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Original Research Article

Assessment of Preoperative and Intraoperative Factors for Difficult Laparoscopic Cholecystectomy: An Observational Study

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Abstract:

Introduction: Cholelithiasis is one of the commonest biliary tract diseases worldwide.

Aim: To evaluate preoperative factors and operative findings associated with difficult laparoscopic cholecystectomy in patients with cholelithiasis and gallbladder polyp disease.

Methodology: A study was conducted involving 161 patients who were scheduled to undergo laparoscopic cholecystectomy for gallstone disease and gallbladder polyps at the Department of General Surgery, Maharana Bhupal Government Hospital & RNT Medical College, Udaipur, Rajasthan, from November 2023 to June 2024.

Result: In our study of 161 patients, significant factors influencing surgical outcomes included age, history of hospitalisation for acute cholecystitis, gallbladder wall thickness, presence of pericholecystic fluid and adhesions, with a notable correlation between these factors and increased difficulty in laparoscopic cholecystectomy, supported by a scoring system that predicts surgical challenges with high sensitivity and specificity.

Conclusion: Our study highlights that while laparoscopic cholecystectomy is generally safe, factors such as history of cholecystitis, palpable gallbladder, gallbladder wall thickness, pericholecystic fluid, intraperitoneal adhesions, and high BMI significantly influence surgical difficulty and conversion rates, thereby enhancing preoperative assessment and decision-making.

Keywords: difficult laparoscopic cholecystectomy, factors, gall stones.

Introduction

Cholelithiasis is one of the commonest biliary tract diseases worldwide [1,2]. It is the most common surgical condition requiring intervention [3,4]. Cholelithiasis can be symptomatic as well as asymptomatic and was traditionally dealt with by conventional or open cholecystectomy [5,6]. Laparoscopic cholecystectomy (LC) has become the gold standard for treating symptomatic cholelithiasis and gallbladder pathologies [7] since the late 1980s [8] largely replacing open cholecystectomy due to benefits like smaller incisions, less pain, and quicker recovery and decrease overall morbidity [9,10].

However, the procedure can sometimes become difficult, and predicting the ease or complexity of the surgery preoperatively remains challenging [11]. Preoperative factors influencing the difficulty of laparoscopic cholecystectomy are numerous and multifaceted [7], with patient demographics playing a crucial role. Age is significant [12], as elderly patients often have longer histories of gallbladder disease, leading to increased inflammation and adhesions Gender also affects complexity, with females more prone to gallstones, while males may experience more severe inflammation. Additionally, obesity complicates the procedure through challenges in port placement and visualization [13]. Previous abdominal surgeries are a key preoperative factor predicting difficult laparoscopic cholecystectomy (LC) [14], as they can lead to intra-abdominal adhesions that alter anatomy and making access to the gallbladder more challenging [15].

The location and extent of prior incisions, especially in the upper abdomen, further influence difficulty. Additionally, the nature of the gallbladder pathology is crucial; acute cholecystitis can cause significant tissue inflammation and friability, while chronic cholecystitis may result in a contracted, fibrotic gallbladder that is challenging to manipulate. Severe complications like empyema, gangrenous cholecystitis, and perforations greatly increase the technical difficulty of laparoscopic cholecystectomy (LC) and the risk of converting to open surgery [8]. Gallstone characteristics—such as size,

number, and location—also play a crucial role; large stones, especially those impacted in the neck or cystic duct, can distort Calot's triangle, complicating dissection. Multiple small stones may lead to extraction difficulties and spillage [16]. Ultrasonography, the preferred imaging modality for gallbladder disease, can help identify intraoperative challenges [17], such as a thickened gallbladder wall or signs of acute inflammation. Advanced imaging modalities like MRCP and CT can provide valuable insights in complex gallstone cases [18], though they are not routinely used for uncomplicated disease. Laboratory tests, including elevated liver function tests and white blood cell counts, help assess potential surgical difficultie [19]. Intraoperatively, adhesions from previous surgeries complicate access and dissection, while a distended gallbladder can increase the risk of perforation [20]. Achieving the "critical view of safety" is essential to prevent bile duct injuries, but severe inflammation and anatomical variations can make this challenging. Bleeding, although rare, can obscure the surgical field and complicate the procedure. The surgeon's experience and equipment quality significantly influence procedural difficulty [2]1, with disparities noted in different healthcare settings, particularly in India. The decision to convert to open surgery is critical and varies widely, impacting surgical time, costs, and patient morbidity [22].

Aim

To evaluate preoperative factors and operative findings associated with difficult laparoscopic cholecystectomy in patients with cholelithiasis and gallbladder polyp disease.

