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Original Research Article

Assessment of risk factors in patients undergoing difficult cholecystectomy: a cross-sectional study at a tertiary care hospital in central India

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the operation of choice in the treatment of symptomatic gallstone disease. Most of the time, the levels of difficulties are hard to assume. The risk factors for difficult LC have not been adequately evaluated in Indian population, especially with respect to western Indian population. Thus, the present study was undertaken to assess the risk factors in patients undergoing difficult cholecystectomy.
Method: The study involved 100 adult patients with cholelithiasis admitted in the department of surgery for cholecystectomy over a period of 2 years from Nov 2020 to Dec 2022. Preoperatively, patients were evaluated for risk factors including age, gender, BMI, history of sickle cell disease, previous abdominal surgery, presence of pericholecystic collection, gall bladder thickness, impacted calculi, adhesions in triangle of Calot's, and previous hospitalization for acute cholecystitis and acute pancreatitis. These factors were assessed to predict difficult LC.
Results: Majority of laparoscopic procedures were easy (65%), while remaining were difficult (35%). Difficult cholecystectomy was significantly associated with age ≥50 years ($p=0.016$), male gender ($p=0.031$), BMI ≥25 kg/m^2 ($p<0.0001$), sickle cell disease ($p=0.030$), previous abdominal surgery ($p=0.004$), pericholecystic collection ($p=0.017$), gall bladder thickness ≥4 mm ($p=0.007$), adhesion in triangle of Calot's ($p<0.0001$), impacted calculi ($p=0.036$), previous hospitalization for acute cholecystitis and acute pancreatitis ($p<0.0001$) and diabetes mellitus ($p<0.0001$). The conversion rate was 2%.
Conclusions: An awareness about reliable predictors for difficult LC would be helpful for an appropriate treatment plan and application of the resources to anticipate difficult LC. However, further studies with larger sample size are required to confirm the findings.

Keywords: LC, Gallstone disease, Difficult, Cholecystitis, Pancreatitis, Triangle of Calot 's

INTRODUCTION

Cholecystectomy was considered as the surgical procedure for the management of symptomatic gall stone diseases, when its pioneer in 1882, Carl Langebuch (1846-1901) of Germany performed the first cholecystectomy. In 1985 (103 years later), prof. Dr. Erich Mühe of Germany performed the first LC.[1] LC is considered as the gold standard treatment for most gallbladder diseases. It has now become one of the most common operations performed by general surgeons. LC though considered as safe and effective yet can become difficult at times due to various problems faced during surgical procedure. Various problems encountered includes problem in identifying anatomy, anatomical variation, creating pneumoperitoneum, accessing peritoneal cavity, releasing adhesions, fibrotic and contracted gall bladder and extracting the gall bladder.[2]

Preoperative prediction of risk of conversion or difficult is an important aspect of planning a laparoscopic surgery. With the help of accurate prediction high risk patient may be informed beforehand and proper counselling can be done. Surgeons too may get indication so that they may schedule time and team for operation appropriately. Patients predicted to be difficult/high risk should be scheduled for intensive post-op care and longer hospitalization. This may also help hospital administration to plan and predict admissions and bed vacancy more efficiently.[3]

Thus, preoperative prediction of-difficult LC-may help in improve patient safety, proper preoperative planning, and counselling, deciding the approach (open/laparoscopic), reduce conversion rate and reduce overall complications and morbidity. LC with these problems along with time taken more than normal are regarded as difficult.[4] The present study was commenced to identify the various factors that can predict difficulty in LC and thus complications can be prevented, and a better patient outcome can be given.

METHODS

After obtaining institutional ethical committee approval and written informed consent from all the patients, this observational, cross-sectional study was conducted on 100 patients with acute/chronic cholecystitis or symptomatic cholelithiasis or gall bladder polyps attending the out-patient department or admitted in wards of department of general surgery at government medical college and hospital Nagpur and undergoing cholecystectomy from November 2020 to December 2022. Patients with acute hepatitis, malignancy, deranged LFT and features of obstructive jaundice, patients unfit for laparoscopic surgery (general anaesthesia), pregnancy women and patients not willing to participate in this study have been excluded.

