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Intra-operative factors responsible for conversion of laparoscopic cholecystectomy to open cholecystectomy in a tertiary care center

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ABSTRACT

Background: Laparoscopic cholecystectomy is the gold standard treatment for symptomatic cholelithiasis and has multiple advantages over open approach. With increasing skills and techniques over the years, the contra-indications to laparoscopic cholecystectomy have reduced. Even after careful selection of appropriate candidates for laparoscopic cholecystectomy, it sometimes becomes necessary to convert into an open cholecystectomy to prevent complications. This study was undertaken so as to identify the intra-operative factors necessitating conversion of laparoscopic cholecystectomy to open cholecystectomy.

Methods: In this study conducted at S. P. Medical College and P. B. M. Hospital, Bikaner, over a period of 1 year, 100 consecutive patients with symptomatic cholelithiasis, planned for laparoscopic cholecystectomy were included. Laparoscopic cholecystectomy was performed and cases which could not be completed laparoscopically were converted to open cholecystectomy via right subcostal incision. Intra-operative factors necessitating conversion were observed and analyzed.

Results: The incidence of conversion was found to be 7%. The most common intra-operative factor for conversion was dense adhesions at the Calot's triangle (71.43%) followed by obscure anatomy (42.86%). Uncontrolled bleeding and CBD stones also led to conversion. The identification and appearance of CBD and achievement of critical view of safety were significant factors for conversion to open cholecystectomy (p=0.0001).

Conclusions: The rate of conversion to open cholecystectomy was 7% which is comparable to similar studies. Conversion is not a failure or complication but actually a safer alternative to ensure completion of the procedure without any real complications of laparoscopic cholecystectomy- biliary or visceral injury, haemorrhage, etc.

Keywords: Cholelithiasis, Conversion, Laparoscopic cholecystectomy, Open cholecystectomy

INTRODUCTION

Cholelithiasis is a major health problem in India and worldwide and cholecystectomy is the treatment of choice. Cholelithiasis affects up to 10-15% of the population in western societies but the majority cases are asymptomatic (>80%).1 In India, the prevalence is estimated to be around 4%.2 Around 1-2% of asymptomatic patients develop symptoms warranting surgery per year making cholecystectomy one of the commonest surgeries performed.1

The first cholecystectomy was performed in 1882 by Carl Langebuch in Germany and the first laparoscopic cholecystectomy was performed in 1985 by Erich Mühe, also in Germany.³ In 1992, The National Institute of Health (NIH) consensus development conference declared laparoscopic cholecystectomy equivalent to open cholecystectomy and presently it is the gold standard for symptomatic cholelithiasis.⁴ The advantages of laparoscopic cholecystectomy over an open procedure include reduced surgical trauma (small incisions), lesser post-operative pain, earlier oral acceptability and ambulation, shorter hospital stay and early return to routine work, better cosmesis and decreased incidence of incisional hernias. An attempt to do the procedure laparoscopically should be made in all cases except if there are absolute contraindications.⁵

Laparoscopic cholecystectomy is a safe procedure and rate of major complications is <5%.6 Even after careful preoperative selection of appropriate candidates for laparoscopic cholecystectomy, in difficult cases, it sometimes becomes necessary to convert the laparoscopic procedure into an open cholecystectomy to prevent major complications and to successfully complete the procedure. With the increasing understanding of laparoscopic techniques and surgeon's experience, the conversion rates have decreased from 2-22% to around 1-6% over the years.⁷⁻¹⁰ Conversion should not be considered as a failure or complication as it is a better alternative to ensure patient safety. The factors leading to conversion can be patient related such as obscure anatomy, adhesions, uncontrolled bleeding or visceral injury; surgeon related such level of expertise; and equipment related such as power/instrument failure. The decision to convert to open cholecystectomy is made by the surgeon intra-operatively and on an individual and subjective basis. This causes a significant change in the post-operative outcome of the patient- longer hospital stay, effects of the cause for conversion in cases such as bile duct injury or visceral perforations.

This study was undertaken so as to identify the intraoperative factors that lead to conversion of a laparoscopic cholecystectomy to an open cholecystectomy in cases which have been evaluated pre-operatively (on basis of patient characteristics, clinical parameters and sonography findings) and considered eligible for a safe laparoscopic cholecystectomy.

METHODS

This was a prospective hospital-based study done over 12 months in the Department of General Surgery, S. P. Medical College and P. B. M. Hospital, Bikaner (October 2018 to September 2019). Consecutive 100 patients (of either sex) with symptomatic cholelithiasis who underwent laparoscopic cholecystectomy and were eligible as per the inclusion and exclusion criteria were included in the study.

