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A clinical study to determine predictive factors for difficult laparoscopic cholecystectomy

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Abstract

Background: Cholelithiasis, affecting 10–15% of the population, is commonly treated with laparoscopic cholecystectomy. However, in 5–10% of cases, conversion to open surgery is required due to complications. This study aimed to identify predictive factors for difficult laparoscopic cholecystectomy and develop a preoperative scoring system.

Methods: A prospective study was conducted at Government Medical College Kota from January 2020 to January 2022, involving 50 patients with confirmed cholelithiasis on ultrasound. Preoperative risk factors were evaluated, and each patient was assigned a score based on clinical assessment and sonographic findings (score <5: easy, 6–10: difficult, 11–15: very difficult).

Results: The highest incidence of cholelithiasis occurred in the 5th decade of life, predominantly in females. Abdominal pain was the most common symptom. Significant predictors of difficult laparoscopic cholecystectomy included:

- BMI >27.5 (P<0.0001)
- History of prior hospitalization (P<0.0011)
- Palpable gallbladder (P<0.0245)
- Impacted stone (P<0.0170)
- Pericholecystic collection (P<0.0392)

The preoperative scoring system had a positive predictive value of 91.89% for easy cases and 100% for very difficult cases. The conversion rate to open cholecystectomy was 6%.

Conclusion: The proposed scoring system effectively predicts difficult laparoscopic cholecystectomy, aiding in preoperative planning and decision-making.

Keywords: Laparoscopic Cholecystectomy, Predictive Factors, Scoring System.

Introduction

Cholelithiasis, or the presence of gallstones, is the most common biliary disorder, affecting around 10-15% of the population. However, more than 80% of people with gallstones do not experience symptoms. The prevalence of gallstones varies across regions. In India, about 4% of the population is affected. A study focused on railroad workers found that the occurrence of gallstones in North Indians is seven times higher than in South Indians [3] In the United States, it is estimated that at least 20 million people have gallstones, with approximately 1 million new cases diagnosed each year. The rising incidence of cholelithiasis in India is attributed to factors such as westernization of lifestyle, increased access to diagnostic tools like ultrasound, and changes in the socioeconomic structure.

Most individuals with gallstones remain asymptomatic, but around 1-2% of those who are asymptomatic will develop symptoms that require surgical intervention, making cholecystectomy one of the most commonly performed surgeries by general surgeons. Gallstones are rare in individuals under the age of 20, with the incidence gradually increasing after 21 years, peaking in the 5th and 6th decades. Women are more likely to be affected than men, with a ratio of approximately 4:1.[1]

In 1992, the National Institutes of Health (NIH) recognized laparoscopic cholecystectomy as a safe and effective treatment for symptomatic gallstones. Since its introduction, the number of laparoscopic cholecystectomies performed in the United States has increased from 5 lakh to 7 lakh annually.[2] This surgical technique offers several benefits over traditional open surgery, including quicker recovery, reduced postoperative pain, shorter hospital stays, and better cosmetic outcomes due to smaller incisions.[3] Additionally, laparoscopic cholecystectomy is associated with a lower risk of infections, better preservation of immune function, and less inflammation compared to open surgery.[4]

Laparoscopic cholecystectomy has become the gold standard for treating cholelithiasis, gradually replacing open cholecystectomy. However, in about 5-10% of cases, laparoscopic surgery may need to be converted to open surgery due to complications or challenges encountered during the procedure. This highlights the need to identify predictive factors for difficult laparoscopic cholecystectomy, which is the focus of the study undertaken.

Aims and objectives of the study

- To determine the predictive factors for difficult laparoscopic cholecystectomy.
- To study the clinical presentation of cholelithiasis
- To study the surgical mode of management.
- To study the complications of laparoscopic cholecystectomy.

Methodology

This study, titled "A Clinical Study to Determine Predictive Factors for Difficult Laparoscopic Cholecystectomy," was conducted at Government Medical College, Kota, involving 50 patients admitted between January 2020 and January 2022. The study focused on patients presenting with upper abdominal pain, vomiting, dyspepsia, or jaundice. After a detailed clinical evaluation, patients with confirmed cholelithiasis on ultrasound were included, following informed consent. Routine hematological and biochemical investigations, including liver function tests (LFT) and prothrombin time-INR (PT-INR), were performed. Imaging studies like OCG, ERCP, and PTC were not routinely done, as they were unnecessary in cases of cholecystectomy without choledocholithiasis.

