Original Research Article

DOI: http://dx.doi.org/10.18203/2349-2902.isj20202073

Factors affecting conversion rates in laparoscopic cholecystectomy: a single surgeon study

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Received: 28 April 2020 Accepted: 11 May 2020

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ABSTRACT

Background: There is need for conversion in laparoscopic cholecystectomy (LC) in some special situation to open cholecystectomy (OC) in order to minimize intraoperative and post-operative complications. The risk factors may be patient related, the gallbladder's pathology and the surgeon. Most studies with regards finding the risk factors for conversion in LC involved multiple surgeons which is one of the factors. Our study is prospective study where in all cholecystectomy were done by the single surgeon so as to find out other risk factors for conversion.

Methods: This was a prospective study conducted between January 2017 to 2020, where in a total 152 patients posted for LC and 27 got converted to OC. The factors analyzed were the age and sex of the patient, elective or emergency surgery, acute or chronic cholecystitis, comorbid conditions, previous abdominal surgery, post endoscopic retrograde cholangiopancreatography, intra operative adhesions, intraoperative complication like bile duct injury, bleeding from cystic artery or gall bladder bed, bile leak.

Results: Out of 152 patient 27 (17.8%) got converted to open cholecystectomy. Mean age was 48.86 with lowest 15 and highest age operated was 83 years, among them 63 (41.4%) were male and 89 (56.8%) were female. Fibrosis at Calot's triangle, intraoperative adhesions, cirrhosis of liver and age older than 60 years, were all significantly correlated with an increased conversion rate to laparotomy.

Conclusions: The risk factors may help to predict the difficulty of the procedure. This would permit the surgeon to better inform patients about the risk of conversion from laparoscopic to open cholecystectomy.

Keywords: Laparoscopic cholecystectomy, Conversion, Open cholecystectomy, Risk factors

INTRODUCTION

Gallstone disease has been observed in the mummies of the Egyptian dynasty 1085-945 BC plaguing mankind for over two thousand years. Incidences of gallstone disease varies throughout the world. Cholecystectomy has become accepted treatment for symptomatic gallstone disease. With the advent of minimal access surgery, the concept of laparoscopic cholecystectomy was born and marked a significant milestone in the treatment of gall stone disease. Today, it has largely replaced open cholecystectomy as the gold standard treatment of gall stone disease. Laparoscopic cholecystectomy an attractive treatment modality for cholelithiasis because of

less scarring, shortened hospital stays, earlier returns to usual activities.⁵ Despite the fact that laparoscopic cholecystectomy (LC) has got many advantages but its conversion into open cholecystectomy (OC) is disappointing not only for patient but for surgeon as well. But conversion should not be considered as complication of the procedure rather it is mature decision by the surgeons to avoid unnecessary lengthening the duration of procedure. The conversion rate of 3.6 to 13.9% is reported in the literature.⁴

Depending on specific circumstances, a conversion can be characterized as either elective, which is defined as the surgeon's decision to resort a laparotomy (because of obscure anatomy or lack of progress of the laparoscopic procedure) before being forced to do so as a result of a major intraoperative complication or as enforced, when an intraoperative emergency such as uncontrollable bleeding or bile duct injury, occurs.6 The most recognizable causes for conversion are obscure biliary anatomy, presence of dense pericholecystic adhesions, intraoperative bleeding, failure of the progression and suspicion of choledocholithiasis.^{7,8} Literature addresses that the factors predisposing to conversion can be classified as patient related, disease related and surgeon related.⁶ Studies from Western countries clearly stated that in general, the conversions rates are lower among the laparoscopic well-trained high-volume surgeons. compared either to the general surgeons or to the inexperienced laparoscopic ones.9-12 The aim and objectives of the study was to identify patient related and gallbladder disease related factors that determine the conversion of laparoscopic to open cholecystectomy excluding surgeon related factors, as it was single surgeon study. Hence this study helps to concentrate more on preoperative and intraoperative risk factors for conversion to OC.

