

Preoperative findings predict difficulty during cholecystectomy

Sharma NK^{1*}, Barolia DK², Sukhadia M³

¹Dr. Narendra Kumar Sharma, ²Dr. Dinesh Kumar Barolia, ³Dr. Mukta Sukhadia. All are affiliated with Department of General Surgery, R.N.T. Medical College, M.B. Govt. Hospital, Udaipur, Rajasthan, India.

Address for Correspondence: Narendra Kumar Sharma, Email drnarendra01983@gmail.com

Abstract

Background: Most previous studies evaluating predictive factors for conversion from laparoscopic to open cholecystectomy have drawn conflicting conclusions. We evaluated objective preoperative variables to predict difficulty during cholecystectomy. **Methods:** This prospective clinical trial conducted in patients undergoing cholecystectomy by open or laparoscopic method in a single surgical unit of M.B. Govt. Hospital, Udaipur between March, 2014 and November, 2014. Abdominal ultrasonography performed in 48 patients before cholecystectomy. The surgeon re-verified sonography findings in the operating room. Many characteristics were subjected to analysis to identify parameters that independently predict difficulty during cholecystectomy. **Results:** Out of 48 patients with cholelithiasis on sonography, we encountered straightforward normal cholecystectomy in 26 patients (54.16%) and difficult cholecystectomy in 22 patients (45.83%). Laparoscopic cholecystectomy was performed on 22 patients. Analysis demonstrated elevated WBC, low serum albumin, increased total bilirubin, and ultra-sound finding of pericholecystic fluid were independent predictors of difficult cholecystectomy. All 4 factors were more frequently identified in patients who had a diagnosis of acute cholecystitis. Factors evaluated but not found to be significant on analysis included male gender and the presence of diabetes mellitus. **Conclusion:** These results demonstrate that difficulty during cholecystectomy can be predicted based on parameters available preoperatively. Difficulty during cholecystectomy is more likely in patients who have acute cholecystitis. However, the correlation between its clinical and pathologic diagnosis is poor. Improvements in the ability to determine the difficulty during cholecystectomy have important implications for surgical care.

Keywords: Albumin, Bilirubin, Cholecystectomy, Cholelithiasis.

Introduction

The first documented laparoscopic cholecystectomy was performed by Erich Muhe in Germany in September 1985 [1]. Laparoscopic cholecystectomy first became popular during the late 1980s and now the procedure is considered the standard approach for symptomatic cholelithiasis.

Conversion to open cholecystectomy is occasionally necessary to avoid or repair injury, delineate confusing anatomic relationships, or treat associated conditions. Conversion to open cholecystectomy has been associated with increased overall morbidity surgical site and pulmonary infections, and longer hospital stays [2, 3]. The ability to accurately identify an individual patient's risk for difficult cholecystectomy based on preoperative information can result in more meaningful

and accurate preoperative counseling, improved operating room scheduling and efficiency, stratification of risk for technical difficulty and appropriate assignment of resident assistance, may improve patient safety by minimizing time to conversion and helps to identify patients in whom a planned open cholecystectomy is indicated.

We hypothesized that an accurate and useful scoring system could be created based on objective available preoperative data to predict difficulty during cholecystectomy. This information is useful in preoperative discussion with patients, addresses issues of patient safety, and optimizes operating room resource allocation and efficiency.

Method

This study was conducted in patients undergoing cholecystectomy by open or laparoscopic method in a

Manuscript received: 5th Oct 2015
Reviewed: 15th Oct 2015
Author Corrected: 19th Oct 2015
Accepted for Publication: 29th Oct 2015

single surgical unit of M.B. Govt. Hospital, Udaipur. This prospective study included all patients undergoing cholecystectomy irrespective of age, sex, physique or parity.

Indication for cholecystectomy was for a pathology requiring cholecystectomy alone e.g. gall stone disease, or cholecystectomy was performed as an allied procedure for a surgical procedure like Whipple's procedure, choledochal cyst excision, etc.

Parameters observed in each patient were-

1. Detailed history of the patient with special emphasis on symptoms of biliary colic, history of previous attacks of colic, jaundice, history suggestive of pancreatitis etc.
2. History of comorbid conditions including DM, HT, significant illnesses and previous symptoms.
3. General physical examination.
4. Abdominal examination.
5. Routine Investigations, including CBC, BT, CT, PT, INR, HIV, HB_sAg, Blood Urea, Serum creatinine, Blood Sugar etc.
6. Findings of specific investigations like Ultrasonography (USG) of abdomen, MRI, MRCP, LFTs and HPE were noted. Findings on certain

imaging studies like CECT abdomen or MRI/ MRCP were noted whenever performed, because these studies were not performed in all patients undergoing cholecystectomy.

