickness, number of stones, empyema gall bladder, adhesions, Calot's triangle anatomy, cut section appearance, level of difficulty, and surgery duration, excluding port insertion and closure times. Post-operative morbidity/mortality were closely monitored, including complications like wound infections, bile leaks, bleeding, or readmissions. The comprehensive data collection aimed to aid treatment decisions and contribute to further research in managing gallbladder-related issues.

Histopathological Study: Histopathological analysis was conducted on recently collected samples using a light microscope after staining with hematoxylin and eosin stain. The laboratory values obtained just before the operation were carefully recorded. An elevated white blood cell count (WBC) was defined as exceeding 11,000 cells per milliliter (ml), while low serum albumin was considered to be below 1.5 grams per deciliter (g/dL).[7]

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RESULTS

Table 1: Complete Blood Count, Blood Sugar and Renal Function Tests

No .of Blood Investigation	No.of Patients	Percentage	Mean
Decreased Hb	11	22.9	12.08
Increased TLC (10^3)	14	29.1	8.41
Neutrophilia (in %)	3	6.2	65.51
Increased Blood Sugar (Random)	2	4.1	91.05
Increased Blood Urea	1	2.04	26.03
Increased Serum Creatinine	1	2.04	0.8

Figure 1: USG Finding

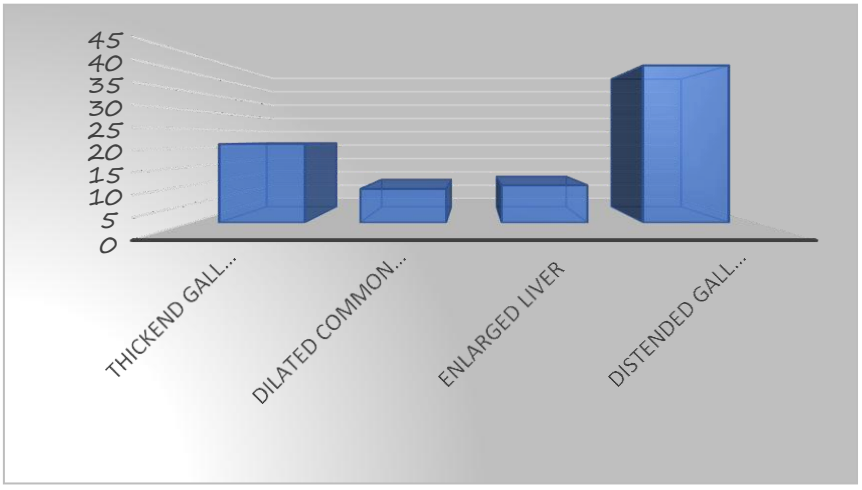

Figure 2: Reasons for difficult cholecystectomy

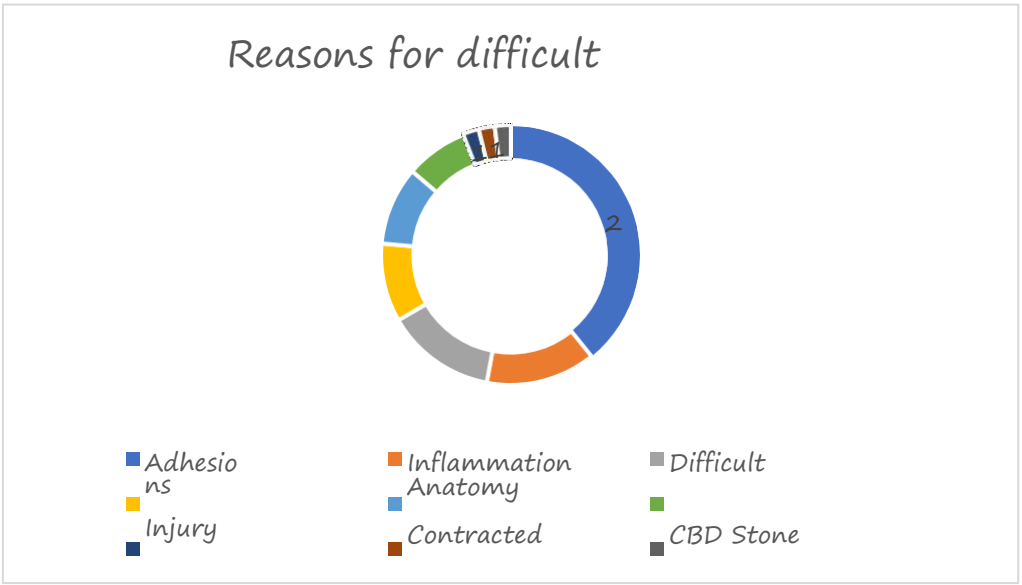

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Table 2: Liver Function Tests

