



FACTORS INFLUENCING CONVERSION OF LAPAROSCOPIC CHOLECYSTECTOMY TO OPEN CHOLECYSTECTOMY

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ABSTRACT **Background** Cholecystectomy is the only effective management of symptomatic gallstones, with 93% of gallbladder disease problems referred to surgeons, Open cholecystectomy (OC) has been widely replaced by laparoscopic cholecystectomy (LC) as a Gold standard therapy. Laparoscopic cholecystectomy has the potential benefits of reducing recovery time, decreasing hospital stay, and allowing patients to return to work sooner. Laparoscopic cholecystectomy is performed by a few small incisions in the belly, while traditional OC required a full laparotomy. With increase peri-operative time, complication rates, peri-operative costs, the length of hospital stay, and hospital charges. Conversion is also associated with complications including death, bile duct injury, bile leak, or bleeding, requiring re-operation or transfusion. It is, therefore, essential to identify risk factors for conversion to allow for safer procedures and better surgical planning. identify the factors leading to the conversion of Laparoscopic cholecystectomy to Open cholecystectomy. **Methods and Materials** This is an Observational analytical study conducted between December 2020 to July 2022 in Department of General surgery, School of Medical sciences and research, Sharda hospital. 196 patients above 18 years of age that had symptomatic cholelithiasis, that were for elective laparoscopic were included in the study. **Results** Dense adhesions and instrument failure was found to be the most common cause of conversion to open cholecystectomy in our patients. We also observed that conversion rates were higher in males and in elderly patients. **Conclusion** During pre-operative evaluation, being prepared beforehand with detailed clinical evaluation adequate back-up support and good functioning instruments to predict the chance of conversion from laparoscopic to open cholecystectomy, to improve outcomes.

KEYWORDS : Cholecystitis, Laparoscopic Cholecystectomy, Re-Operation, Laparotomy

INTRODUCTION

One of the common causes of abdominal pain is the presence of gallstones, all across the world. Gallstones are often found using ultrasonography during the examination of unrelated medical issues, and the vast majority of patients have no symptoms whatsoever.^[1]

Cholecystectomy is the only effective management of symptomatic gallstones, with 93% of gallbladder disease problems referred to surgeons, Open cholecystectomy (OC) has been widely replaced by laparoscopic cholecystectomy (LC) as a Gold standard therapy.

In the last twenty years, the conventional open surgery for gallstones has been replaced with less invasive Laparoscopic cholecystectomy. In comparison to open surgery, Laparoscopic cholecystectomy has a number of advantages, including shorter hospital stays and thus a quicker return to normal activities and work, less postoperative pain, a quicker recovery, enhanced cosmesis, and more control over costs.^[1,2]

Laparoscopic cholecystectomy has the potential benefits of reducing recovery time, decreasing hospital stay, and allowing patients to return to work sooner. Laparoscopic cholecystectomy is performed by a few small incisions in the belly, while traditional OC required a full laparotomy.^[1,3] With increase peri-operative time, complication rates, peri-operative costs, the length of hospital stay, and hospital charges.^[8] Conversion is also associated with complications including death, bile duct injury, bile leak, or bleeding, requiring re-operation or transfusion. It is, therefore, essential to identify risk factors for conversion to allow for safer procedures and better surgical planning.

In cases of acute cholecystitis, the conversion rate for elective LC may be as high as 30%, despite the fact that it is only approximately 5% overall.

