

Reasons and Risk Factors for Conversion from Laparoscopic to Open Cholecystectomy: A Retrospective Analysis in an Urban Teaching Hospital

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ABSTRACT

Introduction: Laparoscopic Cholecystectomy (LC), despite being the gold standard for the treatment of gallstone disease, requires conversion to Open Cholecystectomy (OC) at times for the safe and successful removal of Gallbladder. In spite of various studies done on the topic, there are no accurate preoperative predictive factors for conversion.

Aim: To analyse the most common predictive factors and reasons for conversion amongst patients, who underwent LC in an urban teaching hospital.

Materials and Methods: A retrospective analysis was performed on 907 consecutive patients who underwent LC, from January 2017 till September 2018 in JSS Hospital, which is a tertiary care hospital. Recorded data were sex, age, indication for LC, conversion to OC, reason for conversion, comorbidity, type of complication, length of hospital stay and postoperative morbidity

and mortality. The χ^2 test and Independent t-test were used and all calculations were done using SPSS version 21.0.

Results: Conversion from Laparoscopic to Open Cholecystectomy (LOC) was done in 17 (1.87%) out of the 907 cases. Dense adhesions between the gallbladder and the omentum/bowel (58.8%) and fibrosis of Calot's triangle with distortion of anatomy (29.4%) were the most frequent reasons for conversion. It was also found that recent acute cholecystitis and presence of gall bladder perforation were independent predictive factors for conversion.

Conclusion: The indications for conversion from LOC form a broad spectrum, ranging from more common ones like adhesions and fibrosis of Calot's triangle to rare ones like Common Bile Duct (CBD) injury. The analysis of the predictive factors help in informing the patient about the added risk of conversion preoperatively.

Keywords: Cholecystectomy conversion rate, Gall bladder perforation, Interval cholecystectomy, Preoperative prediction

INTRODUCTION

Gallstones are the most common disease state involving the gallbladder and biliary tree. Up to early 1990s OC was considered the treatment of choice [1]. But in 1992, the National Institutes of Health (NIH) Consensus Development Conference stated that LC provides a safe and elective treatment for most patients with symptomatic gallstones [2]. Currently it is estimated that over 80% of cholecystectomies are performed using the laparoscopic approach and it is considered as the gold standard [1,3,4].

The advantages of LC over OC have been well documented – decrease in the length of hospital stay, decreased morbidity, decreased postoperative pain, better cosmesis and early recovery. However, conversion from LOC is still required in some cases and approximately 2%-15% of patients undergoing LC need conversion to OC for various reasons according to literature [5,6]. Conversion when indicated should not be considered a technical failure but rather accepted as a better surgical practice by both the surgeon and the patient. Although there are several studies reporting varied incidence rates for the causes of this worldwide medical problem, definitive conclusion has not been reached as to which ones are more predictive of conversion to OC, so every institution must have a thorough understanding of the rate and causes of conversion.

Identification of the risk factors which are predictive of conversion preoperatively is beneficial for both the surgeon and the patient. With the availability of such information, patients can be adequately counseled preoperatively and will be better prepared to accept the conversion and make necessary arrangements, which is extremely important in this era of litigation.

The aim of the study was to determine the risk factors which will assist in the prediction of conversion from LOC and to analyse the most common reasons for conversion in patients undergoing LC for mixed indications, under both emergency and elective settings in an urban teaching hospital.

MATERIALS AND METHODS

A retrospective analysis was performed on all the patients who underwent LC from January 2017 till September 2018, in JSS Hospital in Mysore, Karnataka, India. Only surgeons who had undergone training on laparoscopy and have been certified by the department, with more than 10 years of experience in laparoscopic surgery were authorised to perform LC in the department.

The medical records were reviewed after obtaining permission from the medical superintendent (dated 26/10/18) and the following data were recorded: sex, age, indication for LC, conversion to OC, reason for conversion, co-morbidity, type of complication, length of hospital stay and postoperative morbidity and mortality.

The risk factors taken into consideration were age, sex, indication for cholecystectomy, whether it was an interval cholecystectomy, co-morbidities and presence of gall bladder perforation preoperatively. Indications for cholecystectomy were symptomatic cholelithiasis, acute cholecystitis, recent acute cholecystitis which was initially treated conservatively and for which interval cholecystectomy was being performed, recent biliary pancreatitis treated conservatively and recent obstructive jaundice due to common bile duct stones treated with Endoscopic Retrograde Cholangiopancreatography (ERCP). Acute cholecystitis was defined clinically by fever (Temperature $\geq 38^\circ\text{C}$), tenderness in

right upper quadrant, leucocytosis and signs of inflammation on ultrasound [7].