Inclusion criteria

Patients who were planned for laparoscopic cholecystectomy for symptomatic cholelithiasis and gave informed consent for inclusion.

Exclusion criteria

Patients having common bile duct stone, jaundice or abnormal liver function, thickened gall bladder wall or dilated common bile duct on pre-operative ultrasound, known carcinoma gall bladder, peritonitis, cholangitis, biliary enteric fistula, portal hypertension, HBsAg, HCV or retro positive patients, history of previous laparotomies and upper abdominal surgeries and absolute contraindications for laparoscopic surgeries.

Pre-operative analysis

After taking written, informed consent, details of cases including history, clinical examination and investigations were recorded. Pre-operative sonography findings were noted.

Surgical technique

Standard four-port technique and pneumoperitoneum creation with carbon dioxide was used to perform the surgery. Attempt to achieve Critical view of safety was made in all cases before clipping cystic duct and artery. Intra-operatively, all cases were observed and those which could not be completed laparoscopically were converted to open cholecystectomy via right subcostal incision. All converted cases were evaluated regarding the factors responsible for conversion.

Statistical analysis

A record of patient demographics, intra-operative factors, complications, reason for conversion and duration of hospital stay was entered into a fixed proforma. Descriptive statistics was done for all data and suitable statistical tests of comparison were done. Statistical significance was taken as p<0.05. The data was analyzed using SPSS Version 16. Microsoft Excel 2010 was used to generate charts.

RESULTS

Out of the 100 patients that underwent laparoscopic cholecystectomy, 7 required conversion to open cholecystectomy.

It was seen that 88 patients were female while only 12 were male but the rate of conversion was higher in males-2 out of 12 (16.67%) while it was only 5.68% (5 out of 88) in females (Table 1).

Table 1: Sex-wise distribution of cholelithiasis and conversion (n=100).

Sex	Total cases	Conversion (%)
Male	12	2 (16.67)
Female	88	5 (5.68)
Total	100	7 (7)

The maximum number of patients were in the age range of 41-50 years i.e. 26 cases and minimum of 4 cases in ≤20 years. The mean age was 41.29 years. Maximum rate of conversion was seen in patients in range 61-70 years

i.e. 20% (2 out of 10 cases). It was seen that the chances of conversion increased with the increase in age but the change in rate of conversion with respect to age was not found to be significant(p=0.246) (Table 2).

Table 2: Age-wise distribution of cholelithiasis and conversion (n=100).

Age in years	Total cases	Conversion (%)
≤20	4	0
21-30	19	0
31-40	25	0
41-50	26	3 (11.54)
51-60	16	2 (12.5)
61-70	10	2 (20)
Total	100	7 (7)

Out of 100, 25 patients had history of multiple attacks of biliary colic and 4 out of those needed conversion i.e. 16%. 75 patients on the other hand had experienced single episode of biliary pain and 3 out of those i.e. 4% needed conversion. Thus, history of multiple attacks of cholecystitis led to a higher chance of conversion probably because of the fibrosis and adhesions caused by the same. 32 out of 100 cases had tenderness in the right hypochondrium at the time of presentation out of which 5 (15.63%) needed conversion to open cholecystectomy mainly due to intra-operative adhesions. 68 patients did not have tenderness at the time of admission and only 2 out of those (2.94%) needed conversion.

Multiple intra-operative findings were analyzed and it was seen that certain cases had a higher rate of conversion- contracted gallbladder, thickened gallbladder walls, multiple calculi and size of calculi >1 cm were some factors that had higher incidence of conversion but the results were not significant. Identification and appearance of the common bile duct had a significant relation to rate of conversion (p=0.0001). Out of 100 cases, common bile duct was normal in 93 out of which 3 needed conversion i.e. 3.26%. In 5 cases, common bile duct was dilated with 1 having stones in it. 2 out these 5 cases required conversion to open cholecystectomy i.e. 40%. The patient with choledocholithiasis underwent CBD exploration with T-tube insertion. In 2 cases, the common bile duct could not be identified laparoscopically and both underwent conversion to confirm the same i.e. 100%. Also, achievement of critical view of safety was significantly related to rate of conversion (p=0.001). Critical view of safety was achieved in 78 out of 100 cases out of which only 1 (1.28%) needed conversion. Critical view of safety could not be achieved in 22 out of 100 cases out of which 6 (27.27%)needed to be converted into open cholecystectomy.

