Original Research Article

DOI: http://dx.doi.org/10.18203/2349-2902.isj20183210

Predictive factors for conversion from laparoscopic to open cholecystectomy: an institutional study

Digvijoy Sharma, Kunduru Nava Kishore*, Gangadhar Rao Gondu, Venu Madhav Thumma, Suryaramachandra Varma Gunturi, Jagan Mohan Reddy, Nagari Bheerappa

Department of Surgical Gastroenterology, Nizam Institute of Medical Sciences, Hyderabad, India

Received: 05 June 2018 Accepted: 27 June 2018

*Correspondence:

Dr. Kunduru Nava Kishore,

E-mail: navakishore513@yahoo.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Laparoscopic cholecystectomy has become the gold standard treatment for symptomatic gallstones. However, a conversion to open surgery may be required to complete the procedure safely. The aim of this study is to identify the predictive factors of conversion from laparoscopic to open cholecystectomy in elective setting.

Methods: A retrospective review of all patients underwent laparoscopic cholecystectomy electively for symptomatic gallstones from January 2016 to December 2017 was performed. Data considered for analysis were: demographic data, preoperative laboratory values of liver function tests, gall bladder wall thickness on ultrasound, preoperative ERCP, indication for surgery, history of acute cholecystitis, presence of intraoperative adhesions and frozen Calot's triangle. Conversion to open cholecystectomy was chosen as the dependent variable for both, univariate and multivariate analysis.

Results: 546 patients underwent laparoscopic cholecystectomy. 333 were females (60.9%) and 213 (39.1%) males, with a mean age of 44.6 years. The most common indication for surgery was symptomatic cholelithiasis. Conversion to open cholecystectomy occurred in 48 cases (8.8%) and the most common reason for conversion was inability to define the Calot's triangle anatomy due to inflammation/adhesions. Univariate and multivariate analyses of various variables demonstrated that male gender, gall bladder wall thickness >5 mm and presence of previous documented acute cholecystitis had statistically significant co-relation with higher rates of conversion (p<0.001).

Conclusions: Presence of acute cholecystitis, gall bladder wall thickness >5mm on preoperative ultrasound and male gender were independent predictor factors for conversion from laparoscopic to open cholecystectomy. Such patients should be properly counselled about the increased risk for conversion and should be operated by surgeons experienced in laparoscopic procedures to reduce the rate of conversion and operative complications.

Keywords: Conversion, Laparoscopic cholecystectomy, Predictive factors

INTRODUCTION

In the present era laparoscopic cholecystectomy (LC) is the gold standard for treatment of symptomatic gallstones, owing to the lower morbidity, less post operative pain and hospital stay, better cosmesis and earlier return to regular activities.¹ One of the most common causes of abdominal pain is the presence of gallstones. Cholecystectomy is the only effective management of symptomatic gallstones. Open cholecystectomy (OC) has been widely replaced by laparoscopic cholecystectomy (LC). While consenting the patients for laparoscopic cholecystectomy, it is prudent to explain them the possibility of conversion to an open procedure (OC).^{2,3} The conversion rate as per literature ranges between 2% and 15%.^{4,5}

Conversion is known to increase perioperative time, complication rates, the length of hospital stay, and hospital expenses. It is, therefore, essential to identify risk factors for conversion to allow for safer procedures and better surgical planning.

The cause for conversion may be related to patient factors, surgeon factors and equipment failure Though the conversion of the procedure from laparoscopic to open is associated with an increased operating time, hospital stay, and morbidity, it shouldn't be regarded as a failure but rather as a necessary measure to prevent disastrous biliovascular complications. The identification of the predictive factors for conversion to open procedure is necessary to obtain a proper informed consent prior to surgery.

This study was designed to identify both preoperative and intraoperative factors for conversion in patients undergoing laparoscopic cholecystectomy in a tertiary care hospital.

METHODS

After clearance from Institutional Ethical Committee and Review Board, a retrospective review of all patients undergoing laparoscopic cholecystectomy (LC) in the Department of Surgical Gastroenterology at our institute from January 2016 to December 2017, was performed.

All patients underwent a preoperative ultrasonography. A detailed proforma was developed to record information on demographics, past history, history of presenting illness, physical findings, laboratory investigations, ultrasound findings. Reasons for conversion such as difficult dissection or anatomy, perioperative cholangiographic findings of stones and perioperative complications were documented for each patient.

