Factors predicting difficult laparoscopic cholecystectomy: a single-institution experience

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ABSTRACT

Introduction: Cholelithiasis is the most common biliary pathology, with prevalence of 10-15%. In 1992, National Institute of Health consensus development stated that laparoscopic cholecystectomy "provides a safe and effective treatment for most patients with symptomatic gallstones" and it is the treatment of choice for cholelithiasis. This study is undertaken to determine the predictive factors for difficult laparoscopic cholecystectomy. **Methodology:** A prospective open-labeled study was carried out at Padmashree Vasant Dada Patil, Government Hospital Sangli, a tertiary center and teaching hospital in Western Maharashtra that is attached to Government Medical College, Miraj. All patients presenting with upper abdominal pain, or vomiting or dyspepsia or jaundice from January 1, 2011 to December 31, 2013 were screened for cholelithiasis. Ninety-nine cases diagnosed with cholecystitis following exclusion criteria and undergoing laparoscopic cholecystectomy were considered for the study. They were evaluated with following risk factors: age >50 years, male gender, body mass index (BMI) 25.1-27.5 and >27.5, previous surgery, prior hospitalization, palpable gall bladder, gallbladder wall thickening, impacted stone, and pericholecystic collection. Each risk factor was given a score preoperatively. The total score up to five predicted easy, 6-10 difficult and >10 very difficult. Statistical analysis was performed using Fischer's Test for qualitative data and unpaired *t*-test for quantitative data. **Results:** BMI >27.5 history of prior hospitalization, palpable gallbladder, impacted stone and pericholecystic collection are significant predictors of difficult laparoscopic cholecystectomy. **Conclusion:** The proposed scoring system had a positive prediction value for easy prediction of 94.05% and for difficult prediction of 100%.

Key words: Cholelithiasis, laparoscopic cholecystectomy, predictive factors, scoring system

Introduction

Laparoscopic cholecystectomy provides a safe and effective treatment for most patients with symptomatic gallstones [1] and is the treatment of choice for cholelithiasis. It has now become the most common operation performed by general surgeons [2]. Since the introduction of laparoscopic cholecystectomy, the number of cholecystectomy performed in the United States has increased from 5 to 7 lakhs/year [3]. The advantages of laparoscopic cholecystectomy are earlier return to bowel function, less postoperative pain, cosmetics, shorter length of hospital stay, earlier return to full activity, and decreased overall cost [4-6]. The purpose of this study is to determine the predictive factors for difficult laparoscopic cholecystectomy.

Methodology

Study protocol and population

A prospective, open-labeled study was conducted at Padmashree Vasant Dada Patil, Government Hospital Sangli, a tertiary center and teaching hospital in Western Maharashtra that is attached to Government Medical College, Miraj. All patients presenting with upper abdominal pain, or vomiting or dyspepsia or jaundice from January 1, 2011 to December 31, 2013 were screened for cholelithiasis. Ninety-nine cases diagnosed with cholecystitis following exclusion criteria and undergoing laparoscopic cholecystectomy were considered for the study. The Institutional Review Board approved the study protocol and written informed consent was obtained before the study from all patients. All tenets of declaration of Helsinki were followed during the study.

Patients screening, evaluation and scoring

Screening for patients with cholelithiasis presenting with abdominal symptoms was done using an abdominal ultrasonography (USG). Those confirmed as having cholelithiasis on ultrasound, were subjected to routine hemogram, liver and kidney function tests, coagulation profile, and biochemical investigations. Patients with common bile duct (CBD) calculus, dilated CBD, deranged liver function tests, features of obstructive jaundice, age <15 years and those refusing for laparoscopic cholecystectomy were excluded. Investigations such as oral cholecystography, endoscopic retrograde cholangiopancreatography (ERCP), magnetic resonance cholangiopancreatography, and percutaneous transhepatic cholangiography could not be done routinely due to lack of facilities. The selected patients were evaluated

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for the following risk factors: age, sex, history of previous hospitalization, body mass index (BMI), presence of any supraumbilical or infraumbilical abdominal scar, palpable gallbladder, gallbladder wall thickness, pericholecystic collection, and impacted stone. Following workup and evaluation of risk factors, each patient was assigned scores preoperatively based upon the history, clinical assessment, and sonographic findings[7] [Table 1] 1-day prior to surgery. The above preoperative scoring method to predict the difficulty/ ease level for performing laparoscopic cholecystectomy was defined as easy if patient scored <5, difficult for scores between 6 and 10 and very difficult for scores 11-15. Surgery were done using CO_2 pneumoperitoneum with 10 mm Hg pressure and using standard two 5 mm and two 10 mm ports. The timing was noted from the first port site incision until the last port closure. All the intraoperative events were recorded. Postoperatively, we defined the surgical procedure as easy, difficult and very difficult [Table 2 as described by Randhawa and Pujahari] [7]. All patients received symptomatic treatment and vitamin K for 3 days preoperatively. Following thorough clinical and investigative evaluation, all patients underwent laparoscopic cholecystectomy. Time taken for the surgery, biliary/stone spillage, injury to duct/artery or conversion to open cholecystectomy was noted. To avoid bias in surgical outcome, all patients enrolled in the study were operated by a single laparoscopic surgeon. Postoperatively cases were followed-up for any complication. Drain was removed between the 2nd and 5th postoperative day depending upon the amount of drainage. Suture removal was done on the 8th postoperative day for all the cases taking into account all aseptic precautions. A follow-up for any recurrent symptoms or infection was done for all patients.