The intra-operative factors responsible for conversion in all the cases were evaluated. Adhesions were seen in 33 out of 100 cases but were dense enough to lead to

conversion to open cholecystectomy in 5 of those (15.15%). Anatomy at Calot's triangle was obscured in 6 out of 100 cases and 50% of those needed conversion to an open cholecystectomy. Bleeding severe enough to obscure vision and that could not be laparoscopically controlled was seen in only 1 case in the series and it needed to be converted for completion of the procedure. An aberrant branch of right hepatic artery was the source of the bleeding. Intra-operatively, common bile duct stones were found in 1 case which were not detected in the pre-operative abdominal ultrasound. The preoperative liver function tests of the patient were also within normal limits. Laparoscopic procedure was abandoned and open cholecystectomy with CBD exploration was performed and a T-tube inserted into the CBD after retrieval of CBD stones. No cases of visceral or biliary injury were seen in present study neither was there any instrument failure (Table 3).

Table 3: Intra-operative factors responsible for conversion (n=100).

Intra-operative factors	Total	Converted (%)
Adhesions	33	5 (15.15)
Obscure anatomy	6	3 (50)
Bleeding	1	1 (100)
Biliary injury	0	0
Visceral injury	0	0
Instrument failure	0	0
Others-CBD stones	1	1 (100)

Operative time for all the cases was recorded. It ranged from a minimum of 55 to a maximum of 132 minutes. The mean operative time for cases completed laparoscopically was 76.47 minutes while for converted cases was 120.57 minutes. 75 out of 100 cases were completed in <90 minutes and none of them needed conversion. All 7 converted cases took \geq 90 minutes for completion. The difference was found to be significant (p=0.002) (Figure 1).

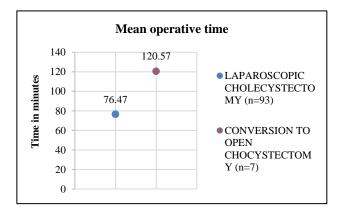


Figure 1: Mean operative time.

The mean post-operative stay for cases completed laparoscopically was 2.29 days while for those converted to open cholecystectomy was 5.57 days. Out of the 93

cases that were completed laparoscopically, 71 (76.34%) were discharged on post-operative day 2, 17 (18.28%) on post-operative day 3 and 5 (6.38%) on day 4. Out of the 7 patients who underwent conversion to open cholecystectomy, 4 (57.14%) were discharged on post-operative day 4, 2 (28.57%) on post-operative day 5 and the 1 (14.29%) patient who underwent CBD exploration was discharged on post-operative day 13 (Figure 2).

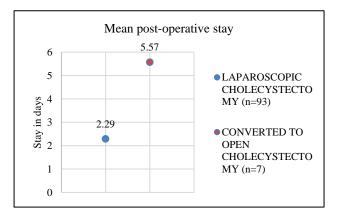


Figure 2: Mean post-operative stay.

DISCUSSION

Laparoscopic cholecystectomy was introduced in 1985 and has been regarded to be a safe technique, equivalent to open cholecystectomy by the NIH consensus in 1992. It is one of the commonest procedures performed at centres for general surgery. Rate of conversion to open cholecystectomy has decreased over the years with expertise and technological enhancement. Most of the open cholecystectomies are now performed as conversion from laparoscopic cholecystectomy for one or the other reason hence all surgeons need to be trained in the same so as to be able to convert if needed.

In present study, as seen previously by Tariq et al and Singh et al, cholelithiasis was commoner in females- 88% versus 12%. ^{11,12} Conversion on the other hand was seen more commonly in males- 16.67%, as was earlier observed by Tariq et al, Thyagarajan et al and Mukherjee et al. ^{11,13,14} Mean age of patients in present study was found to be 41.29 years which is comparable to the studies by Tariq et al, Singh et al and Mukherjee et al. ^{11,12,14} Maximum cases were in the age range of 41-50 years. Maximum rate of conversion i.e. 20% was seen in age group 61-70 years. It was also seen that the rate of conversion increased with the increasing age.