The indications for cholecystectomy were: symptomatic gallstones, elective cholecystectomy after an attack of acute cholecystitis, chronic cholecystitis, biliary pancreatitis, choledocholithiasis treated with ERCP. All patients above 18 years of age who underwent elective laparoscopic cholecystectomy were included in the study. We excluded patients with acute cholecystitis, preoperative suspicion of cancer of the gallbladder. Acute cholecystitis was defined clinically by the presence of fever (>38°C), right hypochondrium pain with radiological evidence of inflammation on ultrasound or computed tomography scan.

The laparoscopic cholecystectomies were performed by experienced laparoscopic surgeons. The surgery was performed using a standardized technique with four ports. The critical view of safety (CVS) was demonstrated in all cases. The following factors were analysed for the study: age, gender, indication for LC, preoperative liver function tests, rate of conversion to open cholecystectomy, and reason for conversion.

For the statistical analysis, continuous variables were transformed into categorical by the division of patients into subgroups. The subgroups were identified according to age (less than 60 years old and older than 60 years), aspartate aminotransferase (AST) value (less than 40 IU/L and above 40 IU/L), alanine aminotransferase (ALT) value (less than 40 IU/L, and above 40 IU/L), alkaline phosphatase (ALP) value (less than 140 IU/L and above 140 IU/L).

Statistical analysis

All patients were divided into two groups, (laparoscopic group and conversion to laparotomy group) for both the univariate and the multivariate analysis. The univariate statistical analysis was performed using the chi-square test

A p-value <0.05 was considered statistically significant. The conversion to laparotomy was considered as the dependent variable in the multivariate statistical analysis. The variables found to be statistically significant on univariate analysis were evaluated by multivariate analysis using a multivariate logistic regression analysis. Statistical analyses were performed using SPSS software.

RESULTS

Five hundred and forty six patients underwent laparoscopic cholecystectomy during the study period. Three hundred and thirty three were females (60.9%) and 213 (39.1%) were males, with a mean age of 44.6 year (range 14-78 years).

The most common indication for surgery was symptomatic cholelithiasis. Patients with acute cholecystitis were managed conservatively as per our unit protocol and operated electively after 6-8 weeks. There was a total of 48 conversions in our study with an overall conversion rate of 8.8%. There were 26 (54.2%) males and 22(45.8%) females in the conversion group. Conversion to laparotomy was done in 27 (56.2%) patients due to frozen Calot's triangle because of inflammatory changes making it difficult to define the anatomy clearly.

Out of these 27 patients, 19 (70.4%) had previous history of acute cholecystitis. Eight (16.7%) patients were converted in view of extensive intra- abdominal adhesions due to previous abdominal surgeries. One (2.1%) conversion was due to injury to the CBD which was identified and repaired on table and 5(10.4%) conversions were due to presence of cholecystoduodenal/ cholecystocolic fistula.

Seven (11.1%) conversions were in patients who underwent a preoperative ERCP. Choledocholithiasis was identified preoperatively in 63 patients (11.5%) out of 546 and CBD clearance by ERCP was done in all the patients. Conversion occurred in 11.1% (7 patients) of

this subset of patients, a difference not statistically significant compared with patients experiencing conversion and not subjected to this procedure. The gall bladder wall thickness >5mm was significantly associated with increased conversion rates (p<0.001). The various causes for conversions are shown in Table 1.

Table 1: Cause for conversion from laparoscopic to open cholecystectomy.

Cause for conversion	Patient number (%)
Frozen/Inflammed Calot's triangle	27 (56.2%)
Extensive intra-abdominal adhesions	8 (16.7%)
Post ERCP status	7 (11.1%)
Cholecystoduodenal/colic fistula	5 (10.4%)
Bile duct injury	1 (2.1%)

Univariate analysis was done to identify risk factors for conversion were done for following – increased age, gender, previous abdominal surgery, gall bladder wall thickness >5mm on ultrasonography, preoperative ERCP, previous attack of acute cholecystitis and increased serum levels of AST, ALT.

Male gender, gall bladder wall thickness >5 mm and presence of previous documented acute cholecystitis had statistically significant co-relation with higher rates of conversion which was confirmed on multivariate analysis (p<0.05) as shown in Tables 2 and 3.

Table 2: Relationship between clinical characteristics and risk factors for conversion from laparoscopic (LC) to open cholecystectomy (OC).

