Original Article

A Study on the Risk Factors for Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy

Goparaju Shanti Kumar[1], Nagabandi Vinay Babu[2], Reddypally Naga Sudha Ashok[3], Divvela Mohan Das[4]

[1]MS Assistant Professor, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal Telangana, India, [2]MS Assistant Professor, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal, Telangana, India, [3]Senior Resident, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal, Telangana, India, [4]Professor of Surgery, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal, Telangana, India

Abstract

Background: Cholecystectomy is the most commonly performed surgery for gallbladder (GB) diseases. Presently Laparoscopic Cholecystectomy is performed routinely due its advantages over Open Cholecystectomy. However in certain conditions conversion to Open Cholecystectomy is required. Knowledge regarding the underlying reasons for conversion could help surgeons during pre-operative assessment and obtain consent of patients with all information provided to them about the conversion to be done if required so that they could have adequate psychological preparation and planning of convalescence. The prediction of a high risk of conversion or a difficult laparoscopic procedure would also allow efficient and appropriate arrangement of the operating schedule and the availability of experienced laparoscopic surgeons for the procedure. It would also allow an earlier intra- operative decision to convert if difficulty is encountered.

Study Design: The study design is of case series.

Aim of the Study: The aim is to study and identify the risk factors for conversion of LC to OC in Indian conditions (Telangana) and to determine the predictive factors of conversion in patients undergoing LC.

Results: This study was done prospectively over a period of 2 years, from September 2014 to September 2016, among 206 patients who underwent LC for symptomatic GB disease in all Surgical Units of Mahatma Gandhi Memorial Hospital, Warangal. Among the 206 patients in the study, 23 (11.16%) patients were converted to OC. The most common reasons for conversion are severe adhesions caused by tissue inflammation (12 patients [52%]) and inability to define anatomy due to fibrosis of Calot's triangle (5 patients [21.7%]). Conversion to OC due to intraoperative hemorrhage occurred in three patients. Conversion was enforced due to uncontrolled bleeding from GB bed in one patient (4.35%), which occurred during diathermic dissection of GB. In another two patients (8.7%), there was uncontrolled bleeding from Calot's triangle, which occurred during dissection of cystic duct and artery. Conversion to OC was required to achieve successful hemostasis, as they could not be controlled laparoscopically. Conversion to OC caused by injury of the common bile duct (CBD) occurred in one patient (4.35%), and the injury is identified intraoperatively and repaired over a T-tube. In one patient (4.35%), conversion to OC was required to perform CBD exploration for suspected choledocholithiasis, based on laparoscopic finding of dilated CBD; pre-operative liver function tests (LFTs) and ultrasound were normal in this patient, and intraoperative OC facility was unavailable. Conversion to OC occurred due to equipment failure in one patient (4.35%). Conversion was due to inability to establish and/or maintain sufficient pneumoperitoneum during the course of LC and due to clip applicator failure.

Conclusions: (1) In this study, the following factors are identified as significant risk factors for conversion of LC to open cholecystectomy. (i) Advanced age (>60 years), (ii) obesity (body mass index >27.5 kg/m^2), (iii) leukocytosis, (iv) abnormal LFT; ultrasonography findings (1) thickened GB wall >4 mm, (2) evidence of pericholecystic fluid; (v) LC done in emergency setting for acute cholecystitis; no significant risk factors: (a) Gender, (b) previous upper abdominal surgery, (c) comorbidities; (2) In patients with these risk factors, management can be improved by (i) pre-operative counseling of the patient regarding these risk factors and high chances of conversion and (ii) early conversion to OC.

Key words: Laparoscopic cholecystectomy, Conversion, Open cholecystectomy cholelithiasis

Corresponding Author: Dr. G. Shanti Kumar, Assistant Professor of Surgery, Department of General Surgery, Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal Telangana, India. E-mail: drgshantikumar@gmailcom