7. Intra operative finding including gall bladder wall thickness, number of stones, empyema gall bladder, adhesions, Calot's triangle anatomy, cut section appearance, level of difficulty, duration of surgery, etc.

The duration of each procedure was recorded starting just after insertion of the three ports till removal of all ports, i.e. time of insertion of ports and time of closure of port sites were not recorded.

8. Post-operative morbidity / Mortality.

Histopathological Study- Histopathological study was carried out on relatively fresh samples by light microscope after staining with hematoxylin and eosin stain.

Laboratory values obtained immediately before the operation were recorded. An elevated white blood cell count (WBC) was defined as >11000/ml, low serum albumin as <3.5 g/dl and elevated total bilirubin as >1.5g/dL [4].

Results

Table- 1: Complete Blood Count, Blood Sugar and Renal Function Tests

| Routine Blood Investigation | Number of patients | Percentage | Reference Value | Mean |
|--------------------------------|--------------------|------------|-------------------------------|-------|
| Decreased Hb | 11 | 22.92 | 11 - 16 g/dL | 12.04 |
| Increased TLC (10^3) | 14 | 29.17 | 4.5 - 11.5 $10^3/\mu\text{L}$ | 8.46 |
| Neutrophilia (in %) | 3 | 6.25 | 36 - 80% | 65.54 |
| Increased Blood sugar (random) | 2 | 4.17 | up to 140 mg/dL | 91.10 |
| Increased Blood urea | 1 | 02.08 | 10-48 mg/dL | 26.13 |
| Increased Serum creatinine | 1 | 02.08 | 0.5-1.4 mg/dL | 0.81 |

4 patients were diabetic but 2 patients had their random blood sugar level more than 140 mg/dL.

Table: 2: Liver Function Tests

| Liver Function Tests | Number of patients | Percentage | Reference Value | Mean |
|------------------------------------|--------------------|------------|-----------------|--------|
| Increased Serum bilirubin (Total) | 9 | 18.75 | 0 - 1.2 mg/dL | 1.25 |
| Increased Serum bilirubin (direct) | 7 | 14.58 | 0.1 - 0.6 mg/dL | 0.90 |
| Increased SGOT | 14 | 29.67 | 9 - 49 IU/L | 45.58 |
| Increased SGPT | 13 | 27.08 | 9 - 49 IU/L | 53.06 |
| Increased Alk. Phos. | 17 | 35.42 | 38 - 126 IU/L | 220.66 |
| Decreased Albumin | 13 | 27.08 | 3.5 - 5 g/dL | 3.88 |

Table- 3: USG Finding

| USG Finding | Number of patients | Percentage | Reference Value |
|---|--------------------|------------|----------------------------|
| Thickened Gall Bladder Wall | 21 | 43.75 | > 3 mm thickened |
| Dilated Common Bile Duct | 9 | 18.75 | > 7 mm |
| Enlarged Liver | 10 | 20.83 | Span \geq 13 cm |
| Distended Gall bladder (distended/contracted) | 42 | 87.50 | Transverse Diameter > 5 cm |

Table-4: Factors independently predictive of difficult cholecystectomy

| Factors | No. of Patients | Acute Cholecystitis |
|---------------------------|-----------------|---------------------|
| Increased TLC | 14 | 8 |
| Decreased Albumin | 14 | 7 |
| Increased Total Bilirubin | 9 | 3 |
| Pericholecystic Fluid | 1 | 1 |

Table- 5: Reasons for difficult cholecystectomy

| Reasons | Number of patients | Percentage |
|--------------------------|--------------------|------------|
| Adhesions | 20 | 41.67 |
| Inflammation | 7 | 14.58 |
| Difficult Anatomy | 7 | 14.58 |
| Injury | 5 | 10.41 |
| Contracted | 5 | 10.41 |
| CBD Stone | 4 | 08.33 |
| Empyema | 1 | 02.08 |
| Gall Bladder Perforation | 1 | 02.08 |
| Choledochal Cyst | 1 | 02.08 |

Table 6: Predictors and Value of Findings for Patients undergoing Cholecystectomy

| Level of Difficulty | Number of patients | Laparoscopic / Open Cholecystectomy | | Presence of Adhesions | Requirement of Drain | Duration of Operation (in min) |
|---------------------|--------------------|-------------------------------------|------|-----------------------|----------------------|--------------------------------|
| | | Lap | Open | | | |
| Normal | 26 | 15 | 11 | 10 | 6 | 25-40 |
| Difficult | 22 | 8 | 14 | 20 | 13 | > 40 |

