

## Predictors of Difficult Cholecystectomy

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### Abstract

**Background:** Laparoscopic cholecystectomy (LC) is one of the most commonly performed laparoscopic surgeries worldwide. There is no uniform consensus as to predictors of pre-operative difficult gall bladder and conversion to open cholecystectomy. Few indicators have been proposed but may not be applicable in all cases leaving a room for intra-operative surprises. In this study, we evaluated the indicators for pre-operative difficult cholecystectomy and possible conversion to open cholecystectomy.

**Methods:** A prospective observational study of patients who underwent LC from 2009 to 2016 was done. A retrospective analysis of possible factors responsible for conversion from laparoscopic cholecystectomy to open cholecystectomy was performed. The statistical analysis was done using chi-square test.

**Results:** Out of 415 cases, 368 (88.7%) patients underwent successful laparoscopic cholecystectomy while 47 (11.3%) patients were converted to open cholecystectomy. These 47 patients constituted the study cohort. Males constituted 62%. Average age was 51.34 years  $\pm$  10.3 years. Abdominal pain was seen in 93.5%, tenderness in 81%, palpable mass in 25.5% and fever in 60% of patients. Raised total leucocyte count was seen in 78.7% and altered liver function tests in 66% of patients. Increased gall bladder wall thickness was found in 91% and pericholecystic fluid collection was seen in 27.5%. Dilated Common bile duct was found in 17% patients. Acute cholecystitis with obliterated Calot's triangle was seen in 49% followed by dense adhesions, empyema and xanthogranulomatous cholecystitis.

**Conclusion:** The most common cause of conversion to open cholecystectomy was presence of dense adhesions obliterating the anatomy at Calot's triangle. Difficult LC can be predicted based on clinical, laboratory and imaging parameters. All said and then, a difficult gall bladder can still be encountered on the operative table in the absence of the above findings. Hence every case should be treated on its individual merit and one should always be ready for difficult dissection.

**Keywords:** Laparoscopic; Cholecystectomy; Open; Acute Cholecystitis; Calot's Triangle

### Background

Laparoscopic cholecystectomy is one of the most commonly performed laparoscopic surgeries for treatment of cholecystitis [1]. The spectrum of the disease may range from simple symptomatic cholelithiasis with minimal oedema, adhesions in Calot's triangle, ruptured and gangrenous gallbladder with dense adhesions to Mirizzi's syndrome [2,3]. There is no uniform consensus

as to predict a preoperative difficult gallbladder and conversion to open cholecystectomy. Few indicators have been proposed but they are not applicable in all the cases leaving a room for intraoperative surprises.

### Materials and Methods

This is a prospective observational study of cholecystectomies operated by me from 2009 to 2016. Data was collected and analyzed

sed retrospectively. All cases were evaluated thoroughly preoperatively based on clinical evaluation, laboratory findings and imaging studies. Cases were divided based on the predictors tentatively into anticipated difficult cholecystectomy and adequate preoperative measures were taken. As a protocol, all patients were explained preoperatively and consent was taken about the possibility of intra-operative surprises like difficult anatomy, frozen Calot's, abnormal anatomy and possibility of conversion to open cholecystectomy. The statistical analysis was done using chi-square test. Significant values were considered for  $p \leq 0.05$ .