On admission, detailed history regarding age and sex, onset duration and progression of symptoms was recorded from patient and his/her relatives. History of comorbid conditions like DM, HTN, COPD, and TB was noted; history of sickling (SS); history of previous surgical procedure if any was noted. Previous history of past similar complaints or admitted for recurrent acute cholecystitis and acute pancreatitis noted. Thorough clinical examination was done in relation to abdominal pain, tenderness, guarding, rigidity, lump in abdomen and positive findings were documented. Relevant biochemical investigations- liver function test and electrolyte imbalance were checked. After that patient was shifted for radiological investigations-ultrasonography (abdomen + pelvis) and if required contrast enhanced CT abdomen and MRCP was done on case-to-case basis. After performing all the necessary investigations and confirmation of diagnosis, patients were posted for appropriate surgical intervention. Before the surgery patient and his/her relatives were informed about the procedure, possible intra and post-op complications of surgery in their respective languages and they were asked to sign informed consent in prescribed proforma.

Preoperatively, patients were kept nil by mouth (NBM) prior to surgery. Pre-anesthetic evaluation was done. Nasogastric decompression was done with Ryle‘s tube 14 or 16Fr. Foley‘s catheter inserted per urethrally for measurement of urine output before Induction of anesthesia. Single dose of 1 gm cefotaxime was administered IV at time of induction of anesthesia in all cases. Physician opinion was taken in case of any comorbidities such as HTN, DM, COPD, raised BMI, sickling status (SS) and patient condition was optimized. All patients who met inclusion criteria posted for LC.

Operative technique

All the patient was anaesthetized with general anesthesia and endotracheal intubation. The patient was placed supine with the arms out at right angles under general anesthesia. An appropriate site for the creation of the pneumoperitoneum was chosen. The initial port was placed by an open, or Hasson, technique, or a Veress needle technique depending on the surgeon ‘s preference. After placement of the primary port, the CO_2 source was attached to the port, and the videoscope was inserted after white-balancing and focusing the system. A general examination of intra-abdominal organs was performed taking special note of any organ pathology or adhesions. Three additional trocar ports were placed, using direct visualization of their sites of intra-abdominal penetration (Figure 1). The second 10-mm trocar port was placed in the epigastrium about 1-2 cm below the xiphoid, with its intra-abdominal entrance site being just to right of falciform ligament. Two smaller 5-mm trocar ports were then placed: one in right upper quadrant near midclavicular line, several centimeters below costal margin and another quite laterally along anterior axillary line. The patient was placed in a mild (10-15 degrees) reverse Trendelenburg position with slight rotation of the patient to the left (right side up) for optimal visualization of the gallbladder region.

Figure 1: Port positions in LC.

The apex of the gallbladder fundus was grasped with a ratcheted forceps through the lateral port. The gallbladder and liver were then lifted superiorly to provide good exposure of the undersurface of the liver and gallbladder and Callot‘s triangle. Omental or other loose adhesions to the gallbladder were gently teased away by the surgeon. The infundibulum of the gallbladder was grasped with forceps through the middle port. Lateral traction with the middle forceps exposed the region of the cystic duct and artery. Hook-Cautery was used by the surgeon through the subxiphoid port to open the peritoneum over the presumed junction of the gallbladder and cystic duct. With gentle teasing and spreading motions, cystic duct and artery were exposed. Each structure was exposed circumferentially. Both structures were dissected free and identified prior to clipping and division (Figure 2).

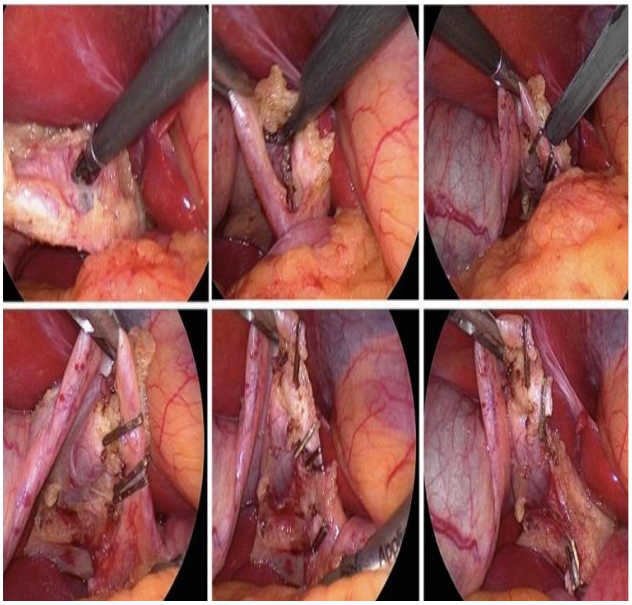

Figure 2: (Upper row left to right) demonstration and dissection of calot’s triangle, clipping of cystic duct of GB. (Bottom row left to right) demonstration of critical view, clipping, and cutting of cystic duct and cystic artery.