The preoperative evaluation included demographic details, history of previous hospitalizations, body mass index (BMI), abdominal scar location (supraumbilical or infraumbilical), palpable gallbladder, and sonographic findings such as gallbladder wall thickness, pericholecystic collection, and impacted stones. Symptomatic treatment was provided to all patients.

Based on the clinical and sonographic findings, each patient was assigned a score (1 day prior to surgery) to predict the difficulty level of laparoscopic cholecystectomy. A score of <5 was classified as "easy," 6–10 as "moderately difficult," and 11–15 as "very difficult."

All surgeries were performed laparoscopically by a single surgeon. Intraoperative parameters such as surgery duration, biliary/stone spillage, injury to the bile duct or artery, and any conversions to open surgery were noted. Postoperative care included monitoring for complications. The drain was removed between the 2nd and 5th postoperative day, depending on drainage output, and sutures were removed on the 8th day. All patients were followed up to check for any recurrent symptoms or complications.

The primary outcome measures were postoperative complications, recurrence of symptoms or gallstones, and patient satisfaction.

Inclusion Criteria

The patients aged between 16 and 60 yrs presenting with symptoms and signs of Cholelithiasis/Cholecystitis and diagnosed by USG examination in surgery Department MBS Hospital and New Medical College Hospital, Kota.

Exclusion Criteria

1. Patients below 15 years of age.
2. Patients with CBD calculus, raised ALP, dilated CBD, where CBD exploration was needed.
3. Patients with features of obstructive jaundice.
4. Patients not willing for laparoscopic cholecystectomy.

Results

This study included 50 cases that were studied prospectively over a period of 2 years and between Jan 2020 to end January 2022.

Age Distribution

In the present series the youngest patient was 17 yrs of age and the oldest was 60 yrs of age. Majority of the patients in the present series were in the age group of 41-50 yrs of age.

Table 1: Showing the age wise distribution of cholelithiasis.

Age In Yrs	Present Series	%
0-10 yrs	0	0%
11-20 yrs	2	4%
21-30 yrs	10	20%
31-40 yrs	12	24%
41-50 yrs	18	36%
51-60 yrs	8	16%
>61 yrs	0	0%

Sex Distribution

Out of 50 patients 33 were females and 17 were male patients. The male: female ratio is 1:1.9.

Table 2: Showing sex wise distribution of cholelithiasis

Sex	Present Series	%
Male	17	34%
Female	33	66%

Presenting Symptoms

Pain was the predominant symptom seen in all 50 patients. Vomiting was present in 44% of the patients with pain. 1 patient had jaundice and 24% had dyspepsia.

Table 3: Showing presenting symptoms

Symptoms	Present Series	%
Pain	50	100%
Vomiting	22	44%
Jaundice	1	2%
Dyspepsia	12	24%
Fever	4	8%

Presenting Signs

Tenderness in right hypochondrium was present in 42 patients, Guarding and rigidity in 2 patients and a mass was palpable in 3 patients.

Table 4: Showing presenting signs

Symptoms	Present Series	%
Pain	50	100%
Vomiting	22	44%
Jaundice	1	2%
Dyspepsia	12	24%
Fever	4	8%

Correlation with Blood Group

Out of the 50 patients 26 had of blood group 'O', 14 had of blood group 'B', 8 had of blood group 'A' and 2 had blood goup 'AB'.

Table 5: Showing correlation with blood group

Blood Group	Present Series	%
A	8	16%
B	14	28%
AB	2	4%
O	26	52%

Ultrasonography

All the 50 patients had stones in gallbladder, 20 patients had wall thickening and 8 had pericholecystic collection. 32 patients had multiple calculi, 10 had solitary calculi and 8 had solitary impacted calculi.

Table 6: Showing ultrasonography findings of present study

Ultrasonography	No of Cases
Multiple calculi	32
Solitary calculi	10
Solitary impacted calculi	8
Wall thickening	20
Pericholecystic collection	8

Correlation of pre-op score and the outcome

2 patients in whom lap. was converted to open, were having dilated CBD. Therefore, these 2 patients were excluded from the study. One out these, one required CBD exploration with T tube insertion.