The ability of the operator has a significant impact on the conversion rate; Takegami et al. observed a 13% conversion rate in LC performed by general surgeons and a 2% conversion rate in LC performed by

expert surgeons. The conversion rate in LC performed by general surgeons was higher than the conversion rate in LC performed by expert surgeons. They have an 11% conversion rate in their patients, with complex anatomy being the leading reason of conversion.^[12,13] One further research by Wagih et al. found that 5% of patients needed to have their LC procedures converted to open cholecystectomies.^[14]

There are a variety of complications that can arise during surgery, including those related to the anaesthesia itself, the peritoneal access (such as vasculature injuries, visceral injuries, and port-site hernia), the pneumoperitoneum (such as cardiac complication, pulmonary complication, and gas embolism), and the thromboembolism. There is always a risk that a laparoscopic cholecystectomy may require conversion to an open procedure. While many studies have reported varying rates of the causes of this worldwide medical problem^[15], it is crucial that every institution have a complete understanding of the rate and causes of conversion to open surgery based on culture and geography, in addition to an understanding of conversion within the institution.^[16]

In addition to the immediate and long-term effects of the underlying reason of conversion, such as bile duct damage, the decision to switch from LC to OC significantly alters patient outcomes. Sometimes,^[17] conversion of procedure is done in order to prevent or repair harm, clarify complex anatomic linkages, or treat related disorders.^[18]

To prevent this from happening again, it is crucial to have a thorough familiarity with the pre- and intra-operative variables that might lead to conversion. Safe surgical practice will always need converting to OC, therefore understanding the outcomes is crucial for enhancing health care.^[18] Calot's triangle inflammation and extensive fibrosis, anatomical ambiguity, life-threatening hemorrhage, and bile duct damage are all possible triggers for a conversion.^[19]

Whether a LC must be converted to an OC is determined by many factors, including the patient's condition, the surgeon's expertise, and

the availability of appropriate surgical equipment. Inability to recognize anatomy and difficult dissection are two of the most common causes of switching from laparoscopic to open cholecystectomy, with complications like bleeding coming in a close third.^[16]

The aim of this study was to identify the factors leading to the conversion of Laparoscopic cholecystectomy to Open cholecystectomy.

METHODS AND MATERIALS

This is an Observational analytical study conducted between December 2020 to July 2022 in Department of General surgery, School of Medical sciences and research, Sharda hospital.

196 patients above 18 years of age that had symptomatic cholelithiasis, that were for elective laparoscopic were included in the study. Those patients with Acute cholecystitis, Gallbladder malignancy (suspected), Patient with CBD Stones, Patients with Acute cholangitis / Pancreatitis, and Patients unfit for General anaesthesia were excluded from the study.

Study Procedure

The general bio-data of the patients regarding their name, age, sex and address was collected. Detailed history was taken with special reference to the duration of right upper quadrant pain or epigastric pain, periodicity, any aggravation by fatty meals and any relief by parenteral or oral analgesics. Any past history of previous surgery or hospitalization and co-morbidities was taken into account.

A routine general physical, abdominal and systemic examination was performed. Pre-operative work up was include laboratory investigations like complete blood count, renal function test, liver function tests, Viral profile, Chest-X-Ray and. Ultra-sonogram of the abdomen was done on all the patients to confirm the diagnosis of cholelithiasis (Site, size, no. of stone, gallbladder wall thickness, pericholecystic fluid and dilatation of CBD).

Pre-anesthetic checkup was done for all patients. A fully explained well informed consent was taken from all patients undergoing surgery and with explanation of risk of conversion to open cholecystectomy. All cases was receive prophylactic pre-op antibiotics after test dose. The Patient was subjected to standard 4 ports laparoscopic cholecystectomy.

Statistical Analysis:

The statistical analysis was carried out using the statistical program SPSS version 21.0 after the data had been loaded into the Microsoft excel spreadsheet. The quantitative (numerical variables) information was presented as the mean and standard deviation, while the qualitative (categorical variables) information was presented as the frequency and percentage of each category. When comparing the mean values of the two groups, the student t-test was used, whilst the chi-square test was utilized to analyze the frequency differences between the two groups. If the p-value was less than 0.05, then it was regarded to be statistically significant.

Financial need: Funds made available by institution / university were utilized for the purpose of conducting NCCT to diagnose/ confirm expulsion of stone.