Out of 48 patients with gall bladder disease we encountered straight forward normal cholecystectomy in 26 patients (54.17%). There were adhesions in 10 patients (38.46%) but most of them were easy to separate from the gall bladder. No postoperative complications were recorded apart from the usual, mild abdominal pain mostly at wound sites. We put a sub hepatic tube drain in only six patients and it was removed the following day with only a few milliliters of blood. The duration of cholecystectomy ranged from 25-40 minutes. We encountered difficulties at cholecystectomy in 22 (45.83%). Difficulty at cholecystectomy as a dependent variable was based on following operative parameters - duration of surgery, bleeding, dissection of calot's triangle, dissection of gall bladder wall adhesions and difficulty of gall bladder extraction.

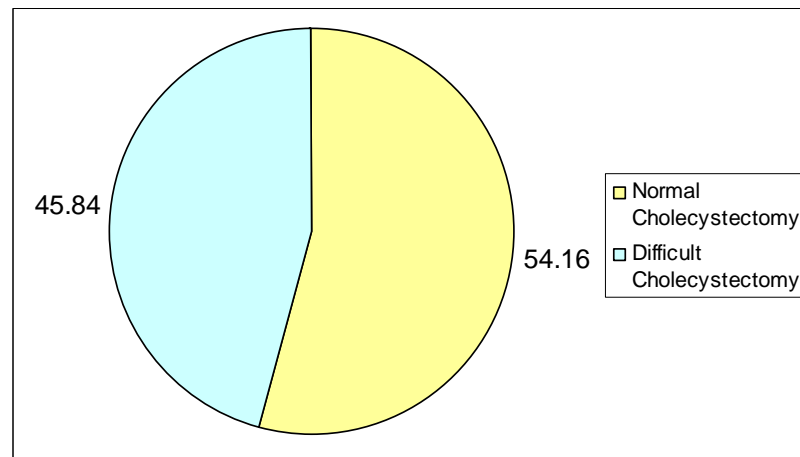


Fig. 1: Percentage of Different Type of Operation.

We faced adhesions in 90.91% of all those "difficult" procedures and they were dense and not easy to separate from the gall bladder and nearby structures and therefore required time for safe dissection to free the operative field. We left a sub hepatic tube drain in 13 patients (59.69%) and all were removed within 24 hours. The duration of a "difficult" cholecystectomy was > 40 minutes.

Factors independently predictive of difficult cholecystectomy include increased TLC 14 patients, decreased albumin 14 patients, increased total bilirubin 9 patients and pericholecystic fluid 1 patient.

22 patients (45.83%) have difficulty during cholecystectomy. The most frequent reasons for difficult cholecystectomy were adhesions 20 patients (41.67%), inflammation 7 patients (14.58%), unclear anatomy 7 patients (14.58%), injury 5 patients (10.41%), contracted 5 patients (10.41), CBD stone 4 patients (08.33%), and empyema gall bladder. Gall bladder perforation and choledochal cyst 1, 1 patient (02.08%) respectively.

Discussion

Now-a-days laparoscopic cholecystectomy is considered as a gold standard for the treatment of symptomatic gall stones, but the procedure is technically more demanding than the classical open cholecystectomy especially in difficult cholecystectomy [5,6,7].

A study by Fuchs found that laparoscopy may even be advantageous for patients who are difficult to operate [8]. Although conversion to laparotomy alone does not worsen patient's outcome, several reasons support the preoperative assessment of the feasibility of laparoscopy. It is important to have some idea about the individual patient's risk when obtaining informed consent. Also cost efficiency aspects should be considered because the equipment for an unsuccessful laparoscopy is expensive. Identifying potential difficulties is especially important in a teaching hospital where an open cholecystectomy has become a rare procedure and requires an experienced surgeon [9].

Difficulty during cholecystectomy has been associated with a longer operative time, the use of more anaesthetic drugs, increased overall morbidity, a higher rate of infective complications, longer recovery time, longer hospital stay, higher cost, and greater patient dissatisfaction [4,10, 11-14]. Thus, the ability to predict preoperatively the technical difficulties that may occur during surgery in order to choose between the laparoscopic or the open approach is desirable.

The identification of parameters predicting difficulties in cholecystectomy improves preoperative patient counseling, provides for better perioperative planning, optimizes operating room efficiency, and helps to avoid laparoscopic associated complications by performing an open operation when appropriate.

On the part of patients benefit, they can be informed of possibility of complications and conversion to the open procedure. The patient can be mentally prepared better and can adjust his or her expectations accordingly. In

addition, the surgeon can directly perform the classical open cholecystectomy in the patients with presumed difficult surgery thus saving operating time and the conversion rate.