Data management and statistical analysis
The data for all the patients was entered into Microsoft© Excel and analyzed using Graphpad prism version 5.04. Data cleaning and editing were performed on a timely basis. To ensure adequate accuracy and reliability of the data, stringent quality assurance measures were followed at various stages of data handling. Statistical analysis was done using Fischer's test for qualitative data and unpaired *t*-test for quantitative data. $P < 0.05$ was considered as significant. Percentages and proportions were calculated wherever appropriate. Percentage value was rounded off to first decimal digit.

Results

This study comprises of 99 cases that were studied prospectively over a period of 3 years, of which 31 (31.31%) were males and 68 (68.69%) were females. In this series, age range for the enrolled patients was from 19 to 60 years. Majority were in the group 31-40 years of age (30 patients, 30.3%).

Of 110 patients who were considered in the beginning, 11 patients were excluded from the study because four of them had aberrant anatomy, while seven had dilated CBD.

Table 1: Scoring factors based upon history, clinical, and sonographic findings [7]

Scoring factors	Score	Maximum score
History		
Age (years)		
<50	0	1
>50	1	
Sex		
Female	0	1
Male	1	
Previous history of hospitalization		
No	0	4
Yes	4	
Clinical		
Body mass index		
<25	0	2
25.1–27.5	1	
>27.5	2	
Abdominal scar		
No	0	2
Infraumblical	1	
Supraumblical	2	
Palpable gallbladder		
No	0	1
Yes	1	
Sonography		
Wall thickness		
Thin	0	2
Thick >4 mm	2	
Pericholecystic collection		
No	0	1
Yes	1	
Impacted stone		
No	0	1
Yes	1	
Total maximum score: 15		

Table 2: Easy/difficult criteria for laparoscopic cholecystectomy as suggested by Randhawa and Pujahari [7]

Factors	Easy	Difficult	Very difficult
Time taken (min)	<60	60-120	>120
Bile/stone spillage	-	+	+
Injury to duct/artery	-	+ duct only	+
Conversion to open cholecystectomy	-	-	+

Two of these five patients with dilated CBD required CBD exploration with T tube insertion. Hence, only 99 of remaining 110 patients were included in the study and for subsequent analysis of the data. Table 3 represents the baseline clinical

characteristics of the enrolled patients that underwent laparoscopic cholecystectomy.

BMI of patients were, <25 in 61 (61.61%) patients; 25.1-27.5 in 20 (20.20%) patients and >27.5 in 18 (18.18%) patients. History of previous surgery was noted in patients. It included 23 (23.23%) with tubectomy, 4 (4.04%) patients with lower (uterine) segment cesarean section, 2 (2.02%) with appendectomy and 2 (2.02%) with hysterectomy. Hence, 31 (31.31%) patients presented with scar over abdomen. Only two had supraumblical scar while rest 29 had an infraumblical scar. Nine (9.09%) patients of 99 had a previous history of admission; 5 (5.05%) for acute cholecystitis, 2 (2.02%) for acute cholecystitis and 2 (2.02%) who got admitted for obstructive jaundice had ERCP with stenting done.

Nine patients presented with hypertension, four with diabetes and two with bronchial asthma. On histopathology, 96 cases were reported as chronic cholecystitis, while three were reported as acute cholecystitis. No case of malignancy of the gallbladder was detected.

From our data, we observed that a higher BMI, previous history of hospitalizations, palpable gallbladder, thickened wall of gallbladder, impacted stone and pericholecystic collection were significant factors associated that posed difficulties in laparoscopic cholecystectomy [Table 4].

Table 3: Baseline clinical characteristics of patients undergoing laparoscopic cholecystectomy (*n*=99)

Factors	Results
Mean age±SD (years)	38.36±12.03
Male gender, *n* (%)	31 (31.31)
BMI, *n* (%)	
<25	61 (61.61)
25.1-27.5	20 (20.20)
>27.5	18 (18.18)
Previous surgical history, *n* (%)	
Tubectomy	23 (23.23)
LSCS	4 (4.04)
Appendectomy	2 (2.02)
Hysterectomy	2 (2.02)
Ultrasonography findings, *n* (%)	
Multiple calculi	66 (66.67)
Solitary calculi	19 (19.19)
Impacted calculi	14 (14.14)
Wall thickening	31 (38.18)
Pericholecystic collection	11 (11.11)
Palpable gallbladder, *n* (%)	5 (5.05)
History of hospitalization, *n* (%)	9 (9.09)

BMI calculated as weight in kilograms divided by height in square meters. Data in parenthesis indicates percentages. SD: Standard deviation, BMI: Body mass index, LSCS: Lower (uterine) segment caesarean section