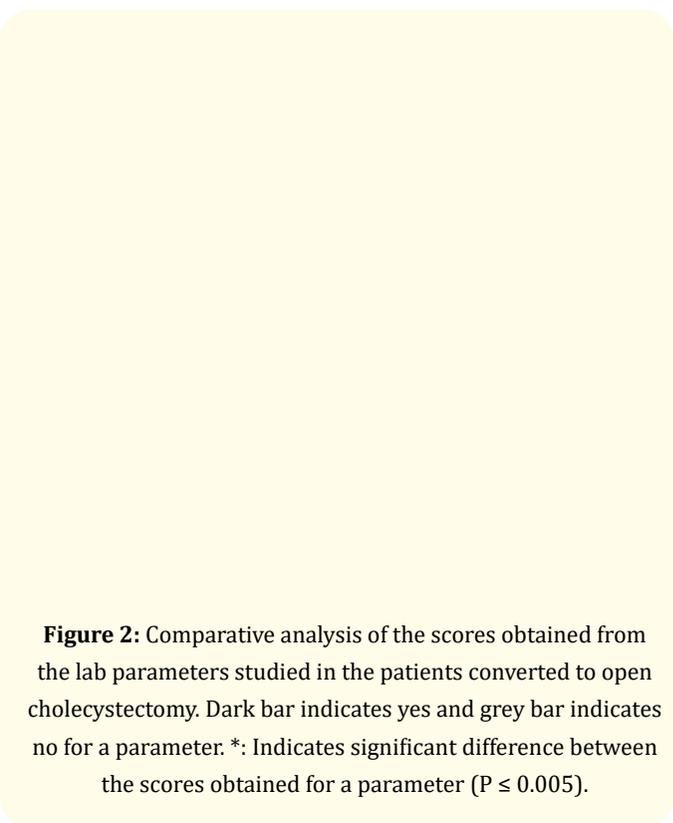
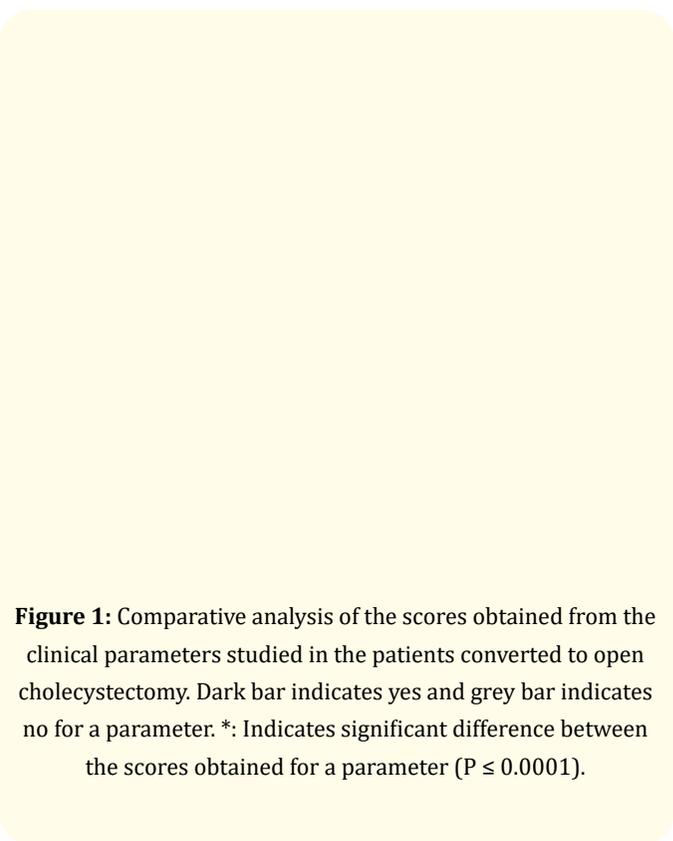
### Results

A total of 415 cases of cholecystectomy were performed from 2009 to 2016. Out of them 368 (88.7%) patients underwent successful laparoscopic cholecystectomy while 47 (11.3%) patients were converted to open cholecystectomy. 40 patients of open cholecystectomy were predicted preoperatively based on clinical, laboratory and imaging studies while the other 7 were an intra-operative surprise. These 47 patients constituted the study cohort. There were 18 females (38%) and 29 males (62%). Average age was 51.34 years  $\pm$  10.3 years. The youngest patient was 28 years and the oldest was 70 years old.

On clinical evaluation, pain was seen in 93.6%, tenderness in 81%, palpable mass in 25.5% and fever in 60% of patients (Figure 1). Raised TLC was seen in 78.7% and altered LFT in 66% of patients (Figure 2). On ultrasonography of abdomen, gall bladder wall thickness was found to be increased in 91% of patients who had acute cholecystitis or had any one of the above parameters. Pericholecystic fluid collection on ultrasound was seen in only 27.5% of patients with acute cholecystitis. Dilated CBD on ultrasound was found in only 17% who were further evaluated by a CECT abdomen or an MRCP (Figure 3 and 4) (Table 1).

Surgical results were good in 95.74%. Two deaths occurred, both in hospital due to multiorgan failure, secondary to pre-existing septicemia. Postoperative complications occurred in 36%. The most common complication was surgical site infection seen in 14 patients followed by incisional hernia in one patient, bile duct injury requiring re-exploration and repair of posterior sector duct in one. Atypical mycobacterial infection in surgical site which responded to Antituberculosis treatment (ATT), a rare complication was seen in one patient.

Six patients had empyema gall bladder necessitating conversion. 23 patients had acute cholecystitis with obliterated calot's ana-



**Figure 3:** Comparative analysis of the scores obtained from the ultrasonography data studied in the patients converted to open cholecystectomy. Dark bar indicates yes and grey bar indicates no for a parameter. \*: Indicates significant difference between the scores obtained for a parameter (P ≤ 0.0001).

**Figure 4:** Comparison of the scores obtained with respect to CECT abdomen studied in the patients converted to open cholecystectomy. (P ≤ 0.05). Dark bar indicates yes and grey bar indicates no for a parameter.

Clinical parameter	Number (%)
Abdominal Pain	44 (93.6)
Tenderness	38 (80.8)
Palpable mass	12 (25.5)
Fever	28 (59.6)
<b>Laboratory parameters</b>	
Raised TLC	37 (78.7)
Altered LFT	31 (61.9)
<b>Imaging</b>	
Pericholecystic fluid collection	11 (23.4)
GB wall thickness	43 (91.5)
Dilated CBD	8 (17)

**Table 1:** Preoperative evaluation in patients converted to open cholecystectomy.

tomy necessitating conversion to open cholecystectomy. 2 patients had gallbladder perforation (16,24) with peritonitis necessitating open cholecystectomy. Failed Endoscopic Retrograde Cholangiopancreatography (ERCP) and Common Bile Duct (CBD) clearance was the reason for open cholecystectomy and CBD exploration in 7 patients. Three patients had choledochal cyst excision and hepaticojejunostomy, when cholecystectomy is being done as a part of the procedure. Three patients had xanthogranulomatous cholecystitis on histopathology, one patient had gallstone pancreatitis for which he underwent pancreatic necrosectomy and diversion loop ileostomy which was closed 3 months later. One patient had gastric outlet obstruction with acute cholecystitis hence truncal vagotomy and GJ were also added to the procedure (Table 2).