Methodology

A study was conducted involving 161 patients who were scheduled to undergo laparoscopic cholecystectomy for gallstone disease and gallbladder polyps at the Department of General Surgery, Maharana Bhupal Government Hospital & RNT Medical College, Udaipur, Rajasthan, from November 2023 to June 2024.

The study received ethical approval and informed written consent was obtained from all participants. Inclusion criteria for the study included patients with calculus cholecystitis, gallbladder polyps, and acalculous cholecystitis, all aged over 12 years. Exclusion criteria encompassed patients with carcinoma of the gallbladder, choledocholithiasis and dilated common bile duct, gallbladder perforation, and preoperative Mirizzi's syndrome.

Result

Table 1: Age distribution

Age in years	No of patients	Percentage
<30	26	16.14%
31-40	29	18.01%
41-50	42	26.08%
51-60	34	21.11%
>60	30	18.63%

In our study group, the age of the patients varies from range 16-87 year. The most common age group is 41-50 years comprising 26.08% of cases. The combined mean age is 47.06 years.

Table 2: Previous hospitalisation

Previous hospitalisation	No of patients	Percentage	Surgical outcome	Easy	Difficult	Very difficult
Yes	23	14.29%		6	14	3
No	138	85.71%		126	7	5
P-value 0.0						

Majority of patients (85.71%) had no previous hospitalization in our study previous hospitalization in predicting difficult laparoscopic cholecystectomy.

Table 3: GB palpable

GB palpable	No. Of patients	Percentage	Surgical outcome	Easy	Difficult	Very difficult
Yes	1	0.62%		0	0	1
No	160	99.37%		132	21	7
P-value 0.0000662						

Gall bladder was not palpable in 99.37% of individuals in this study. The surgical outcome was difficult in patients with palpable gallbladder (p-value 0.000066). Hence the data is statistically significant.

Table 4: Ultrasonography finding

Ultrasonography finding		No. of patients	Percentage	Surgical outcome	Easy	Difficult	Very difficult	P value
GB wall thickness > 4mm	Yes	30	18.63%		14	12	4	0.000000156
	No	131	81.37%		118	9	4	
Pericholecystic collection	Yes	20	12.42%		7	9	4	0.0000000337
	No	141	87.58%		125	12	4	

In our study, 81.37% of patients had gallbladder wall thickness less than 4 mm, while 18.63% had thickness greater than 4 mm; the presence of pericholecystic fluid collection was noted in 12.42% of cases, and laparoscopic cholecystectomy was significantly more difficult in patients with thickened walls (p-value 0.00000015), highlighting the importance of these factors in surgical outcomes.

Table 5: Pre-op scoring

Scoring	No. of patients	Percentage	Surgical outcome	Easy	Difficult	Very difficult	P value
Easy	142	88.20%		131	6	5	2.252 x 10-23
Difficult	18	11.18%		1	15	2	
Very difficult	1	0.62%		0	0	1	

Preoperative scoring predicted around cholecystectomy to be easy in 88.20% Difficult in 11.18% and very difficult in less than 0.62% of patients. Pre-op scoring is statistically significant in predicting the surgical outcome.

Table 6: Gall bladder appearance intraoperative and Pericholecystic adhesion intraoperative

GB appearance	No. of patients	Percentage	Surgical outcome	Easy	Difficult	Very difficult	P value
Distended & normal	68	42.23%		64	3	1	0.012
Distended & inflamed	65	40.37%		49	12	4	
Contracted	28	17.39%		19	6	3	
Percholecystic adhesion							
Without adhesion	108	67.08%		102	5	1	3.03x10-12
Adhesion < 50%	27	16.77%		21	6	0	
Adhesion > 50% or buried GB	26	16.14%		9	10	7	

In our study of 161 patients, 42.23% had distended and normal gallbladders, 40.37% had distended and inflamed gallbladders, and 17.39% had contracted gallbladders, while adhesion was present in 32.92% of cases; significant differences were noted in surgical outcomes among those with distended and inflamed gallbladders and pericholecystic adhesions.

Table 7: Usefulness of pre-op scoring system parameters

Parameters	Easy	Difficult	Very difficult
Sensitivity	92.25%	65.21%	12.5%
Specificity	94.73%	99.27%	100%
Positive predictive value	99.24%	93.75%	100%
Negative predictive value	62.06%	94.48%	95.62%
Accuracy	92.54%	94.40%	95.65%

The scoring system effectively predicts difficult surgical outcomes with a sensitivity of 65.21%, specificity of 99.27%, and an accuracy of 94.40%, while predicting very difficult outcomes requiring conversion with a sensitivity of 12.5%, 100% specificity, and 95.65% accuracy.