After dissection, the cystic artery was cleared for a 1cm zone, and its path followed onto the surface of the gallbladder. The clear zone was then secured with metal clips both proximally and distally. The cystic artery was divided with endoscopic scissors. The cystic duct was also cleared for about 1 cm or so on case-to-case basis such that the surgeon could clearly identify its continuity with the gallbladder and achieve the critical view of safety. A metal clip was then applied as high as possible on the cystic duct where it began to dilate and form the gallbladder.

The cystic duct–gallbladder junction was grasped with forceps through the middle port and the gallbladder was removed from its bed beginning inferiorly and carrying the dissection up the gallbladder fossa. The liver bed was reinspected for any bleeding sites. The region was irrigated with saline and the diluted bile and blood if any present, were suctioned out. The final peritoneal attachments of the gallbladder were divided from the liver and the gallbladder was positioned above the liver. The gallbladder was removed through the 10-mm Umbilical port (Figure 3).

After removal of the gallbladder and final inspection of the abdomen, all ports were removed, and the sites closely inspected for bleeding. The videoscope was removed and the pneumoperitoneum was evacuated so as to lessen postoperative discomfort. Placement of peritoneal drains was considered if there was considerable inflammation and bleeding, depending on the surgeon ‘s preference.

Figure 3: Specimen of gall bladder.

The fascia at the 10-mm port sites was sutured with one or two absorbable sutures (port closure needle & suture). The skin was approximated with non-absorbable simple intermittent sutures (ethilon 3-0). Sterile dressings were applied.

Intra operatively- duration of procedure and intraoperative findings were documented, based on the that it was decided whether the LC was easy (<70 minute), difficult (>70 minute). If converted to open cholecystectomy, then reason/cause of conversion and step at which conversion was done were noted.

Post operatively patient was shifted to surgical ward or surgical ICU (if required). Post-operative pain and hospital stay were noted. Complications (if any) like port site infection, bile leak etc. were recorded in the prescribed proforma. If patient developed any complications, they were treated accordingly. After discharge patients were followed up for next one month for detection of post-operative complications if any.

Statistical analysis

The data were collected and entered in Microsoft excel sheet and then statistically analysed using SPSS version

20.0. Continuous variables were expressed as mean ± SD and categorical variables were summarized as frequencies and percentages. The chi-square test was used to compare categorical variables in easy and difficult laparoscopic procedures. P 'value' of less than 0.05 was considered significant.

RESULTS

During the study period a total of 100 subjects were included in the study. In maximum cases the laparoscopic procedures were easy (65%), while remaining were difficult (35%). Significantly greater proportion of patients with difficult laparoscopy had age ≥50 years (p=0.016), were males (p=0.031) and had BMI ≥25 kg/m^2 (p<0.0001) as shown in Table 1.

Difficult cholecystectomy was significantly associated with impacted calculi (p=0.036), sickle cell disease (p=0.030), pericholecystic collection (p=0.017), diabetes mellitus (p<0.0001), adhesion in triangle of Calot 's (TOC) (p<0.0001), previous abdominal surgery (p=0.004) and prev hospitalization for acute cholecystitis and acute pancreatitis (p<0.0001) and (Table 2).

Significantly greater proportion of patients with difficult laparoscopy had gall bladder wall thickness ≥4 mm (p=0.007) as depicted in Figure 4.