Our results demonstrate that elevated WBC, elevated total bilirubin, low albumin, and ultrasound findings of pericholecystic fluid are associated with difficulties in cholecystectomy.

Preoperative and intra-operative factors that predict or contribute to difficulties in cholecystectomy have been evaluated previously, but no consensus has emerged. Our model predicted based on 4 easily obtained parameters.

In our analysis, the preoperative clinical diagnosis of acute cholecystitis was a significant predictor of difficulties in cholecystectomy on analyses. Despite the availability of ultrasound and leukocyte count to assist with the clinical diagnosis of acute cholecystitis, there was a poor correlation with the pathologic findings. Therefore, we excluded it from analysis. Our data demonstrate that patients with the constellation of clinical symptoms typically associated with acute cholecystitis do not always demonstrate the pathologic findings to support the diagnosis. All 4 factors that independently predicted difficulties in cholecystectomy were found significant more frequently in patients with diagnosis of acute cholecystitis. The objective parameters identified by this analysis provide a more accurate prediction of the difficulties in cholecystectomy than the clinical suspicion of acute cholecystitis.

The association between an elevated WBC and difficulties in cholecystectomy has been reported previously [3,15-23]. This parameter likely reflects the inflammatory response associated with more acute diseases and is more commonly present with acute cholecystitis. Hypoalbuminemia has been identified previously as a risk factor for difficulties in cholecystectomy [4]. Severe acute inflammation which is associated with acute cholecystitis, results in decreased albumin synthesis. Hypoalbuminemia also can result from protein-calorie malnutrition or reduced hepatic synthetic function owing to cirrhosis or other hepatic diseases. Pericholecystic fluid results from the translocation of fluid from the surrounding tissues owing to severe inflammation of the gall bladder. This factor has been previously demonstrated to predict conversion [17, 23]. In our series pericholecystic fluid

was the important radiographic finding predictive of difficulties in cholecystectomy. Acute cholecystitis was more common among patients with pericholecystic fluid on ultra-sound. An elevated bilirubin has been previously recognized as a significant predictor of difficulties in cholecystectomy in acute cholecystitis [17, 23]. We have found that it is predictive of difficulties in cholecystectomy for patients with both acute and chronic cholecystitis. Hyperbilirubinemia is most likely a marker for inflammation in this setting rather than an indicator of biliary obstruction. Elevated bilirubin is also associated with Mirizzi syndrome, the presence of which may increase the probability of difficulties in cholecystectomy [24]. In a study conducted by Lipman demonstrated that male gender elevated WBC, low serum albumin, ultrasound findings of pericholecystic fluid, the presence of diabetes mellitus and elevated total bilirubin were independent predictors of conversion. All six factors were more frequently identified in patients who had a diagnosis of acute cholecystitis [4].

In our study analysis demonstrated elevated WBC, low serum albumin, increased total bilirubin, and ultrasound finding of pericholecystic fluid were independent predictors of difficult cholecystectomy. All 4 factors were more frequently identified in patients who had a pathologic diagnosis of acute cholecystitis.

Conclusion

Cholecystectomy has become now a common surgical procedure. White blood count, albumin, bilirubin, and ultrasonography findings are predictors of difficult cholecystectomy.

Funding: Nil, **Conflict of interest:** None.

Permission of IRB: Yes

References

1. Douglas O. Olsen, Historical overview and indications for cholecystectomy. In: Bruce v. Macfadyen, Jr, MD et al Editors, Laparoscopic surgery of the Abdomen. New York: Springer 2004; 10:71.
2. Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. Am J Surg. 2004 Sep;188(3):205-11.
3. Alponat A, Kum CK, Koh BC, Rajnakova A, Goh PM. Predictive factors for conversion of laparoscopic