Ethical Considerations: All patients have received standard of care as per guidelines. Approval from institutional ethics committee obtained.

RESULTS

In our study of sample size of 196 patients 16 were converted to open cholecystectomy with conversion rate of 8%.

Table 1: showing the Conversion to open procedure

Conversion To Open Procedure	Frequency	Percent
No	180	92.0%
Yes	16	8.0%
Total	196	100.0%

Conversion to open procedure were 16 (8.0%) subjects.

The Reasons for LOC among 16 patients were dense adhesion over calot's triangle in 10 cases, Equipment failure like malfunction of CO2

insufflator in 2 cases, camera in 1 case & clip applicator in 1 case during surgery & haemorrhage & anatomical anomaly in 2 cases.

Table 2: showing the Reason for conversion

Reason for Conversion	Frequency	Percent
Adhesions Around Calot's Triangle	10	62.5%
Equipment Failure	4	25.0%
Bleeding/ Anatomical Anomalies	2	12.5%

- The reason for conversion was Adhesions around calot's triangle among 10 (62.5%), Equipment failure among 4 (25.0%) and Bleeding/ Anatomical anomalies among 2 (1.0%) patients.
- In the age wise distribution the mean age for symptomatic cholelithiasis were between 26 to 56 years age group. The mean age of the study population was 39.02 ± 7.75 (26-56) years.
- In the age group wise distribution for symptomatic cholelithiasis the maximum number frequency between 41-50 years age group.
- In the gender wise distribution for symptomatic cholelithiasis the maximum number were since in Female group of 61%.
- In the age group wise LOC conversion rate was higher between 41-50 years age group.

Table 6: showing the age group wise Conversion to open procedure

Age Groups	Frequency	Percent	Conversion To Open Procedure
21-30 years	30	100.0%	0
31-40 years	52	26.0%	4
41-50 years	84	42.0%	8
51-60 years	34	17.0%	4
p-value	< 0.001*		

- Conversion to open procedure was significantly more among 41-50 years and 51-60 years age groups.
- In the gender wise LOC conversion rate was significantly higher in males.

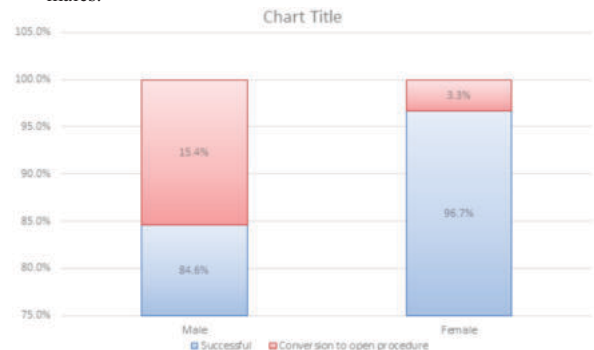


Figure 7: showing the gender wise Conversion to open procedure

- The LOC conversion rate was higher amongst patients with single / multiple GB calculi
- Of size more than 10mm when compared to size compared to less than 10mm calculi with no features suggestive of Acute cholecystitis, 10 cases out of 78 were converted LOC with more than 10mm GB calculi, 6 cases out of 122 were converted LOC with GB calculi size less than 10mm
- GB Calculi of more than 10 mm single or multiple was reported among 39.0% and less than 10mm among 61.0% subjects.

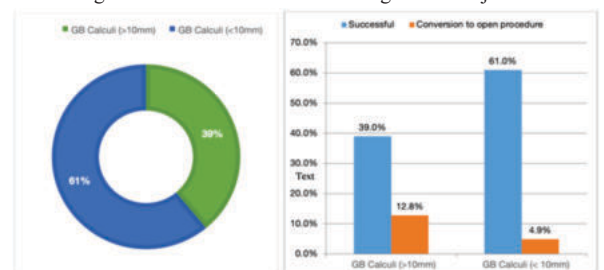


Figure 3: showing the GB stone size wise Conversion to open procedure

- The duration of hospital stay were significantly more in converted to open surgeries
- The duration of hospital stay was < 5 days among 120 (60.0%), 5-7 days among 25 (25.0%) and > 7 days among 15 (15.0%) patients.