Table 7: Showing correlation of pre-op score and the outcome

Pre-Op Score	Easy	Difficult	Very Difficult	Total
0-5	34	2	1	37
6-10	2	7	2	11
11-15	0	0	2	2
Total	36	9	5	50

Analysis of Per-Operative Outcome with The Risk Factors

D-Difficult E-Easy PS-Present Study R-Journal with reference to no32 bibliography NP-Non palpable N-Normal P Value-Predictive value.

As per the R[32] study prior hospitalization, BMI >27.5, Palpable GB, Thick GB wall on USG were significant predictors of difficult laparoscopic cholecystectomy.

In the present study prior hospitalization, BMI >27.5, Palpable GB, Thick GB wall, impacted stone and Pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy.

Table 8: Showing the analysis of pre-operative outcome with the risk factors

Risk factors	Level	Per-op outcome		P value	
		D-no (%)	E-no (%)	Ps	R[32]
Age	<= 50 y	8	30	1.000	0.937
	>50 y	2	8		
Sex	Female	7	26	0.6974	0.736
	Male	2	13		
Bmi wt(kg)/ht(m²)	<=25	2	26	0.5698	0.227
	25.1-27.5	2	10		
	>27.5	7	1	<0.0001	0.010
Previous surg	Nil	7	25	0.6974	0.882
	Yes	2	14		
Hospitalization	Nil	6	38	0.0011	<0.001
	Yes	4	0		
Gb palpable	Np	7	37	0.0245	0.022
	Yes	3	1		
Usg- wall thick	N	1	31	0.0001	0.038
	Yes	9	7		
Impacted stone	Nil	5	36	0.0170	0.190
	Yes	4	3		
P/c collection	Nil	7	34	0.0392	0.999
	Yes	4	3		

Fischer exact test was used to find the significant association of findings of preoperative score with peroperative outcome.

Post-Operative Complication

Only 3 patients had infection of the epigastric port site which required about 2 to 3 dressing.

Table 9: Showing postoperative complications

Post-Operative Complication	No. of Cases
Wound infection	3
Haemorrhage	0
Retained stone	0
Bile leak	0
Prolonged ileus	0

Histopathological Examination

48 cases were reported as chronic cholecystitis, while 2 was reported as acute cholecystitis. No case of malignancy of the GB was detected.

Table 10: Showing histopathological examination

Histopathologic Examination	No. of Cases
Chronic Cholecystitis	48
Acute Cholecystitis	2
Ruptured Gall Bladder	0
Gangrenous Gall Bladder	0

Discussion

Age Distribution

The majority of patients in this study were aged 41-50 years. In comparison, Herman's series found most patients in the 51-60 age range.[5] while Hanif's series observed the majority in the 41-50 age group.[6]

Sex Distribution

Out of 50 patients, 33 were female and 17 were male, giving a male-to-female ratio of 1:1.9. In Battachary's series, 71.4% of patients were female, and 28.6% were

male.[7] Hanif's series showed a slightly different distribution, with 36% male and 64% female patients.[6]

Presenting Symptoms

Pain: Pain was a universal symptom, present in all 50 patients with chronic recurring pain. In 84% (42) of patients, the pain was in the right hypochondrium. Comparatively, pain was also the most common symptom in Ganey's series and Alok Sharma's series.[8,9]

Vomiting: Present in 44% of cases, vomiting was typically spontaneous and occurred with pain attacks.

Jaundice: Jaundice was seen in one patient, obstructive in nature, requiring ERCP with CBD stenting followed by cholecystectomy.

Dyspepsia: Affected 24% of the patients.

Fever: Found in 8% of patients, characterized as moderate with chills.

Past History

Of the 50 patients, 11 had undergone tubectomy, 2 had undergone LSCS, 1 had an appendectomy, and 1 had a hysterectomy. One patient had obstructive jaundice due to a CBD calculus, treated with ERCP and CBD stenting. Two patients had acute cholecystitis requiring hospitalization and conservative management, and one patient was treated for acute pancreatitis.

Personal History

Forty-two patients were vegetarian, while the remaining had mixed diets. Five of the 17 male patients consumed alcohol regularly, while none of the female patients did.

Family History

No patients in this series had a family history of cholelithiasis.

General Physical Examination

Most patients (56%) had a BMI under 25, 24% had a BMI between 25-27.5, and 16% had a BMI over 27.5. Four patients were hypertensive, two were diabetic, one had bronchial asthma, and one was on thyroid supplementation for hypothyroidism. Surgical scars were seen in 30% of patients, predominantly infraumbilical.