Liver Function Test	No. of Patients	Percentage	Mean
Increased Serum Bilirubin (Total)	9	18.7	1.26
Increased Serum Bilirubin (Direct)	7	14.58	0.91
Increased SGOT	14	29.6	45.51
Increased SGPT	13	27.1	53.1
Increased Alk. Phos.	17	35.4	220.6
Decreased Albumin	13	27.1	3.8

Table 3: Predictors and Value of Findings for Patients undergoing Cholecystectomy

Level of Difficulty	No. of Patients	Laparoscopic/ Open Cholecystectomy		Presence of Adhesions	Requirement of Drain	Duration of Operation (in min)
		Lap	Open			
Normal	26	15	11	10	6	24-41
Difficult	22	8	14	20	13	>40

We observed a total of 48 patients with gall bladder disease. Among them, 26 patients (54.1%) underwent a straightforward normal cholecystectomy. In 10 patients (38.4%), adhesions were present, but they were mostly easy to separate from the gall bladder during the procedure. Fortunately, there were no postoperative complications, except for mild abdominal pain, typically around the wound sites.

During the surgeries, we only placed a sub hepatic tube drain in six patients, which was removed the next day with minimal blood discharge. The duration of cholecystectomy varied between 25 to 40 minutes. However, in 22 cases (45.8%), we encountered some difficulties during the cholecystectomy. The assessment of difficulty was based on various operative parameters, including the duration of surgery, bleeding, dissection of calot's triangle, dissection of gall bladder wall adhesions, and the complexity of gall bladder extraction.

In 90.9% of the cases classified as "difficult" procedures, we encountered dense adhesions that posed challenges in separating the gall bladder from nearby structures. Consequently, these cases required careful and time-consuming dissection to ensure a safe operative field. Additionally, we placed a sub hepatic tube drain in 13 patients (59.6%) with difficult cholecystectomy, and all drains were successfully removed within 24 hours. The duration of a "difficult" cholecystectomy exceeded 40 minutes.

Several factors were found to be independently predictive of difficult cholecystectomy. These

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factors included increased total leukocyte count (TLC) observed in 14 patients, decreased albumin levels in 14 patients, increased total bilirubin levels in 9 patients, and pericholecystic fluid in 1 patient.

Among the 22 patients (45.8%) who experienced difficulty during cholecystectomy, the most common reasons were adhesions in 20 patients (41.6%), inflammation in 7 patients (14.5%), unclear anatomy in 7 patients (14.5%), and surgical injury in 5 patients (10.4%).Additionally, 5 patients (10.4%) had contracted gall bladders, 4 patients (8.3%) had CBD (common bile duct) stones, and there were isolated cases of empyema of the gall bladder, gall bladder perforation, and choledochal cyst in 1 patient each (2.1%).

DISCUSSION

In the current era, laparoscopic cholecystectomy is widely accepted as the preferred and gold standard treatment for symptomatic cholelithiasis. To ensure successful planning and execution of laparoscopic surgery, it is crucial to predict the risk of conversion from laparoscopic to open cholecystectomy, which can be a significant aspect to consider. Over the years, several studies have been conducted to identify risk factors for difficult laparoscopic cholecystectomy (LC).[8] The clinical profile of a patient can provide valuable insights into the likelihood of encountering challenges during gallbladder surgery. According to the existing literature, age has been identified as a risk factor for difficult gallbladder surgery.[9] Moreover, previous studies have also recognized age as a risk factor for conversion from laparoscopic to open cholecystectomy.[10] However, it is important to note that our study and some other authors' findings did not observe age to be significantly associated with the conversion rate.[10]