Discussion

In this study, out of 161 patients, 97 (60.24%) patients aged < 50 years and 64 (39.75%) patient age >50 years. Our study correlates with Pujahari et al. [23] this study has 228 cases. The age ranges from 9 years to 71 years with a mean of 44.37 years (SD ± 12.45). Maximum cases were in the age group of 30–50 years (54.4%) In this study, 14.29% of patients had a history of hospitalisation for acute cholecystitis, and among these, 60.86% faced difficult surgical outcomes, indicating a significant correlation between prior hospitalisation and surgical difficulty. Khetan AK et al. [24] this study out of 30 patients, 9 (30%) patients had a previous history of admission; 4 (13.33%) for acute cholecystitis,

and 5 (16.67%) for biliary colic. out of 9 patients, 6 (66.67%) patients have a difficult outcome. The history of hospitalisation due to cholecystitis has a significant correlation with the difficulty. Out of 161 patients, 1 (0.62%) patient had a palpable gallbladder. patients had very difficult surgical outcomes resulting in conversion.

A palpable gallbladder was found to be a significant factor in this study. Pujahari et al. [23] In this study, they found that of a total of 114 cases, 14 cases had palpable gallbladder and 8 cases had a difficult laparoscopic cholecystectomy. Palpable gallbladder found a significant correlation with difficult outcomes in this study. In our study out of 161, 30 (18.63%) patients had thickened gallbladder walls.

Out of which 12 (40%) patients had difficult surgical outcomes and 4 (13.34%) patients had very difficult surgical outcomes requiring conversion. Thickened Gallbladder is a significant factor in this study. Khetan AK et al. [24] study they found that out of 30 cases, 6 (20%) cases have thickened gallbladder walls and all cases have difficult surgical outcomes. They found an extremely significant correlation between the GB wall thickness and the difficulty level of surgery.

In our study, 12.42% of patients had pericholecystic collections, with 45% experiencing difficult surgical outcomes, highlighting its significance. Additionally, 40.37% of patients had a distended gallbladder, where 18.46% faced difficult outcomes, while 17.39% had a contracted gallbladder, correlating with increased surgical challenges. Bhagavan BC et al. [25] In a study of 31 cases, 48.39% had a distended gallbladder, while 51.61% had a normal gallbladder. Although all difficult cases were associated with a distended gallbladder, the overall analysis indicated no significant correlation between gallbladder distension and surgical outcomes. Pericholecystic adhesion had a significant correlation with difficult and very difficult surgical outcomes. Bhagavan BC et al. [25] In this study, In a study of 31 cases, 77.41% had no adhesions, while 22.58% did.

All easy cases showed no adhesions, while all difficult and extreme cases were associated with adhesions, indicating a strong correlation between adhesion presence and surgical difficulty. They found a significant association between adhesion and surgical outcome in this study. In our study we found a significant correlation between preoperative scoring and surgical outcomes, with 88.20% of cases categorized as easy. Among the difficult cases, intraoperative assessments showed that 5.55% were still considered easy, while 100% of very difficult cases confirmed their predicted difficulty. Bhagavan BC et al. [25], In the study among those with Easy22 (70.96%) Preoperative score, 20 (90.9%) had easy, and 2 (9.1%) had moderate Intraoperative score. Among those with difficulty 9 (29.09%) had preoperative scores, 3 (33.3%) had easy, 1 (11.1%) had moderate, 2 (22.2%) had difficulty and 3 (33.3%) had extreme intraoperative scores. There was a significant association between Pre-operative score and Intra-operative score. The scoring system effectively predicts difficult surgical outcomes in laparoscopic cholecystectomy, showing a sensitivity of 65.21% and a specificity of 99.27%, with high positive and negative predictive values. It also accurately forecasts very difficult cases requiring conversion, achieving a sensitivity of 12.5% and an accuracy of 95.65%, Mohanaraja et al. [26]

The scoring system is useful as it predicts very difficult surgical outcomes requiring conversion with a sensitivity of 63.64% and a specificity of 94.70%. Also, the positive predictive value is 87.50%. This scoring system predicts difficult surgical outcomes requiring conversion with an accuracy of 83.33%.

Conclusion

Laparoscopic cholecystectomy is a safe procedure for managing gallstone disease, with our study revealing several key findings. Gallstone disease is more prevalent in females, but this does not significantly impact surgical outcomes. A history of cholecystitis and a palpable gallbladder are associated with increased surgical difficulty, along with radiological indicators such as gallbladder wall thickness and pericholecystic fluid collection.

Intraoperative factors like a contracted or distended gallbladder and intraperitoneal adhesions also contribute to procedural challenges. Additionally, a high BMI correlates with a greater risk of gallstone disease and higher conversion rates to open surgery. Overall, our study aids in preoperative assessments, allowing for better patient counseling and earlier decision-making regarding potential conversion to open cholecystectomy in high-risk cases.

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