Reason contributing to conversion	Number (%)
Acute cholecystitis	24 (51)
Failed ERCP and CBD clearance	7 (15)
Empyema gall bladder	6 (13)
Choledochal cyst excision and HJ	3 (6.5)
Xanthogranulomatous cholecystitis	3 (6.5)
Gall bladder perforation and peritonitis	2 (4)
Gall stone pancreatitis with pancreatic necrosis	1 (2)
Acute cholecystitis with gastric outlet obstruction	1(2)

**Table 2:** Distribution of causative factors in patients who had undergone open cholecystectomy.

## Discussion

Laparoscopic cholecystectomy is one of the most commonly performed surgeries in the world. With improving technology and precision, learning curve has significantly reduced but the rates of conversion to open have not changed. Similarly, after the advent of laparoscopic cholecystectomy, incidence of bile duct injuries has shown an increase. However, an increase in expertise as well as exposure in dealing gall bladder disease laparoscopically has decreased the conversion rate to open cholecystectomies [4]. In our study the LC was completed successfully in about 89% of the total cases which is in accordance with the earlier reports. A preoperative assessment helps to predict the possibility of a difficult cholecystectomy and chances of conversion to open cholecystectomy.

Among the various factors considered, male gender has shown to have an association with difficult cholecystectomy and increased chance of conversion. These findings are in corroboration with earlier reports [5,6]. This may be because of the cohort here being more of a male population. They seem to be having a greater tolerance compared to female counterpart and hence present late in the evolution of disease. Females present early in the disease and hence chance of conversions is less in this study.

Coming to the clinical parameters, presence of a palpable mass in association with tenderness almost always predicts a difficult cholecystectomy and in such situation, it is the surgeon's technical expertise which determines the chances of conversion to open cholecystectomy. Patients with palpable tender mass also have a raised TLC, altered liver enzymes and associated fever [7]. All these factors suggest that it is an acute cholecystitis with/without features of septicemia [22,23]. Raised liver enzymes also suggest the presence of cholestasis due to the acute inflammation which may increase the chances of intraoperative difficulties especially when dissecting GB from liver bed sometimes causing uncontrolled bleeding [8]. Hence, the presence of a combination of factors i.e. altered LFT and raised TLC along with clinical signs should act as deterrent in planning cholecystectomy vs conservative management and interval cholecystectomy later [19,20,22,23].

Similarly, when coming to imaging the first and the most accurate modality of diagnosing cholelithiasis and changes of acute cholecystitis is a transabdominal ultrasound [10,11,19]. Features suggestive of acute cholecystitis on ultrasound are increased wall thickness > 4 mm, presence of pericholecystic fluid and fluid in Morrison's pouch. Also factors of importance are impacted stone

in Hartmann pouch, shrunken intrahepatic gallbladder, changes of cirrhosis in the liver [21], associated dilated CBD and calculi and pancreatitis [15]. Consistent difficulty at cholecystectomy was found with presence of at least two of these factors, most frequent association being pericholecystic fluid collection and increased GB wall thickness. A dilated CBD with an altered LFT warranted further imaging in the form of a CECT abdomen or MRCP as the case decides [12]. CBD clearance was achieved before cholecystectomy by ERCP but failed CBD clearance following ERCP almost always ended in a difficult cholecystectomy and CBD exploration. Wound infections in this group especially was quite common in the postoperative period. Presence of empyema also increased the rate of conversion and it is in this subgroup that few of them had dense adhesions in the region of Calot's triangle causing obliteration of proper anatomy increasing the chance of bile duct injuries [8,9,17]. Few patients from this subgroup also had Mirizzi's syndrome and during dissection accidental bile duct injury [17,18] occurred because of which conversion was done and an immediate hepaticojejunostomy was done. Similarly, for three patients conversion was done due to difficult dissection and histopathology came as Xanthogranulomatous cholecystitis [13,14].

## Conclusion

Clinical, biochemical and imaging parameters must be kept in mind before attempting a cholecystectomy. Anything can go wrong during the surgery and a seemingly simple surgery may get complicated. Absence of any of these parameters gives only a false assurance about the anticipated difficulty preoperatively. Presence of at least two of these parameters should always ring the alarm that it is going to be an anticipated difficult cholecystectomy and adequate measures should be taken preoperatively. The most consistent factors preoperatively that help to predict a difficult cholecystectomy are raised TLC, altered LFT and presence of a palpable mass [25]. Other factors such as male gender with h/o a severe attack, presence of cirrhosis, contracted GB, dilated CBD, failed ERCP should also raise the index for difficult dissection and conversion so that adequate preoperative preparation done and caution exercised.

## Conflicts of Interest

We have no conflicts of interest to disclose and received no funding for conducting this study.

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