Variable	LC (n=498)	LC-OC (n=48)	p value	
Age				
<60 yrs	303 (60.8%)	30 (62.5%)	0.564	
>60 yrs	195 (39.2)	18 (37.55)		
Sex				
Male	187 (37.5%)	26 (54.2%)	0.006	
Female	311 (62.5%)	22 (45.8%)	0.006	
Previous abdominal surgery	56 (11.2%)	8 (16.75)	0.937	
Post ERCP status	56 (11.2%)	7 (11.1%)	0.161	
Gall bladder wall thickness > 5mm	33 (6.6%)	23 (47.9%)	<0.001	
Previous acute cholecystitis	27 (5.4%)	19 (39.6%)	< 0.001	
AST				
<40IU/L	470 (94.3%)	43 (89.6%)	0.438	
>40IU/L	28 (5.7%)	5 (10.4%)		
ALT				
<40IU/L	463 (92.9%)	45 (93.7%)	0.562	
>40IU/L	35 (7.1%)	3 (6.3%)		
ALP				
<140IU/L	454 (91.1%)	44 (91.6%)	0.498	
>140IU/L	44 (8.9%)	4 (8.4%)		
I C-lanaroscopic ch	oleczistectomy		narosconic	

LC-laparoscopic cholecystectomy. LC-OC- laparoscopic converted to open cholecystectomy

Table 3: Univariate and multivariate analyses in relation to conversion to open cholecystectomy.

	Univariat	ł o		Multiva	rioto	
** 1.4			0.504.005		****	0.50/ 0.5
Variable	P value	HR	95% CI	P value	HR	95% CI
Age (<60/>60 years)	0.564	0.901	0.633-1.283			
Gender (Male/Female)	0.006	1.585	1.139-2.206	0.003	1.811	1.229-2.669
Previous abdominal surgery (Yes/No)	0.937	0.986	0.700-1.390			
Post ERCP status (Yes/No)	0.161	0.631	0.332-1.201			
Gall bladder wall thickness (<5mm/>5mm)	< 0.001	4.266	3.053-5.961	< 0.001	2.194	1.489-3.233
Previous acute cholecystitis (Yes/No)	< 0.001	4.512	2.927-6.954	< 0.001	2.613	1.621-4.212

HR-hazard ratio, CI-confidence interval

DISCUSSION

Since Mouret P first performed the first laparoscopic cholecystectomy, it has been widely performed throughout the world and has become the gold standard for treatment of symptomatic gall stone disease. ^{6,7} A number of studies have reported the conversion rate of laproscopic cholecystectomy to open cholecystectomy at 2 to 15%. ^{4,5} The causes for conversion reported in literature are: unclear anatomy of the Calot's triangle due to inflammation or adhesions, bleeding during dissection, contracted gallbladder, biliovascular injuries, cholecystoenteric fistula, gallbladder cancer, Mirizzi

syndrome, technical issues, and bowel injury.⁸⁻¹⁰ In our series the most frequent cause of conversion was the inability to define the anatomy of the Calot's triangle and demonstrate the critical view of safety due to inflammation and/or fibrosis, as reported in other studies too.¹¹⁻¹³ Acute cholecystitis is one of the common factors mentioned in previous studies, which is highly predictive of conversion which was also seen in patients in our study who had a previous episode of acute cholecystitis.^{14,15} The second cause of conversion in our study was the presence of extensive intra-abdominal adhesions that rendered a safe dissection difficult to perform. The presence of adhesions is a known risk factor

for conversion in elective LC. Numerous studies have shown that previous surgery of the upper abdomen is a risk factor for conversion to open cholecystectomy. 16,17 However, our study, has not shown this to be a factor predisposing to conversion. In several studies a preoperative ERCP has been identified as an independent predictor of conversion. 18,19 The likely cause is inflammation of CBD and pericholedochal tissues secondary to the procedure. Though few studies have shown early laparoscopic cholecystectomy after ERCP was associated with a lower conversion rate than delayed LC controversy still exists on the timing of surgery. ^{20,21} In our series choledocholithiasis was found preoperatively in 63 cases, all of whom underwent ERCP clearance before laparoscopic cholecystectomy. The conversion rate in these patients was similar (11.1%) as compared to the LC group (11.2%). Preoperative ERCP was not a predictor of conversion in the univariate analysis. In our study a statistically significant difference between the incidence of conversion in males and females was demonstrated (p=0.003). This is in accordance with other studies that show the male gender to be a risk factor for conversion, probably due to the more frequent association with severe disease, and presence of more intraabdominal and visceral adipose tissue than women. 16,17 Few authors have shown that older age is an independent risk factor for conversion where as others have failed to demonstrate a clear correlation.^{4,12,17,22} Present study did not demonstrate a correlation between older age and conversion rates. Gallbladder wall thickness more than 4-5 mm on preoperative ultrasound was a risk factor for conversion in many studies and present study findings were consistent with these studies.^{4,12}