INTRODUCTION

Biliary diseases constitute a major portion of digestive tract disorders. Among these, gallstone disease is the most common biliary pathology. Cholecystectomy is the most commonly performed surgery for gallbladder (GB) diseases. Alternative treatments such as chemical dissolution, percutaneous extraction, and ultrasonic lithotripsy have been tried. Although these methods are minimally invasive, most individuals require subsequent therapy for recurrent symptoms. Due to the frequency of recurrent calculi after stone removal alone, cholecystectomy remains the standard therapy. Carl–Langenbuchper formed the first ever open cholecystectomy (OC) on July 15, 1882, in Berlin on a 42-year-old man. The most common complications that occur after cholecystectomy are post-operative ileus, atelectasis, and wound infection; other rare complications include pulmonary embolus, pneumonia, myocardial infarction, biliary peritonitis, subphrenic abscess, bacterial peritonitis, and delayed hemorrhage, due to which patients are hospitalized for several days and disabled from normal activity for several months in a year. In an attempt to reduce morbidity and disability, OC has been replaced by minimally invasive laparoscopic cholecystectomy (LC). LC was first performed in March 1987 by Philipe Moret in Lyon, France, a revolution in the treatment of cholelithiasis. Since the National Institutes of Health Consensus Conference in 1993, LC has replaced OC as the standard treatment in patients with symptomatic cholelithiasis. In the last decade, more than 90% of cholecystectomies were performed laparoscopically due to its advantages such as decreased post-operative pain and ileus, shorter hospital stay, earlier return to normal activity, earlier oral intake, and improved cosmetic result over OC.[1-6] However, there is still a substantial proportion of patients who need OC such as patients with severe cardiac disease, pulmonary disease, concomitant disease, multiple previous abdominal incisions and in whom LC cannot be successfully performed, and conversion to open surgery is required because of technical difficulties, to avoid or repair intra-operative injury, not clearly visualized anatomic relationships, or to treat associated conditions.

Conversion to OC has been associated with an increased overall morbidity, surgical site and pulmonary infections, longer hospital stays, increased total cost, and dissatisfaction of the patients.[7-9]

Knowledge regarding the underlying reasons for conversion could help surgeons during pre-operative assessment and obtain consent of patients with all information provided to them about the conversion to be done if required so

that they could have adequate psychological preparation and planning of convalescence.

The prediction of a high risk of conversion or a difficult laparoscopic procedure would also allow efficient and appropriate arrangement of the operating schedule and the availability of experienced laparoscopic surgeons for the procedure. It would also allow an earlier intra-operative decision to convert if difficulty is encountered.

METHODOLOGY

Inclusion Criteria
The inclusion criteria were as follows: All patients with symptomatic cholelithiasis, ultrasound (US) abdomen demonstrating cholelithiasis and normal common bile duct (CBD) and patients with a calculous cholecystitis.

Exclusion Criteria
Patients with severe heart and/or pulmonary diseases, concomitant disease requiring open surgery, or multiple previous upper abdominal incisions and patients who were not willing for surgery were excluded from the study. The total number of cases were 206.

All the patients ($n = 206$) selected as per the criteria from September 2014 to September 2016 were admitted in the surgical unit of Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal, Telangana State, India, after ethical committee approval and patient consent.

The variables recorded and studied in this study are as follows:
- Sex,
- Age,
- Obesity,
- History of previous upper abdominal surgeries,
- Comorbid illnesses (chronic obstructive pulmonary disease, ischemic heart disease, hypertension, chronic renal failure, and diabetes),
- The surgery setting (emergency or elective),
- White blood cell (WBC) count,
- Serum total bilirubin, and
- Sonographic findings, including GB wall thickness, pericholecystic fluid, CBD stone, and CBD diameter,
- Operative details such as operation time,
- Causes for the conversion to open surgery.

Cholecystitis was diagnosed by clinical and laboratory assessments and radiological report. Patients who presented with acute cholecystitis in the 1st 72 h underwent emergency LC. The patients whose radiological results did not support the clinical and laboratory data were not considered to have acute cholecystitis. If the patients with acute

infection were admitted more than 72 h after the onset of symptoms, elective LC was carried out 8–10 weeks later following a course of conservative treatment (delayed cholecystectomy). Obesity was defined as body mass index (BMI) above the cutoff value of 27.5 (kg/m^2).

A patient was categorized as having comorbidity when at least one of the following conditions was present at the time of cholecystectomy:
• Diabetes mellitus,
• Hypertension,
• Myocardial infarction,
• Congestive heart failure or
• Chronic obstructive pulmonary disease,
• Chronic renal failure.

LC was performed by experienced surgeons and surgical residents under supervision. The operation was performed using a four-port technique, with the surgeon standing on the left side of the patient. Veress needle insertion was attempted in all patients. Minimal diathermy was used to dissect a critical view of safety. Method of dissecting the GB from the liver bed, using the diathermy spatula or hook, was left to the preference of the surgeon. Conversion to OC was performed through a right subcostal incision. The cystic artery and cystic duct were ligated separately. The duration of operation was taken from the time of the initial skin incision to the time of skin closure. The post-operative duration of hospital stay was taken as the number of nights the patient stayed in the hospital after the procedure. Total patients in this study are divided into two groups based on completion of LC. One group is LC-completed group and the other one is LC converted to OC group.