METHODS

This was a prospective study conducted over period of 36 months between January 2017 to 2020 where in a total 27/152 patients posted for LC and 27 got converted to OC. All surgeries were done by single surgeon in single surgical unit who has 10 years' experience in laparoscopic surgeries in SDM college of medical sciences and hospital. Approval of study from ethical committee of college was taken and an informed written consent was taken from all patients.

All patients with symptomatic gall stones, acute or chronic cholecystitis, elective or emergency and patients of age 15 years and above were included in the study. The patients who were directly underwent open cholecystectomy and in those along with LC and common bile duct (CBD) was explored or clubbed with other surgery were excluded. The clinical diagnosis of acute cholecystitis was based on the presence of right upper quadrant pain, fever, elevated white blood cell count, signs of inflammation on ultrasound, and operative findings. The diagnosis of empyema or hydrops of the gallbladder was based on the presence of pus or mucus in the gallbladder when aspirated laparoscopically.

Standard four port LC was done with gallbladder extracted from the epigastric port. Drain if necessary was placed. For elective LC patient received third generation cephalosporin as prophylactic antibiotics, in acute cholecystitis patient received therapeutic doses. We collected and analyzed data including age groups (>60, <60), gender, body mass index (>30 kg/m²), mode of admission (elective or emergency), indication for LC

(chronic or acute cholecystitis), comorbid disease like diabetes, hypertension and ischemic heart disease (IHD), previous abdominal surgery, post endoscopic retrograde cholangiopancreatography (ERCP), intraoperative complications, operation time.

Statistical analysis

Statistical analysis was performed using the statistical package for the social sciences, version 20.0 (SPSS). Categorical variables are expressed as frequencies (and percentage), and continuous variables are expressed as the mean±SD. The chi-square test was used to evaluate potential associations between categorical variables, whereas odds ratios (ORs) and 95% confidence intervals (CIs) were calculated using simple logistic regression analysis. A multivariate stepwise logistic regression model was constructed to explore the independent effect of variables that showed a significant influence on conversion by univariate analysis. The patient's, age, obesity, post ERCP, intraoperative adhesions, fibrosis at Calot's triangle, IHD, cirrhosis diabetes, and history of previous abdominal surgery were included independent variables. Statistical significance was defined as p<0.05.

RESULTS

A total of 152 patients underwent LC between January 2017 to 2020. Male patients were 63 (41.4%) and female 89 (58.6%). The mean age of the patients was 48.86±14.43 years (range: 15-83 years). Conversion to open surgery occurred in 27 patients (17.8%), of which 9 (5.9%) had acute inflammation and 18 (11.82%) had no inflammation of the gallbladder as shown in (Table 1).

Table 1: Laparoscopy to open conversion rate.

Variables	Number	%
Laparoscopy	125	82.2
Open	27	17.8
Total	152	100

Table 2: The reasons for conversion to open cholecystectomy.

Digly footons	Numbou	%
Risk factors	Number	70
Fibrosis at Calot's triangle	12	7.89
Intraoperative adhesions		
between gallbladder and	8	5.26
bowel and omentum		
Bleeding from gallbladder	2.	1.31
bed or cystic artery	2	1.31
Bile duct injury	1	0.65
Cirrhosis	1	0.65
Post ERCP	3	1.97
Total	27	17.8

Table 3: The various preoperative and intraoperative characteristics correlating with conversion.