In numerous worldwide studies, male sex has been consistently associated with difficult laparoscopic cholecystectomy (LC).[11] Lein and Huang conducted research that concluded male gender as a risk factor for severe symptomatic cholelithiasis.[12] In a study by Kumar A et al[13], which included 21 males (10%) and 189 females (90%), they reported that the total time taken for the LC procedure and the conversion rate to laparotomy were significantly higher for men compared to women. These findings are consistent with previous reports.[9,14,15] However, the specific reasons behind the increased risk of conversion to laparotomy for men are not entirely clear. Some studies suggest a more frequent association of men with severe, acute, and chronic gallbladder disease, which might contribute to the higher risk of conversion.[16] Further research is needed to fully understand the underlying factors contributing to the observed gender differences in LC outcomes.

The data from our study indicates that elevated white blood cell (WBC) count, elevated total

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bilirubin levels, low albumin levels, and the presence of pericholecystic fluid on ultrasound are associated with difficulties in cholecystectomy. Initially, the clinical diagnosis of acute cholecystitis was considered a significant predictor of difficulties in the procedure, but its correlation with pathological findings was found to be poor, leading us to exclude it from the analysis. However, all four factors that independently predicted difficulties in cholecystectomy were observed more frequently in patients diagnosed with acute cholecystitis. Our analysis suggests that relying on objective parameters rather than solely on the clinical suspicion of acute cholecystitis provides a more accurate prediction of difficulties in cholecystectomy, improving preoperative planning and decision-making for patients undergoing the procedure.

In a study conducted by Chand P et al.[17], it was observed that 83.3% of the patients predicted to have moderately difficult cholecystectomy and 66.7% of those predicted to have very difficult cholecystectomy had abnormal liver function tests. This finding is consistent with a study by Alponat et al.[18]

Previous studies[19,20] have already reported an association between elevated white blood cell (WBC) count and difficulties in cholecystectomy. This parameter is thought to reflect the inflammatory response linked with more acute diseases and is often present in cases of acute cholecystitis.

Hypoalbuminemia has also been identified as a risk factor for difficulties in cholecystectomy.[7] It is often a result of severe acute inflammation associated with acute cholecystitis, leading to reduced albumin synthesis. Additionally, hypoalbuminemia can be caused by protein-calorie malnutrition or reduced hepatic synthetic function due to conditions like cirrhosis or other hepatic diseases. Pericholecystic fluid, which results from the translocation of fluid from surrounding tissues due to severe inflammation of the gall bladder, has been previously demonstrated to predict conversion to open cholecystectomy.[21,22] In this study, pericholecystic fluid was found to be an important radiographic finding predictive of difficulties in cholecystectomy. Moreover, acute cholecystitis was more commonly observed among patients with pericholecystic fluid detected on ultrasound.

Lipman conducted a study that showed several factors to be independent predictors of conversion from laparoscopic to open cholecystectomy. These factors include male gender, elevated white blood cell count (WBC), low serum albumin levels, ultrasound findings of pericholecystic fluid, the presence of diabetes mellitus, and elevated total bilirubin levels. Importantly, all six of these factors were more commonly observed in patients who had a diagnosis of acute cholecystitis.[7]

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CONCLUSION

Laparoscopic cholecystectomy (LC) has become the preferred treatment for symptomatic gallstone disease, recognized as the gold standard. Elderly patients are more likely to encounter challenges during LC procedures. While cholecystitis is more common in females, difficulties during LC are encountered more frequently in males. Patients with recurrent cholecystitis are prone to experiencing more surgical difficulties. Abnormal serum hepatic and pancreatic enzyme profiles are associated with increased difficulty during the surgery. Preoperative ultrasound (USG) is a valuable tool for predicting potential difficulties during LC. Specific features observed during USG, such as a distended or contracted gallbladder, are associated with subsequent challenges during the surgical procedure. Although LC is generally safe and straightforward, there are instances when it can be difficult. What an inexperienced laparoscopic surgeon may perceive as difficult, an experienced laparoscopic surgeon mayfind relatively simple due to their skill and expertise in the procedure.

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