Conversion to open procedure was significantly more among subjects with duration of hospital stay > 7 days.

- The post-operative complications reported were Abdominal distension among 10 (5%), Jaundice among 6 (3.0%), Retention of urine among 2 (1.0%) and Vomiting among 26 (13.0%) subjects.
- The duration of hospital stay was between 3 to 16 days in converted to open surgeries
- The mean Duration of stay in hospital was significantly more among subjects with Conversion to open procedure (8.28 ± 3.09) days compared to laparoscopic cholecystectomy (4.09 ± 1.85) days.

DISCUSSION

Since Carl Johann Langenbuch conducted the first open OC in 1882, OC has been the gold standard therapy for GB problems for more than a century.^[72] In 1987, Dr. Philip Mouret successfully completed the first LC procedure on a human patient. For the treatment of GB disease, it has almost entirely supplanted the practice of OC and has been dubbed the "new gold standard therapy."^[72] In 1990, a LC was done in India for the first time at the JJ Hospital in Mumbai. This was followed a few months later by Dr. Jyotsna Kulkarni performing the procedure in Pune.^[73]

It is essential to bear in mind that switching from LOC is not considered a problem, but rather a question of good medical judgment, since the health and wellbeing of the patient should always come first. LOC may be necessary in order to prevent damage to the bile duct, in order to treat an intraoperative problem (such as an injury to the biliary system, the vasculature, or the colon), or in order to address a failure to make progress during surgery.^[74] The cause might be simply one of these things, or it could be a mixture of many of them.

Age

GB illness is reported to afflict people of all ages; nevertheless, our research found that it was most prevalent in people's third, fourth, and fifth decades of life, which accounted for 75% of all of the cases we looked at. Maximum incidence was seen in the age range of 41-50 years, which corresponds to 42 patients (42%) and was followed by that in the age group of 31-40 years, which corresponds to 26 patients (26.0%)

Patients who were older than 60 years old were related with a greater conversion rate, according to the findings of Awan et al.^[5] It was determined that there was a statistically significant link between the two variables. Age was shown to have a strong correlation with an increased conversion rate of LOC in studies carried out by Wiebke EA et al, Kanaan SA et al, and Simopoulus C et al.^[75-77] Fried GM and colleagues were of the opinion that it was challenging to outline the anatomy in older individuals who had a significant history of GB illness.^[78] Symptoms of this condition include the GB becoming thickened, shrunken, and constricted. It is possible for the GB to become tightly adherent to the common bile duct, which causes the cystic duct to become shorter.

Gender

It has been documented in the research that the rate of conversion and intra-operative difficulties is higher in male patients. This information can be found in several pieces of published research. The findings of our investigation were consistent with those found in the study by Awan and colleagues.^[3] In their research, there were 79.3% females and 20.7% men, and the conversion rate was much greater among males (15.1%) than it was among females (3.4%). However, research conducted by Kanaan SA et al and Simopoulos C et al indicated that male sex was a major preoperative factor in predicting a problem leading to conversion. This was the case in both of these investigations.^[76,77]

It was determined that there was a statistically significant link between the two variables. However, Fried GM et al. have attempted to explain the higher risk associated with male patients on the basis of correlation matrix analysis, which showed a small but significant correlation between male sex and increased likelihood of acute cholecystitis, older age, and increased GB wall thickness. The reason for the higher conversion rate among males is still a mystery, but Fried GM et al. have attempted to explain the higher risk associated with male patients.^[78]

This association may help explain, at least in part, why males have a higher probability of undergoing conversion or experiencing difficulties after surgery.