RESULTS

This study was done prospectively over a period of 2 years, from September 2014 to September 2016, including 206 patients who underwent LC for symptomatic GB disease in all Surgical Units of Mahatma Gandhi Memorial Hospital, Warangal. Among the 206 patients in the study, 23 (11.16%) patients were converted to OC.

The most common reasons for conversion are severe adhesions caused by tissue inflammation (12 patients [52%]) and inability to define anatomy due to fibrosis of Calot's triangle (5 patients [21.7%]).

Conversion to OC due to intraoperative hemorrhage occurred in three patients. Conversion was enforced due to uncontrolled bleeding from GB bed in one patient (4.35%), which occurred during diathermic dissection of GB. In another two patients (8.7%), there was uncontrolled

Table 1: Summary of reasons for conversion

Reasons for conversion	*n*=23 (%)
Dense adhesions between GB and bowel	12 (52.17)
Inability to define anatomy at Calot's triangle	5 (21.7)
Bleeding from cystic artery injury	2 (8.7)
Bleeding from GB bed	1 (4.35)
Choledocholithiasis (preoperatively undiagnosed)	1
Bile duct injury	1
Equipment failure	1

GB: Gallbladder

bleeding from Calot's triangle, which occurred during dissection of cystic duct and artery.

Conversion to OC was required to achieve successful hemostasis, as they could not be controlled laparoscopically.

Conversion to OC caused by injury of the CBD occurred in one patient (4.35%), and the injury is identified intraoperatively and repaired over a T-tube.

In one patient (4.35%), conversion to OC was required to perform CBD exploration for suspected choledocholithiasis, based on laparoscopic finding of dilated CBD; pre-operative liver function tests (LFTs) and US were normal in this patient and there was no intraoperative OC facility available.

Conversion was due to an inability to establish and/or maintain sufficient pneumoperitoneum during the course of LC and due to clip applicator failure.

Gender
Of the 206 patients in the study, 145 were female and 61 were male. Successful LC was performed in 131 females and 52 males, whereas conversion was required in 14 females (9.7%) and 9 males (14.8%).

Age
In this study, patients aged under 60 years constituted 177 and over 60 years constituted 29; successful LC was performed in 161 patients aged under 60 years and 22 patients over 60 years, whereas conversion was required in 16 (9.03%) patients aged under 60 years and in 7 (24.1%) patients over 60 years.

BMI
In this study, out of 140 non-obese patients, 130 are in LC-completed group and 10 (7.14%) in converted group. Out of 66 obese patients, 53 are in LC-completed group and 13 (19.7%) in converted group.

Previous Upper Abdominal Surgery
In this study, five patients had upper abdominal scar, of these three patients were in LC-completed group and

2 (40%) were in converted group. A total of 201 patients had no upper abdominal scar, of these, 180 patients were in LC-completed group and 21 (10.44%) were in converted group.

Comorbidity
Sixty-four patients had comorbidity, of these 55 were in LC-completed group and 9 (14.06%) were in converted group. One hundred and forty-two patients were without comorbidity, of these 128 were in LC-completed group and 14 (9.85%) were in converted group.

Leukocytosis
In this study, 22 patients had elevated WBC, out of these, 16 were in LC-completed group and 6 (27.3%) were in converted group. About 184 patients had normal WBC, out of these, 167 were in LC-completed group and 17 (9.2%) were in converted group.

Abnormal LFT
Among the 206 patients in this study, 18 patients had abnormal LFT, of these, 5 (27.8%) were converted to OC. About 188 patients had normal LFT, of these 18 (9.57%) were in converted group.

Ultrasonography (USG) Findings
In this study, 66 patients had thickened GB wall, of these 13 (19.7%) patients were in converted group. About 140 patients had normal GB wall thickness, of these 10 (7.14%) were in converted group.

Pericholecystitis
In this study, pericholecystitis was found in 7 patients, of these 3 (42.9%) were in converted group. About 199 patients were without pericholecystitis, of these 20 (10.05%) were in converted group.

Surgery Setting: Emergency or Elective
Among the 206 patients in the study, chronic cholecystitis was found in 187 patients and acute cholecystitis in 19 patients. Emergency LC for acute cholecystitis was done in 19 patients, of these 5 (26.3%) required conversion elective LC in 187 patients with cholecystitis was done of these 18 (9.62%) required conversion.