- cholecystectomy. *World J Surg.* 1997 Jul-Aug;21(6):629-33.
4. Lipman JM, Claridge JA, Haridas M, Martin MD, Yao DC, Grimes KL, Malangoni MA. Preoperative findings predict conversion from laparoscopic to open cholecystectomy. *Surgery.* 2007 Oct;142(4):556-63; discussion 563-5.
5. Corr P, Tate JJ, Lau WY, Dawson JW, Li AK. Preoperative ultrasound to predict technical difficulties and complications of laparoscopic cholecystectomy. *Am J Surg.* 1994 Jul;168(1):54-6.
6. Escallon A Jr, Rosales W, Aldrete JS. Reliability of pre- and intraoperative tests for biliary lithiasis. *Ann Surg.* 1985 May;201(5):640-7.
7. Liu CL, Fan ST, Lai EC, Lo CM, Chu KM. Factors affecting conversion of laparoscopic cholecystectomy to open surgery. *Arch Surg.* 1996 Jan;131(1):98-101.
8. Fuchs KH, Freys SM, Heimbucher J, Thiede A. [Laparoscopic cholecystectomy--what is the value of laparoscopic technique in "difficult" cases?]. *Chirurg.* 1992 Apr;63(4):296-304.
9. Schauer PR, Page CP, Stewart RM, Schwesinger WH, Sirinek KR. The effect of laparoscopic cholecystectomy on resident training. *Am J Surg.* 1994 Dec;168(6):566-9; discussion 569-70.
10. Fried G, Barkun J, Sigman H, Lawrence J, Clas D, Garzon J, Hinchey J, Meakins J (1994) Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. *Am J Surg*167: 35-41.
11. Cho KS, Baek SY, Kang BC, Choi HY, Han HS. Evaluation of preoperative sonography in acute cholecystitis to predict technical difficulties during laparoscopic cholecystectomy. *J Clin Ultrasound.* 2004 Mar-Apr;32(3):115-22.
12. Trondsen E, Edwin B, Reiertsen O, Faerden AE, Fagertun H, Rosseland AR. Prediction of common bile duct stones prior to cholecystectomy: a prospective validation of a discriminant analysis function. *Arch Surg.* 1998 Feb;133(2):162-6.
13. Shapiro AJ, Costello C, Harkabus M, North JH Jr. Predicting conversion of laparoscopic cholecystectomy for acute cholecystitis. *JLS.* 1999 Apr-Jun;3(2):127-30.
14. Ilie AC, Nica C, Szucsik IA, Motoc A, Sava A, Grosu S. Preoperative ultrasonography as a mean of predicting the conversion of mini cholecystectomy into classic cholecystectomy. *Rev Med Chir Soc Med Nat Iasi.* 2009 Oct-Dec;113(4):1136-40.
14. Kama NA, Kologlu M, Doganay M, Reis E, Atli M, Dolapci M. A risk score for conversion from laparoscopic to open cholecystectomy. *Am J Surg.* 2001 Jun;181(6):520-5.
16. Ibrahim S, Hean TK, Ho LS, Ravintharan T, Chye TN, Chee CH. Risk factors for conversion to open surgery in patients undergoing laparoscopic cholecystectomy. *World J Surg.* 2006 Sep;30(9):1698-704.
17. Simopoulos C, Botaitis S, Polychronidis A, Tripsianis G, Karayiannakis AJ. Risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy. *Surg Endosc.* 2005 Jul;19(7):905-9. Epub 2005 May 4.
18. Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. *Am J Surg.* 2002 Sep;184(3):254-8.
19. Schäfer M, Krähenbühl L, Büchler MW. Predictive factors for the type of surgery in acute cholecystitis. *Am J Surg.* 2001 Sep;182(3):291-7.
20. Kanaan SA, Murayama KM, Merriam LT, Dawes LG, Prystowsky JB, Rege RV, Joehl RJ. Risk factors for conversion of laparoscopic to open cholecystectomy. *J Surg Res.* 2002 Jul;106(1):20-4.
21. Brodsky A, Matter I, Sabo E, Cohen A, Abrahamson J, Eldar S. Laparoscopic cholecystectomy for acute cholecystitis: can the need for conversion and the probability of complications be predicted? A prospective study. *Surg Endosc.* 2000 Aug;14(8):755-60.
22. Halachmi S, DiCastro N, Matter I, Cohen A, Sabo E, Mogilner JG, Abrahamson J, Eldar S. Laparoscopic cholecystectomy for acute cholecystitis: how do fever

and leucocytosis relate to conversion and complications? *Eur J Surg*. 2000 Feb;166(2):136-40.

23. Schrenk P, Woisetschläger R, Rieger R, Wayand WU. A diagnostic score to predict the difficulty of a laparoscopic cholecystectomy from preoperative variables. *Surg Endosc*. 1998 Feb;12(2):148-50.

24. Rohatgi A, Singh KK. Mirizzi syndrome: laparoscopic management by subtotal cholecystectomy. *Surg Endosc*. 2006 Sep;20(9):1477-81. Epub 2006 Jul 24.

.....
How to cite this article?

Sharma NK, Barolia DK, Sukhadia M. Preoperative findings predict difficulty during cholecystectomy. *Int J Med Res Rev* 2015;3(10):1133-1139. doi: 10.17511/ijmrr.2015.i10.205.
.....