A patient was categorised as having co-morbidity when one of the following was found in the medical records – diabetes mellitus, hypertension, ischemic heart disease or Chronic Obstructive Pulmonary Disease (COPD). Complications were recorded which included perioperative complications such as bleeding and CBD injury and also postoperative complications such as surgical site infection, intra-abdominal bile leakage, lung complications and death.

The preoperative risk factors and postoperative morbidity which was analysed using incidence of complications and the length of hospital stay were collected for a cohort of LC and a cohort of LOC. The preoperative risk factors were then compared between the LOC and LC groups.

STATISTICAL ANALYSIS

The χ^2 test was used for statistical analysis of the LOC and LC groups for the categorical parameters. Independent t-test was used for the continuous parameters. All calculations were done using SPSS version 21.0. A p-value <0.05 was considered statistically significant. Another data point that was collected was the reason for conversion in the LOC group as dictated by the operating surgeon in the record file.

RESULTS

A total of 907 laparoscopic cholecystectomies were performed from January 2017 to September 2018 of which 17 cases were converted to OC, bringing about a conversion rate of 1.87%. The baseline characteristics are outlined in [Table/Fig-1].

		Conversion				p-value
		Yes		No		
		Count	N %	Count	N %	
Age (years)	11-20	0	0.0	17	100.0%	0.001
	21-30	0	0.0	101	100.0%	
	31-40	1	0.5	187	99.5%	
	41-50	1	0.4	228	99.6%	
	51-60	9	5.2	164	94.8%	
	61-70	6	4.2	136	95.8%	
	>71	0	0.0	57	100.0%	
Sex	F	7	1.3	548	98.7%	0.09
	M	10	2.8	342	97.2%	
Interval cholecystectomy	No	8	0.9	882	99.1%	<0.0001
	Yes	9	52.9	8	47.1%	
Co-morbidities	No	6	1.5	402	98.5%	0.4
	Yes	11	2.2	488	97.8%	
Complication	No	10	1.2	858	98.8%	<0.0001
	Yes	7	17.9	32	82.1%	
Perforation	No	13	1.4	889	98.6%	<0.0001
	Yes	4	80.0	1	20.0%	

[Table/Fig-1]: Baseline characteristics.

Amongst the 17 cases which underwent conversion, the most common reasons for conversion were found to be dense adhesions between the gall bladder and the omentum/bowel (10 cases, 58.8%) and fibrosis of Calot's triangle (5 cases, 29.4%) with distortion of the anatomy. Other reasons were CBD injury and difficult port entry which made up one case each [Table/Fig-2].

Indication for conversion	Count	N%
Adhesions	10	58.8%
Fibrosis	5	29.4%
Difficult port entry	1	5.9%
CBD Injury	1	5.9%

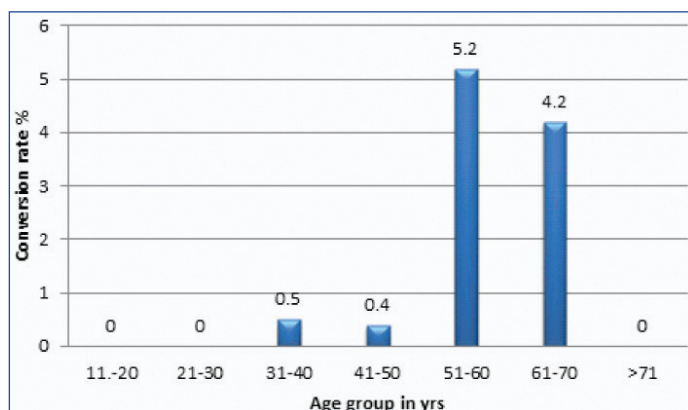
[Table/Fig-2]: Indication for conversion from LC to OC.

The main preoperative indications requiring conversion, as analysed by chi-square test, were recent acute cholecystitis (52.9%) for which interval cholecystectomy was done [Table/Fig-3] and the presence of Gall bladder perforation preoperatively (80%) based on sonological evidence [Table/Fig-1].