Presenting Signs

Right hypochondrium tenderness was present in 84% of patients, higher than in Hadfield's series.[10] Guarding and rigidity were observed in 4% of patients, compared to 18.7% in Hadfield's series. Murphy's sign was noted in 24% of cases.[10] and a palpable mass was found in 6%, slightly lower than the 7% reported in Hadfield's series.[10]

Investigation

Routine blood and biochemical tests were conducted, with most patients displaying normal ranges. Blood group distribution showed 52% with blood group O, 28% with B, 16% with A, and 4% with AB. In contrast, the North American series reported 36.5% of patients with blood group A, 30% with O, 20% with B, and 13.5% with AB.

Ultrasonography

Ultrasound was conducted in all cases. Every patient had gallbladder stones, with 20 showing wall thickening and 8 showing pericholecystic collection. Among the stones, 32 patients had multiple calculi, 10 had solitary calculi, and 8 had solitary impacted calculi. In Alok Sharma's series, 98.3% of patients had stones in the gallbladder, with 5.2% exhibiting gallbladder wall thickening. Of the 98.3%, 73.7% had multiple stones, 26.3% had solitary stones and 5.2% had bile duct stones.[9]

Evaluation of predictive factors for difficult laparoscopic cholecystectomy

Factors such as age, sex, BMI, prior hospitalizations, previous surgeries, palpable gallbladder, wall thickness, pericholecystic collection, and impacted stones were evaluated as predictors of surgical difficulty. According to a study by Randhawa and Pujahari, similar predictive factors were assessed, with a positive prediction value of

88.8% for easy laparoscopic cholecystectomy and 92% for difficult cases.[11]

Correlation of pre-op score and the outcome

In this series, three cases required conversion to open cholecystectomy due to a dilated common bile duct (CBD), with one needing CBD exploration and T-tube insertion. The conversion rate was 10%. Comparatively, Randhawa and Pujahari reported a 1.315% conversion rate due to anomalous ducts.[11]

Post-operative treatment

Standard post-operative treatment included nasogastric aspiration, IV fluids, antibiotics, analgesics, and drainage tube removal within 1-5 days.

Post-Operative Complications

Three patients developed minor infections at the epigastric port site, which required dressing changes. Saxena et al. reported a 6.3% postoperative infection rate.

Histopathological examination

Histopathology showed 48 cases of chronic cholecystitis and 2 of acute cholecystitis. No malignancies were identified, similar to findings in studies by Battachary and Raza et al.[7]

Follow up

All patients were followed for one month post-surgery, with no major complications reported.

Conclusions

The study concluded that the highest incidence of gallstones occurred in individuals aged 41-50, followed by those aged 31-40 and 21-30, contrasting with Herman's series, where the highest incidence was in ages 51-60, and Hanif's series, where it was in 41-50. The male-to-female ratio was 1:1.9, showing a global trend of female predominance, attributed to estrogen and progestin.

Patients with blood group O had a higher incidence of gallstones, differing from the North American series, which noted a higher incidence in blood group A. Pain was the predominant symptom in all patients (100%), followed by vomiting (44%), dyspepsia (24%), and fever (8%), aligning well with Ganey's series.[8]

In terms of physical signs, 84% of patients had tenderness in the right hypochondrium, while guarding and mass were observed in 4% and 6% of cases, respectively. Ultrasound proved to be the most accurate diagnostic tool, identifying gallstones in all 50 patients, with 20 exhibiting gallbladder wall thickening and 8 showing peri-cholecystic collection.

Significant predictors for a difficult laparoscopic cholecystectomy in this study included prior hospitalization, BMI > 27.5, palpable gallbladder, thick gallbladder wall, impacted stone, and peri-cholecystic collection. This was consistent with the R32 study, which also identified prior hospitalization, BMI > 27.5, palpable gallbladder, and thick gallbladder wall as predictors. The positive predictive value for easy cases was 91.89% and 100% for very difficult cases, with a 6% conversion rate to open cholecystectomy, comparable to the 6% rate in Kama et al.'s study.[12]

The incidence of port site infection was 6%, with both cases involving intraoperative biliary spillage. According to Nooghabi.[13], complications due to bile stone spillage occurred in 2.3% of cases. Histopathological analysis found chronic cholecystitis in 96% of cases and acute cholecystitis in 4%.

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