Discussion

This single institution based observational study was done to determine factors for prediction of difficult laparoscopic cholecystectomy. It excels in providing more consistency in the selection of the study group patients, standardized surgical practices and post follow-up. The study does not have any observer related bias as done by a single observer. The majority

Table 4: Comparison of preoperative risk factors and surgical outcome in the present study with that conducted by Randhawa and Pujahari [7]

Risk factors	Preoperative score and outcome		*P* value	
	Difficult	Easy	Present study	Randhawa and Pujahari [7]
Age (years)				
<50	18	64	0.511	0.937
>50	2	15		
Sex				
Female	15	53	0.596	0.736
Male	5	26		
Bmi (kg/m²)				
<25	2	59	<0.001	0.227
25.1-27.5	2	18		
>27.5	16	2		
Previous surgery				
None	15	53	0.596	0.882
Yes	5	26		
History of hospitalization				
No	11	79	<0.001	<0.001
Yes	9	0		
Gallbladder palpable				
Not palpable	15	79	0.0002	0.022
Yes	5	0		
Ultrasound wall thickness			<0.0001	0.038
Not thickened	2	66		
Thickened	18	13		
Impacted stone				
None	11	74	0.0001	0.190
Yes	9	5		
Pericholecystic collection				
None	13	75	0.001	0.999
Yes	7	4		

BMI calculated as weight in kilograms divided by height in square meters. BMI: Body mass index

of the population in this study was young to middle-aged group with the majority of patients falling under the 31-40 year age group; which is in accordance with Bingener-Casey et. al. [8] whose study depicted a mean age of study subjects as 40 years. Multiple calculi, solitary calculi, and impacted calculi are mutually exclusive events. In our study, highest numbers were patients with multiple calculi [Table 3], which was similar to findings of Sharma [9]. Though the thickening of the gallbladder wall and pericholecystic collection can be seen in any number of calculi patients the percentages of these findings were higher in our study when compared with the findings reported by Sharma [9].

Despite low preoperative score of 0-5, the operating surgeon experienced difficulties that were graded as difficult in 5 out of the 88 patients and very difficult in 4 out of 88 patients undergoing surgery [Table 5]. Similarly, for predictive score of 6-10, 4 out of the 19 patients were graded as very difficult to operate and were excluded from the analysis. Our study statistics did not show age and male gender as significant factors for difficult laparoscopic cholecystectomy [Table 4], whereas according to Hugh et. al.[10] and Brodsky et. al. [11], age and gender have been found significant. The discrepancies could be because we had more chronic cases than acute.

This study showed gall bladder thickness as a significant factor for difficult laparoscopic cholecystectomy [Table 4], which is supported by Lal et. al. [12], Jansen et. al. [13], Alponat et. al. [14], Strasberg SM et al.[15] and Daradkeh et. al. [16]. However, Carmody et. al.[17] gives opposite results for gallbladder wall thickness. Our study shows that stone impaction at the gallbladder neck is a good predictor of difficulty in laparoscopic cholecystectomy, which is contrary to the findings in other studies[17,18] in which stone impaction is shown to have a moderate correlation. According to the Randhawa and Pujahari[7] prior hospitalization, BMI > 27.5, palpable gallbladder, thick gallbladder wall on USG were significant predictors of difficult laparoscopic cholecystectomy.

Postoperative complication was seen in two patients who developed an infection of the epigastric port site. These patients were treated with dressing and closure with secondary intention. These patients healed after 1-2 weeks of treatment.

Study Limitations

One of the main limitations of the study is the defined age group. No patients above 60 years were undertaken so and also the majority of the population in this study was young to middle aged group. Hence, it does not prove factors efficacy or co-relation for older age group. Cohort study and meta-analysis of the data from various regions/study groups and private hospitals are needed to validate these findings.

Conclusion

Considering each factors independently prior hospitalization, BMI > 27.5, palpable gallbladder, thick gallbladder wall on USG, impacted stone at the neck and pericholecystic collection are strong predictors of difficult laparoscopic cholecystectomy. Furthermore, keeping in mind that the scoring system was applied as a whole the proposed scoring system had a positive prediction value for easy prediction of 94.05% and for difficult prediction of 100%.

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Table 5: Correlation of preoperative score and the surgical outcome (n=99)

Preoperative score	Easy	Difficult	Very difficult# (−)	Total (−)
0-5	79 (94.05)	5 (5.95)	4	88
6-10	0 (0)	15 (15)	4	19
11-15	0 (0)	0 (0)	3	3
	79 (79.80)	20 (20.20)	11	110

#Values not included for data analyses due to exclusion. Data in parenthesis indicates percentages

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Author's Contributions

PSD and SPU conceptualized and contributed to the drafting of the manuscript. PSD contributed to the design, literature search, and manuscript editing and participated in the statistical analysis. PSD serves as the guarantor of the paper. SPU defined the intellectual content, helped in data acquisition and helped revised the manuscript. Both authors have read and approved the final version of the manuscript.

Consent

Written informed consent was obtained from all the patients enrolled in the study and for the publication of the findings and accompanying images (if any) generated from the protocol. A copy of the written consent/s is available for review for the editor-in-chief of this journal.

Competing Interest

Nil

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