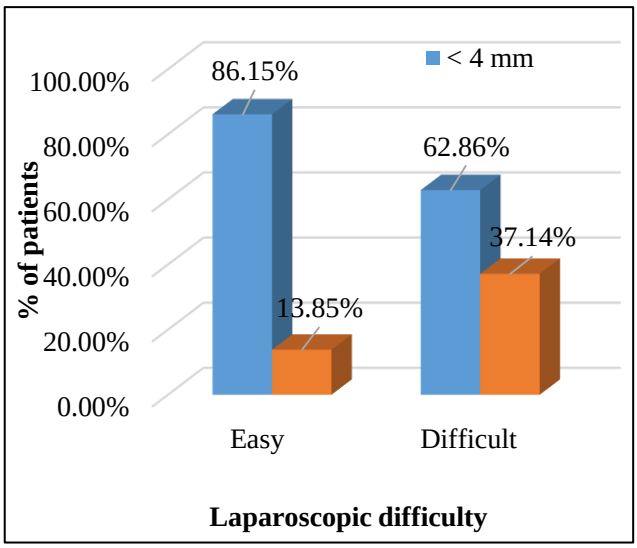

Figure 4: Comparison of laparoscopic difficulty with gall bladder wall thickness.

Table 1: Comparison of laparoscopic difficulty with demographic data of the patients.

Demographic data		Laparoscopic difficulty, n (%)		P value
		Easy (n=65)	Difficult (n=35)	
Age group (In years)	21-30	06 (9.23)	05 (14.29)	0.016
	31-40	31 (47.69)	07 (20)	
	41-50	07 (10.77)	08 (22.86)	
	51-60	13 (20.00)	08 (22.86)	
	61-70	05 (7.69)	03 (8.57)	
	71-80	03 (4.62)	02 (5.71)	
Gender	Male	16 (24.62)	16 (45.71)	0.031
	Female	49 (75.38)	19 (54.29)	
BMI (kg/m^2)	<25	59 (90.77)	18 (51.43)	<0.0001
	≥25	06 (9.23)	17 (48.57)	

Table 2: Comparison of laparoscopic difficulty with various risk factors.

Various risk factors		Laparoscopic difficulty, n (%)		P value
		Easy (n=65)	Difficult (n=35)	
Impacted calculi	Yes	02 (3.08)	05 (14.29)	0.036
	No	63 (96.92)	30 (85.71)	
Sickle cell disease	Yes	01 (1.54)	04 (11.43)	0.030
	No	64 (98.46)	31 (88.57)	
Pericholecystic collection	Yes	00 (0.0)	03 (8.57)	0.017
	No	65 (100)	32 (91.43)	
Diabetes mellitus	Yes	3 (4.62)	10 (28.57)	<0.0001
	No	62 (95.38)	25 (71.43)	
Adhesion in TOC	Yes	10 (15.38)	17 (48.57)	<0.0001
	No	55 (85.62)	18 (51.43)	
Previous abdominal surgery	Yes	01 (1.54)	06 (17.14)	0.004
	No	64 (98.46)	29 (82.86)	
Previous hospitalization	Yes	8 (12.31)	20 (57.14)	<0.0001
	No	57 (87.69)	15 (42.86)	

Most of the patients underwent LC (98%). However, 2 (2%) required conversion of LC to OC. Thus, the rate conversion of LC to OC was 2%.

DISCUSSION

In the present study the frequency of difficult LC was noted in 35(35%) cases which is comparable with the study done by Bourgouin et al (35.2%) and Zaineb et al (30%).[5,6] Old age (age ≥50 years; p=0.016) and male sex (p=0.031) has been found to be a significant risk factor for difficult LC. These findings are consistent with the findings of previous studies.[7,8] Higher conversion rate and significantly higher mortality had been reported in old age group and male patients. The reasons for the increased risk of conversion for men and old age are not clear. However, a more frequent association with severe inflammation and dense adhesion has been postulated in men and old age.[9,10]

Obese patients may have a difficult laparoscopic surgery due to various factors. Port placement in obese patient takes longer time due to the thick abdominal wall. Dissection at the Triangle of calot ‘s is also technically difficult due to the obscure anatomy because of excessive intraperitoneal fat and difficulty in the manipulation of instruments through an excessively thick abdominal wall.[11] However certain studies claim that there was no difference in operative time, time to start general diet, length of hospitalization or complications in obese subjects.[12] In the present study, significantly greater proportion of patients with difficult LC had BMI ≥25 kg/m^2 (p<0.0001). Thus, obesity is a significant predictor or risk factor of difficult LC which is similar to the study conducted by Bunkar et al and Ghadhban.[13,14]

The SCD is associated with a high incidence of gallstone disease and its sequelae, and many patients with SCD eventually therefore require cholecystectomy. These patients have been demonstrated to have elevated inflammatory markers even in health, indicating dysregulated inflammation.[15] In the present study, significantly greater proportion of patients with difficult LC had sickle cell disease (p=0.030). To the best of our knowledge, none of the available studies have reported the role of SCD in risk factor for difficult LC. Thus, the findings of the present study add to the existing literature.