CONCLUSION

In present study authors found that presence of history of acute cholecystitis, gall bladder wall thickness >5mm on preoperative ultrasound and male gender were independent predictor factors for conversion from laparoscopic to open cholecystectomy. Patients with these features should be properly counselled about the increased risk for conversion and should be operated by surgeons experienced in laparoscopic procedures to reduce the rate of conversion and operative complications. Conversion to open cholecystectomy shouldn't be regarded as a failure but rather as a necessary measure to prevent serious complications and towards the safety of the patient.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

1. Keus F, De Jong JA, Gooszen HG, Van Laarhoven CJ. Laparoscopic versus open cholecystectomy for

- patients with symptomatic cholecystolithiasis. Cochrane Database Syst Rev. 2006;4:CD006231.
- 2. Le VH, Smith DE, Johnson B. Conversion of laparoscopic to open cholecystectomy in the current era of laparoscopic surgery. Am Surg. 2012;78:1392-5.
- 3. Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. Am J Surg. 2004;188:205-11.
- 4. 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;181(6):520-5.
- Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. Am J Surg. 2002;184(3):254-8
- 6. Muhe E. The first cholecystectomy through the laparoscope. Langenbecks Arch Chir. 1986;396(1):804
- 7. Soper NJ, Stockmann PT, Dunnegan DL, Ashley SW. Laparoscopic Cholecystectomy The New'Gold Standard'?. Arch Surg. 1992;127(8):917-23.
- 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;30:1698-1704.
- 9. Shamiyeh A, Danis J, Wayand W, Zehetner J. A 14-years analysis of laparoscopic cholecystectomy: conversion when and why? Surg Laparosc Endosc Percutan Tech. 2007;17:271-6.
- Pavlidis TE, Marakis GN, Ballas K, Symeonidis N, Psarras K, Rafailidis S et al. Risk factors influencing conversion of laparoscopic to open cholecystectomy. J Laparoendosc Adv Surg Tech A. 2007;17:414-8.
- 11. Rosen M, Brody, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. Am J Surg. 2002;184: 254-8.
- 12. Ishizaki Y, Miwa K, Yoshimoto J, Sugo H, Kawasaki S. Conversion of elective laparoscopic to open cholecystectomy between 1993 and 2004. Br J Surg. 2006;93:987-91.
- Van Der Steeg HJ, Alexander S, Houterman S, Slooter GD, Roumen RM. Risk factors for conversion during laparoscopic cholecystectomyexperiences from a general teaching hospital. Scand J Surg 2011; 100: 169-173.
- 14. 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;30:1698-704.
- 15. Yajima H, Kanai H, Son K, Yoshida K, Yanaga K. Reasons and risk factors for intraoperative conversion from laparoscopic to open cholecystectomy. Surg Today. 2014;44:80-3.
- 16. Ercan M, Bostanci EB, Teke Z, Karaman K, Dalgic T, Ulas M et al. Predictive factors for conversion to open surgery in patients undergoing elective

- laparoscopic cholecystectomy. J Laparoendosc Adv Surg Tech. 2010;20:427-34.
- 17. Tang B, Cuschieri A. Conversion during laparoscopic cholecystectomy: risk factors and effects on patients outcome. J Gastrointest Surg. 2006;10:1081-91.
- 18. Boerma D, Rauws EA, Keulemans YC, Jansen IM, Bolwerk CJ, Timmer R et al. Wait-and-see policy or laparoscopic cholecystectomy after endoscopic sphinterectomy for bile-duct stones: a randomized trial. Lancet. 2002;360:761-5.
- Sarli L, Iusco DR, Roncoroni L. Pre-opeperative endocopic sphinterectomy and laparoscopic cholecystectomy for the management of cholecystocholedocholithiasis: 10-year experience. World J Surg. 2003;27:180-6.
- 20. Schiphorst AH, Besselink MG, Boerma D, Timmer R, Wiezer MJ, Van Erpecum KJ et al. Timing of

- cholecystectomy after endoscopic sphincterotomy for common bile duct stones. Surg Endosc. 2008;22:2046-50.
- 21. Salman B, Yilmaz U, Kerem M, Bedirli A, Sare M, Sakrak O et al. The timing of laparoscopic cholecystectomy after endoscopic retrograde cholangiopancreaticography in cholelithiasis coexisting with choledocholithiasis. J Hepatobiliary Pancreat Surg. 2009;16:832-6.
- 22. Lee NW, Collins J, Britt R, Britt LD. Evaluation of preoperative risk factors for converting laparoscopic to open cholecystectomy. Am Surg. 2012;78:831-3.

Cite this article as: Sharma D, Kishore KN, Gondu GR, Thumma VM, Gunturi SV, Reddy JM et al. Predictive factors for conversion from laparoscopic to open cholecystectomy: an institutional study. Int Surg J 2018;5:2894-8.