Indication	Conversion			
	Yes		No	
	Count	N %	Count	N %
Cholelithiasis	4	0.6	679	99.4
Acute cholecystitis	1	1.7	57	98.3
Recent acute cholecystitis	9	52.9	8	47.1
Biliary pancreatitis	0	0.0	36	100.0
Recent obstructive jaundice	3	2.7	110	97.3

[Table/Fig-3]: Comparison of the conversion rates for different indications of cholecystectomy.

Age was compared and it was found that LOC group had an average age of 57.35 versus the LC group which had an average age of 47.44, which indicated a statistically significant rise in the percentage of conversion with increase in the patient's age as shown in [Table/Fig-1,4].



[Table/Fig-4]: Conversion rate in each age group.

Sex and presence of co-morbidities were not found to have a statistically significant influence on the rate of conversion to OC. The co-morbidities were mainly type II diabetes mellitus, hypertension, ischemic heart disease and COPD.

Out of the 907 cases, there were 17 cases of interval cholecystectomy. Out of these 17 cases, 9 cases were converted from LOC. On comparing the two groups it was found that the cases which did not go in for conversion were done within the ideal period of 4-6 weeks after the episode of acute cholecystitis. While for those which went in for conversion, even though the median range was 4 weeks, the standard deviation was from 3.5 weeks to 7 weeks, compared to LC group in which the range was from 3.8 weeks to 5.5 weeks which fell within the ideal period. This was found to be a significant variable for conversion according to Mann Whitney Test.

Postoperative morbidity was analysed based on the presence of postoperative complications and length of the hospital stay and was found to be significantly higher in the LOC group when compared with the LC group. Complications were present in 7 out of the 17 cases in LOC group compared to the 32 out of 907 cases in LC group. The complications in the LOC group were mainly surgical site infection and postoperative atelectasis,

but there was bile leak and bowel injury in one case each. The length of stay also was significantly increased in the patients who underwent conversion with a mean hospital stay of 13 days with a standard deviation of 6.3 days, while the average hospital stay in laparoscopic cholecystectomy cases was just 6.2 days with a standard deviation of 3 days [Table/Fig-5]. This went on to prove that conversion indicated an increased postoperative morbidity and increased financial burden as they were more in need of higher end antibiotics and ICU care.

	Conversion				p-value
	Yes		No		
	Mean	Standard deviation	Mean	Standard deviation	
Age (years)	57.35	7.09	47.44	14.70	<0.0001
Hospital stay (days)	13.0	6.3	6.2	3.0	<0.0001

[Table/Fig-5]: Descriptive statistics – age of the patient and number of days of postoperative hospital stay.

Moreover, it has also been found that in patients in whom cholelithiasis was the indication of surgery, the odds ratio was less than one and also the confidence interval did not increase by more than a point, resulting in a significant p-value, from which it can be statistically deduced that when the indication for LC is cholelithiasis, it is highly unlikely for it to go in for conversion [Table/Fig-6].

Preoperative attributes	Odds ratio	95% CI		p-value
Gender (Male)	2.29	0.86	To 6.07	0.093
Diabetes	1.00	0.35	To 2.88	0.994
Hypertension	1.50	0.57	To 3.98	0.421196
Ischemic heart disease	1.75	0.39	To 7.82	0.493404
Cholelithiasis	0.10	0.03	To 0.30	<0.0001
Acute cholecystitis	0.91	0.12	To 7.01	0.929664
Recent acute cholecystitis	110.12	34.63	To 350.16	<0.0001
Recent biliary pancreatitis	0.00	1.46	To 9.67	0.2384
Recent obstructive jaundice	1.52	0.43	To 5.37	0.534284
Gall Bladder perforation	273.54	28.60	To 2616.13	<0.0001

[Table/Fig-6]: Preoperative attributes and the odds of conversion to open surgery.

This analysis and reasoning has been found to add weight to our words while counseling the patient and the relatives regarding the higher risk of conversion to OC in these cases which was one of the main objectives of this study.