Factors		Laparoscopy (n=125)	Open (n=27)	P value	
A go (voors)	>60	24	11	0.01	
Age (years)	<60	101	16	significant	
Sex	Male	49	14	0.22	
Sex	Female	76	13	0.22	
Padry mass inday (lvg/m²)	>30	14	6	0.124	
Body mass index (kg/m²)	<30	111	21	0.124	
Diabetes	Yes	29	8	0.48	
Dianetes	No	96	19	0.48	
IHD	Yes	7	5	0.024	
IHD	No	118	22	significant	
A 4 1 1 4'4'	Yes	34	9	0.50	
Acute cholecystitis	No	91	18	0.52	
Dog EDCD	Yes	15	8	0.02	
Post ERCP	No	110	19	significant	
II/a ah daminal annaam	Yes	44	7	0.25	
H/o abdominal surgery	No	81	20	0.35	
Circle - de	Yes	1	2	0.025	
Cirrhosis	No	124	25	significant	
Ethan de et Calatta talanda	Yes	29	15	< 0.001	
Fibrosis at Calot's triangle	No	96	12	significant	
Intraoperative adhesions between	Yes	76	25	0.002	
GB and bowel or omentum	No	49	2	significant	
E	Yes	15	4	0.600	
Emergency surgery	No	110	23	0.688	

Table 4: Multivariate logistic regression of conversion risk factors of total patients who underwent laparoscopic cholecystectomy.

Risk factors	В	SE	Wald	P value	Adjusted OR (odds ratio)	95% CI for OR	
	(coefficient)	(standard error)	walu			Lower	Upper
IHD	-0.013	0.934	0.000	0.989	0.987	0.158	6.152
Post ERCP	-0.628	0.627	1.002	0.317	0.534	0.156	1.825
Intraoperative adhesions	-1.871	0.911	4.217	0.040	0.154	0.026	0.918
Fibrosis of Calot's triangle	-1.204	0.552	4.769	0.029	0.300	0.102	0.884
Cirrhosis	-3.183	1.571	4.104	0.043	0.041	0.002	0.902
Age group	0.666	0.588	1.281	0.258	1.946	0.614	6.167
Obesity	-0.608	0.722	0.710	0.399	0.544	0.132	2.240
Constant	18.392	5.434	11.457	0.001	97.908	-	-

The reasons for conversion to open cholecystectomy are summarized in (Table 2). The most common reason for conversion was fibrosis at Calot's triangle, next one was adhesions between gallbladder and omentum or bowel. The other cases of conversion involved bleeding from cystic artery or gallbladder bed (n=2), common bile duct injury (n=1), post ERCP (3) There were no cases of injury to major vessels or death.

The various preoperative and intraoperative characteristics correlating with conversion are shown in (Table 3). Significant predictors of conversion based on

univariate analysis were higher age (p=0.02), ischemic heart disease (IHD) (p<0.024), post ERCP (p<0.02), intraoperative adhesions (p=0.002), fibrosis at Calot's triangle (p=0.001) and cirrhosis (p=0.02). There was no relationship between the likelihood of conversion and BMI (p=0.12), diabetes (p=0.48), hypertension (p=0.97), acute cholecystitis (p=0.58), gender (p=0.22) or h/o previous abdominal surgery (p=0.35).

In Table 4, multivariate logistic regression of conversion risk factors of total patients who underwent laparoscopic cholecystectomy. Multivariate analysis with a multiple logistic regression model showed that the significantly independent predictive factors for conversion were, fibrosis of Calot's triangle (p=0.04), intra operative adhesions between gallbladder and bowel or omentum (p=0.036) and cirrhosis (p=0.04).

We had one case of situs inversus with acute cholecystitis which was successfully treated with laparoscopic cholecystectomy but patient developed jaundice post-operative second day due to slipped stone into CBD which was treated with ERCP and stenting with stone extraction. Stent was removed after three weeks. In two patients we have done subtotal cholecystectomy with no complications.

DISCUSSION

The advantages of LC over OC have been well documented and these advantages include earlier return of bowel function, less postoperative pain, shorter length of hospital stay, earlier return to full activity, decreased overall cost and improved cosmesis. However, the risk of conversion to open cholecystectomy is always present.