DISCUSSION

LC is regarded as the gold standard in treating all GB diseases. Its benefits compared to OC are lower morbidity, shorter hospital stay, quicker recovery, and decreased post-operative pain.[10] Conversion to OC is, however, still necessary in up to 20% of the overall cases.[53] This study was conducted prospectively over a period of 2 years, from September 2014 to September 2016, including 206 patients who underwent LC for indicated GB disease in all Surgical Units of Mahatma Gandhi Memorial Hospital, Warangal.

This study evaluated the effects of patient characteristics on conversion, such as gender, age, BMI, history of previous upper abdominal operation, associated comorbid illnesses, leucocytosis, LFTs and USG findings including GB wall thickness, pericholecystic fluid, acute or chronic cholecystitis, surgery setting, and operative details such as operation time and causes for conversion.

This study prospectively analyzed 206 patients who underwent LC for indicated GB diseases, of these 23 (11.16%) patients required conversion to OC.

In this study, the overall conversion rate was 11.16%, comparatively higher than reports that have been published from highly specialized centers with extensive and special expertise in laparoscopic surgery.[11-13] General surgical practice might have somewhat less favorable results.

CONCLUSION

(1) In this study, the following factors were identified as significant risk factors for conversion of LC to open cholecystectomy: (i) Advanced age (>60 years), (ii) obesity (BMI >27.5 kg/m²), (iii) leucocytosis, (iv) abnormal LFTs; USG findings (1) thickened GB wall >4 mm, (2) Evidence of pericholecystic fluid; (v) LC done in emergency setting for acute cholecystitis; no significant risk factors: (a) Gender, (b) previous upper abdominal surgery, (c) comorbidities, (2) In patients with these risk factors, management can be improved by (i). Pre-operative counseling of the patient regarding these risk factors and high chances of conversion and (ii) early conversion to OC.

REFERENCES

1. Healy JS, Borley NR, Wigley C, editors. Gall bladder and biliary tree. In: Standring S, editor. Gray's anatomy: The Anatomical Basis of Clinical Practice. 39th ed. Ch. 86. London: Elsevier Churchill livingstone; 2005. p. 1227-31.
2. Oddsdottir M, Pham TH, Hunter JG. Gallbladder and the extrahepatic biliary system. In: Brunicardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Mathews JB, *et al.*, editor. Schwartz's Principles of Surgery. 9th ed. Ch. 32. New York, NY: McGraw Hill; 2010. p. 1135-67.
3. Griffiths GD. Disorders of the biliary tract. In: Alfred CS, Robert J, Moosa AR, editors. Essential Surgical Practice. 4th ed. London: Arnold; 2002. p. 375-452.
4. Glenn F, Grafe WR Jr. Historical events in biliary tract surgery. Arch Surg 1966;93:848-52.
5. Crawford JM. Liver and Biliary tract. In: Kumar V, Abbas AK, Fausto N, editor. Robbins and Cotran Pathologic Basis of Disease. 7th ed. Ch. 18. Philadelphia, PA: Elsevier; 2005. p. 877-939.
6. Conlon K. The gallbladder and bile ducts. In: Williams NS, Bulstrode CJ, Connell RO, editor. Bailey and Love's Short Practice of Surgery. 25th ed.

Ch. 63. London: Hodder Arnold; 2008. p. 1111-30.

7. Nagle AP, Soper NJ, Hines JR. Colecystectomy (open and laparoscopic). Zinner MJ, Ashley SW, editor. Maingot's Abdominal Operations. 11ᵗʰ ed. Ch. 2. New York, NY: McGraw Hill; 2007. p. 847-64.

8. Gabriel R, Kumar S, Shresth A. Evaluation of predictive factors for conversion of laparoscopic cholecystectomy. Kathmandu Univ Med J 2009;7:26-30.

9. Bulbuller N, Ilhan YS, Baktir A, Kirkil C, Dogru O. Implementation of a scoring system for assessing difficult cholecystectomies in a single center. Surg Today 2006;36:37-40.

10. Kama NA, Doganay M, Dolapci M, Reis E, Atli M, Kologlu M, *et al*. Risk factors resulting in conversion of laparoscopic cholecystectomy to open surgery. Surg Endosc 2001;15:965-8.

11. Simopoulos C, Botaitis S, Polychronidis A, Tripsianis G, Karayiannakis AJ. Risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy. Surg Endosc 2005;19:905-9.

12. Lipman JM, Claridge JA, Haridas M, Martin MD, Yao DC, Grimes KL, *et al*. Preoperative findings predict conversion from laparoscopic to open cholecystectomy. Surgery 2007;142:556-63.

13. Alponat A, Kum CK, Koh BC, Rajnakova A, Goh PM. Predictive factors for conversion of laparoscopic cholecystectomy. World J Surg 1997;21:629-33.