Author	Year	Number of patients	Conversion rate	Indication for conversion	Predictive factor
Ercan M et al., [11]	2010	2015	5%	Adhesions	Male gender, increasing age, USG showing gall bladder wall thickening, preoperative ERCP.
Genc V et al., [12]	2011	5164	3.16%	Adhesions and Calot's triangle fibrosis	Male gender
Lee NW et al., [8]	2012	346	11.9%	Degree of inflammation	Age, male gender previous upper abdominal surgery, acute cholecystitis
Al Ghadhban MR et al., [9]	2018	200	6%	Adhesions	Female gender

[Table/Fig-7]: Comparison of the conversion rates, indication for conversion and predictive factors in previous similar studies [8,9,11,12].

REFERENCES

- Zinner MJ, Ashley SW. Maingot's abdominal operations. McGraw-Hill Professional; 2018 Sep 22.
- Conference, NC. Gallstones and laparoscopic cholecystectomy. JAMA. 1992;269:1018–24.
- Goyal V, Nagpal N, Gupta M, Kapoor R. A prospective study to predict the preoperative risk factors for conversion of laparoscopic to open cholecystectomy. J Contemp Med Surg Radiol. 2017;2(4):148–52.
- Soper NJ, Brunt LM, Kerbl K. Laparoscopic general surgery. New England Journal of Medicine. 1994;330(6):409–19.
- Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. The American Journal of Surgery. 2002;184(3):254–58.
- The Southern Surgeons Club. A prospective analysis of 1518 laparoscopic cholecystectomies. N Engl J Med. 1991;324:1073–78.
- Fischer JE, Bland KI, Callery MP, editors. Mastery of surgery. Lippincott Williams & Wilkins; 2006 Dec 18.
- Lee NW, Collins J, Britt R, Britt LD. Evaluation of preoperative risk factors for converting laparoscopic to open cholecystectomy. The American Surgeon. 2012;78(8):831–33.
- Al Ghadhban MR, Alkumasi HA, Meziad MS. Causes and incidence of laparoscopic cholecystectomy conversion to open cholecystectomy in Al Karama teaching hospital. International Surgery Journal. 2018;5(5):1640–43.
- 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 Journal of Surgery. 2006;30(9):1698–704.

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 [8–10].

The conversion rate in this study was 1.87%, which was less compared to other studies in which the conversion rate ranged from 3% to 12% [Table/Fig-7] [8,9,11,12].

On comparing previous studies done on the topic it was found that the presence of inflammation was one of the most frequent indicators for conversion to OC. This is in correlation with present study findings, as both gall bladder perforation and recent acute cholecystitis are severe infective foci, which result in inflammation. Pericholecystitis 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. The reason for the low conversion rate in this study is thought to be the expertise available in a territory care hospital.

Increase in age was also found to be a significant risk factor for conversion as substantiated by similar findings in other studies [3,8,10,13,14]. Even though acute cholecystitis was found to be a predictive factor in other studies, most of the cases in the index study were not converted, which could be attributed to expertise and ideal timing of performance of the procedure.

LIMITATION

The study limitation is that the patients were admitted in various different units; hence the operating surgeons were different for each patient. Even though the amount of expertise was similar, the decision to convert varied depending on the operating surgeon.

CONCLUSION

To conclude, in older patients with recent acute cholecystitis and gall bladder perforation, the patient and the relatives must be adequately counseled regarding the increased risk of conversion, complications, increased length of hospital stay and the need for performance of interval cholecystectomy within the ideal time period of 4–6 weeks. The surgeons, anaesthetist and OT staff should also be ready for conversion at any point and should be more vigilant towards intraoperative and postoperative complications in such cases.

- [11] 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. *Journal of Laparoendoscopic & Advanced Surgical Techniques*. 2010;20(5):427-34.
- [12] Genc V, Sulaimanov M, Cipe G, Basceken SI, Erverdi N, Gurel M, et al. What necessitates the conversion to open cholecystectomy? A retrospective analysis of 5164 consecutive laparoscopic operations. *Clinics*. 2011;66(3):417-20.
- [13] Pavlidis TE, Marakis GN, Symeonidis N, Psarras K, Ballas K, Rafailidis S, et al. Considerations concerning laparoscopic cholecystectomy in the extremely elderly. *Journal of Laparoendoscopic & Advanced Surgical Techniques*. 2008;18(1):56-60.
- [14] Ballal M, David G, Willmott S, Corless DJ, Deakin M, Slavin JP. Conversion after laparoscopic cholecystectomy in England. *Surgical Endoscopy*. 2009;23(10):2338.

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