The Rate Of Conversion

LOC may be necessary in order to prevent damage to the bile duct, in order to treat an intraoperative problem (such as an injury to the biliary system, the vasculature, or the colon), or in order to address a failure to make progress during surgery.^[62] The explanation might be any one of them, or it could be a mixture of many of them.

There are a lot of research on the conversion rate for LC and the reasons why people convert that can be found in the academic literature. According to the findings of our research, the LOC was 8%, which was consistent with the findings of the study conducted by Thyagarajan M et al (10%).^[65] Studies conducted during the last several years and made public have shown that conversion rates are quite variable, ranging anywhere from 2.6% to 7.7%.^[15,19,79-84]

According to Genc et al.^[16], it was discovered that the conversion rate was 3.16%, which compares well with the rates that were published in the literature. It would seem that a past history and/or new inflammation (i.e., AC) are two of the most common scenarios that involve an elevated operating risk and are the primary grounds for conversion to the open procedure. This is because these are the situations that occur the most often.

Mishra and Soni.^[85] observed an 8.0% conversion rate while moving from the laparoscopic approach to the open procedure. Adhesions, uncertain anatomy, hemorrhage, and GB perforation were the primary causes of this condition. The surgeon has to have sufficient experience, as well as increasing laparoscopic ability, in order to accomplish the desired reduction in conversion rate. In LC, changing to an open approach at the appropriate moment is seen to be good judgment on the part of the surgeon.

When it is not possible to assure that the LC will be completed safely, an OC will need to be performed instead of a laparoscopic one. In order to prevent problems and minimize morbidity, it is seen more as an exercise in prudent decision-making than as a botched laparoscopic operation. The discovery of the characteristics that predict conversion aids in preoperative patient counseling, enables for better perioperative planning, and minimizes the difficulties associated with LOC when and when it is suitable.^[50,80,86,87]

Prior Diagnosis Of Acute Cholecystitis

The presence of a history of fever with pain was found to be significantly associated with chances of conversion, probably because it signifies repeated attacks of acute inflammation leading to increased fibrosis and is therefore one of the clinical variables of significance that was found to be significantly associated with chances of conversion. According to earlier investigations, this specific past history of acute cholecystitis effecting more conversions is consistent with the findings of those studies.^[50,88,89]

Patients who have had acute cholecystitis at any point in the past would have a greater risk of undergoing conversion when undergoing LC, according to Fried GM et al's findings. These researchers came to this conclusion after doing research.^[78] It has been observed that a history of acute cholecystitis leads to a GB that is scarred and fibrosed and has extensive fibrotic adhesions, both of which make laparoscopic dissection challenging.

Laparoscopy becomes more difficult as a result of peri cholecystitis, which also alters the local architecture and makes it more complicated to locate the Calot's triangle and the common bile duct. Peri cholecystitis may also make it easier for the patient to bleed from the GB bed or the cystic artery. Additionally, it provides a greater chance of GB rupture and, as a result, the leakage of gallstones into the peritoneal cavity as the GB is being dissected.^[90] As a result, conversion rates in instances involving AC were reported to reach as high as 27.7% in the relevant literature.^[91]

Ultrasound Findings

The discovery of a thicker GB wall on ultrasound that is more than 4 millimeters has been suggested as a prognostic factor for conversion in the majority of investigations.^[61,92-94] In order to increase the sensitivity of imaging as a tool for predicting the likelihood of conversion to open surgery, Chauhan et al. included the findings of contracted GB and stone impacted at the neck of GB.^[94] They did this in order to find out how many patients in the conversion group had one or more of these findings on imaging. The researchers found that 27 of 33 patients in the conversion group had one or more of these findings on imaging.

Awan et al.³ reported that, out of 450 patients, 37 cases were having inflated GB (>5 cm), out of which 5 cases were converted to OC, 357 cases showed normal GB size on USG, and out of those 357 cases, 16 (4.5%) were converted to OC. In the research that Steeg Van der HJJ and colleagues conducted on 346 individuals, they discovered that conversion was necessary in 17.2% of the instances.^[95] In both the univariate and the multivariate analyses, an enlarged GB was revealed to be a significant predictor of both difficulty and conversion.