After previous upper or lower abdominal surgery there may be adhesions present between viscera or omentum and abdominal wall. There may be chances of injury to these structures during insertion of first port and risk of conversion was reported to be higher.[16] In the current study, significantly greater proportion of patients with difficult LC had previous abdominal surgery (p=0.004) which is consensus with the Agrawal et al and Botaitis et al study.[17,18] However, significantly greater proportion of patients with difficult LC had pericholecystic collection (p=0.017), this finding is in accordance with the study done by Bunkar et al and Dhanke et al.[13,19] Other study by Lipman et al showed that pericholecystic fluid can predict the conversion of LC to OC.[20] This finding is probably related to the intense inflammatory response or to the advanced stage of AC. Thus, pericholecystic collection predicts or is a likely risk factor for difficult LC.

Increased GB wall thickness is associated with difficult dissection of the GB from its bed. Presence of a thick GB wall may make grasping and manipulation of GB difficult. This makes the dissection at the (TOC) triangle of Calot ‘s and the GB bed to be difficult and limits the extent of anatomical definition.[21] In the present study, significantly greater proportion of patients with difficult LC had GB thickness ≥4 mm (p=0.007). Thus, thickened GB wall predicts /risk factor difficult LC which is comparable with the study done by Bhandari et al and Bunkar et al.[7,13]

While performing LC, stone impacted at the neck of GB poses some technical problems, because of distension of GB, as is with thick GB wall. It is difficult to grasp the GB neck to allow adequate retraction to perform dissection at the Calot's triangle.[22] In the present study, significantly greater proportion of patients with difficult LC had impacted calculi (p=0.036) as similar to previous studies.[13,17]

Significantly greater proportion of patients with difficult LC had previous hospitalization for acute cholecystitis and acute pancreatitis (p<0.0001) as found in other studies.[13,23] However, significantly greater proportion of patients with difficult LC had adhesions in Triangle of Calot ‘s (p<0.0001). Similarly, Bhandari et al and Sugrue et al suggested that adhesion in Triangle of Calot‘s is important predictor.[7,24] A significantly greater proportion of patients with difficult LC had diabetes mellitus (p<0.0001). Likewise, Goyal et al demonstrated that diabetes mellitus was a significant predictor of difficult LC.[25]

Although, the LC is the most common operation performed these days, some of the intended LC require conversion due to several factors. Many a time it demands conversion to open cholecystectomy due to intraoperative complications for the safe ending of the procedure and takes more than anticipated time. However, current literature has mentioned a conversion rate of nearly about (2-10%).[26] In the present study, most of the patients underwent laparoscopic cholecystectomy (98%). However, 2 (2%) required conversion of LC to OC (open cholecystectomy). Thus, the rate conversion of LC to OC was 2% which is comparable with the study done by Zaineb et al (2%) and Singh et al (1.86%).[6,27] The conversion rate observed in the present study is lower than that documented in literature.[28,30] Undoubtedly experience of surgeon is an important factor that should be considered in for conversion, as it is low in cases done by experienced surgeons. In the present study, all the surgeries were performed by a single experienced surgeon.

Limitations

This study involved a relatively small number of patients. This was a single-center study hence, the results cannot be generalized to the community. Other factors predicting the difficult LC, including size of calculi, fever at the time of presentation, clinically palpable gall bladder, history of acute cholecystitis, previous ERCP, gall bladder fibrosis, and laboratory parameters (leucocyte count, raised liver function test), were not evaluated.

CONCLUSION

To conclude, male gender, age ≥50 years, BMI ≥25 kg/m^2, SCD, previous abdominal surgery, pericholecystic collection, gall bladder thickness ≥4, adhesion in Triangle of Calot 's, impacted calculi, diabetes mellitus, previous hospitalization for Acute cholecystitis and acute pancreatitis, and diabetes mellitus are significant predictors for difficult LC. The conversion rate was 2%. Moreover, an awareness about reliable predictors for difficult LC would be helpful for an appropriate treatment plan and application of the resources to anticipate difficult LC. However, further studies with larger sample size are required to confirm the findings.

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