The conversion rate in patients who undergo an elective LC is 3-5% and for acute cholecystitis it is 6-35%. ¹⁶⁻¹⁹ In our study, the conversion rate was 17.8% which included both elective and emergency cases. We do not consider conversion as failure but rather as a purposeful alteration of the operative plan due to intraoperative problems thus avoiding further complications.

Cholecystitis changes the local anatomy resulting in formation of adhesions and fibrotic changes at the Calot's triangle, which destroys the planes and causes increased risk of bleeding during dissection and also increases the risk of gall bladder perforation. The adhesions also increase the risk of CBD injury and bowel injury. Severe adhesions at Calot's triangle as was directly related to the overall operative time, the conversion rate.²⁰ In our study fibrosis at Calot's triangle fibrosis was most common cause for conversion with significant p value (p=0.001).

In elderly patients, the longer the history of symptomatic gallstones disease, the more the delay in the presentation, thus; the more the untreated episodes of acute or even gangrenous cholecystitis, because of this they have the higher the incidence of dense adhesions formation, the greater the difficulties in dissection at Calot's triangle and higher chances of converting as shown in our study with significant p value (p=0.01). ²¹⁻²⁴

Previous upper abdominal surgery and diabetes also affect the conversion rate. Uncontrolled diabetes leads to autonomic and peripheral neuropathy; so, they develop symptoms later in the course of disease that leads to delay diagnosis and presents with more complication and risk of conversions are more.²⁵ Risk of conversion in diabetic is still controversial. In some studies, it favors as one of the risk factors, while other studies it doesn't affect conversion.^{26,27} In our study diabetes is not risk factor for conversion.

Previous history of abdominal surgery was considered as one of the risk factors for conversion from laparoscopic to open cholecystectomy, but the majority of adhesions do not alter the anatomy of the abdominal right upper quadrant so it does not negatively impact the likelihood of a successful LC. Previous upper abdominal surgery does associate with an increased need for adhesiolysis, and more chances of open conversion rate, and a long operating time.^{6,26} But in our study, it did not corroborate this finding.

Obesity, especially morbid obesity, is a risk factor in conversion to open cholecystectomy, but in our study, it did not contribute to conversion. In our study the factors contributed to conversion are higher age, IHD, post ERCP, intraoperative adhesion's, fibrosis at Calot's triangle and cirrhosis.

Intraoperative bleeding and followed by bile duct injury are most common intraoperative complications for conversion.²⁸ Other complication are bowel injury, bleeding from liver bed. Table 5 shows conversion rates, reason for conversion and other predictive factors of other studies.

Limitation

The main limitation of our study is sample size because it was done by single surgeon. Advantage of single surgeon study is, experience of surgeon, decision making during surgery and method of surgery will not affect the study (surgeon factors for conversion).

Table 5: Comparison of the conversion rates, indication for conversion and predictive factors in other studies.

Author	Year	Number of patients	Conversion rate (%)	Indication for conversion	Predictive factor
Ercan et al ²⁹	2010	2015	5	Adhesions	Male gender, increasing age, USG showing gall bladder wall thickening, preoperative ERCP
Genc et al ³⁰	2011	5164	3.16	Adhesions and Calot's triangle fibrosis	Male gender

CONCLUSION

The conversion of a LC to an open procedure seems to be multifactorial, be affected by factors related to the patient, the gallbladder's pathology and the surgeon. The need for conversion to laparotomy should be considered as neither a failure nor a complication, but as an attempt to be avoided intra or post-operative complications.

None of the risk factors assessed are contraindications, to LC, but it helps to predict the difficult gallbladder, that in turn would help the surgeon to better inform the patients about the risk of conversion from laparoscopic to open cholecystectomy.

ACKNOWLEDGEMENTS

Author would like to thank SDM College of Medical Sciences and Hospital, Sattur, Dharwad, India.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

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Cite this article as: Moger J, Badiger S. Factors affecting conversion rates in laparoscopic cholecystectomy: a single surgeon study. Int Surg J 2020;7:1746-51.