The intraoperative factors that were finally found to be associated with higher chances for conversion were dense adhesion and frozen Calot's triangle. These were probably the result of the repeated inflammatory attacks that were suggested by the preoperative factors. The most common causes of conversion were dense adhesion and frozen Calot's triangle.

Uncertain anatomy, ductal damage, and the presence of cholecystoduodenal or cholecystocolic fistula were additional explanations that were seen in a limited number of patients but had a nearly 100% conversion rate.^[69]

Complications of LC

The process of conversion should not be considered a complicated one. Hemorrhage, perforation of the GB, bile leakage, damage to the bile duct, perihepatic collection, and visceral injury are the real consequences of LC. Conversion could be necessary in certain circumstances, and it might be able to assist avoid some of these potential issues. In addition, a few very uncommon problems, such as an external biliary fistula, wound sepsis, hematoma, foreign body inclusions, and adhesions, have been documented.^[16,96,97]

Bile leakage without overt bile duct damage is the most frequent postoperative complication associated with laparoscopy. This might occur as a result of leaking from a clipped cystic duct stump or gallbladder bed. It is possible to treat it conservatively or to avoid it altogether by using endo suture ligation in the appropriate location. In this research, the incidence was 4% in the LC group while there was no incidence in the OC group patients. This result may be compared to a study that Ch Chauet al^[98] conducted and obtained postoperative bile leak incidence of 6.5% in the LC group and 2.4% in the OC group patients.

Mishra and Soni^[85] discovered that wound infection was the most clear and overt disadvantage of OC in this investigation, achieving a result of 20% in OC group patients as opposed to 4% in LC group patients. This finding was based on the comparison between the two treatment groups. Pulmonary problems were also more common in the open technique (8% in OC), as opposed to the laparoscopic approach, which had 4%, due to the fact that the laparoscopic approach had a decreased inflammatory stress response, better pulmonary function, and less hypoxia than the open method. One patient in the OC group was reported to have an incidence of incisional hernia, which was determined to be related. This is because the open approach involves making a huge incision and disrupting the normal structure of the abdominal wall. All of these problems rates in both operations may be compared with the findings of Chau et al and 's Grace et al studies,^[98,99]. However, the overall risk of problems after either of the procedures investigated in this research is not substantially different from that of the other.

Stay In The Hospital After The Operation

In the present research, participants who had a conversion to an open operation spent considerably longer time in the hospital than those who had a LC (4.091.85 days, compared to 8.283.09 days for subjects who had LC).

Post-operative hospital stays were found to be significantly shorter among LC group patients in the study by Mishra and Soni^[85] (4.482.83 days) than OC group patients (7.841.68 days), and Huang SM et al^[100] got the result of post-operative hospital stay (mean) 3.931.71 for LC group as compared to 7.920.79 days for OC group patients. These findings are comparable to the findings of the current study.

CONCLUSION

In the treatment of symptomatic gallstone disease, laparoscopic cholecystectomy is considered to be the gold standard procedure. However, there are a great number of circumstances that make it unavoidable to change the technique to open. When obtaining a patient's permission for a laparoscopic cholecystectomy, it is thus

required to inform the patient that there is a potential that the procedure will need to be performed using an open approach. According to the findings of this research, dense adhesion was the most prevalent reason of conversion, followed by unclear anatomy at calot's triangle. A trustworthy back up may help mitigate the effects of some avoidable problems such as the malfunction of an instruments. Additionally, it is necessary for the team to crosscheck clinical history and examination and investigation prior to shifting the patient OT from pre-operative room, to make arrangements of special instruments (e.g. Endo Harmonic scalpel, Endo loop ligature) one day prior to surgery in anticipated difficult procedure.

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