Adhesions and obscured anatomy at Calot's triangle were the most common causes leading to abandonment of laparoscopic cholecystectomy and conversion to open procedure. In our study, we noted that out of 100 cases, 7 needed to be converted to open cholecystectomy and dense adhesions near the gall bladder was the commonest factor leading to conversion i.e. 71.43%. Obscure anatomy at Calot's triangle amounted to 42.86%

conversions, while uncontrolled bleeding and common bile duct stones were responsible for conversion in 14.26% cases each. Volkan et al, Kumar et al, Tariq et al and Singh et al also found adhesions at the gall-bladder and Calot's triangle to be the most common cause for conversion in their studies. 11,12,15,16 Ahmed et al in their study, recorded ill-defined anatomy as the most common cause (69.23%) for conversion to open cholecystectomy which was the second most common cause for conversion in present study.¹⁷ Bleeding as a cause for conversion was seen in present study in 1 case out of 7 and was also recorded by various other studies namely by Volkan et al, Kumar et al and Tariq et al. 11,15,16 Common bile duct stones were found intraoperatively in 1 out of 100 cases in our study and necessitated conversion to open cholecystectomy and CBD exploration. Mukherjee et al also report a single case of CBD stones and Kalwaniya et al report 2 cases of choledocholithiasis in their study which needed conversion and CBD exploration along with cholecystectomy. 14,18 Bile duct injury was another factor seen in many studies which led to conversion to open cholecystectomy and definitive management- Singh et al, Kumar et al, Mukherjee et al and Kalwaniya et al reported conversion secondary to biliary injury. 14,16,18,19 Mukherjee et al, Volkan et al and Tariq et al in their studies, also found bowel injury as a cause of conversions. 11,14,15 In the present study, we did not come across any case of biliary or visceral injuries during laparoscopic cholecystectomy. It can be attributed to the fact that the threshold for conversion in our set-up is lowif Calot's triangle dissection is not complete by 30-45 minutes, we chose to electively convert the procedure to an open approach rather than trying to dissect further laparoscopically and risking visceral or biliary injuries.

Intra-operatively, 5 cases had dilated common bile ducts with 1 of those also having choledocholithiasis. 2 cases out of these 5 needed conversions to open cholecystectomy with the 1 with choledocholithiasis also requiring a CBD exploration and insertion of T-tube. In 2 cases, the common bile duct could not be positively identified laparoscopically and both the cases were converted to open cholecystectomy for proper identification of Calot's triangle. The association of identification and appearance of the CBD with conversion to open cholecystectomy was found to be significant n present study (p=0.0001). Conversions were also needed by Tariq et al, Vishnuvarthan et al and Ahmed et al because of unclear or ill-defined anatomy. 11,17,20

Misidentification of biliary structures led to an increased incidence of bile duct injuries with the advent of laparoscopic cholecystectomy. Strasberg et al in 1995 introduced the critical view of safety to minimize the risk of biliary injuries in laparoscopic cholecystectomy. The cystic structures should not be clipped and divided until all three elements of CVS are attained -the lower one-third of the gallbladder has to be separated from the cystic plate, the hepatocystic triangle is cleared of fat and

fibrous tissue and only two structures should be attached to the gallbladder- cystic duct and cystic artery. In present study, we aimed to achieve the critical view of safety in all attempted laparoscopic cholecystectomies. In all the cases where CVS was achieved, only 1.28% needed conversion to open cholecystectomy while in cases where CVS could not be achieved, 27.27% required conversion. The difference was found to be significant (p=0.0001).

The mean operative time for the completion of converted cases was 120.57 minutes while that of the cases completed laparoscopically was only 76.47 minutes. 75% of cases could be completed within 90 minutes and none of them required conversion to open cholecystectomy. The difference was significant (p=0.002).

Conversion to open cholecystectomy affects the patient satisfaction and increases the morbidity of the procedure. Present study did not record any serious complications or mortality in either group of patients and post-operative period of all was uneventful. Post-operative stay was one factor which was affected because of conversion of laparoscopic cholecystectomy to open cholecystectomy. It was seen that out of the 93 cases that were successfully completed laparoscopically, 76.34% patients were discharged on post-operative day 2, 18.28% were discharged on post-operative day 3 and 6.38% were discharged on day 4. Patient who underwent conversion to open cholecystectomy had a comparatively longer post-operative hospital stay- 57.14% were discharged on post-operative day 4 and 28.57% on post-operative day 5. 1 patient who underwent CBD exploration was discharged on post-operative day 13 after a postoperative T-tube cholangiogram which was found to be normal. In present study, average duration of postoperative stay was 2.29 days for cases completed laparoscopically and 5.57 days for the converted cases. Kumar et al also recorded the mean post-operative stay in their study which was 3.37 days in laparoscopic cases and 5.75 days in converted cases.¹⁶

Rate of conversion is widely variable as seen in literature. Over the years, conversion rates in various centres has decreased owing to increasing expertise of the surgeons and better equipment. It is found to range from 2-22%. ^{19,22} In present study, the rate of conversion of laparoscopic cholecystectomy was found to be 7% which is comparable to the studies done by Tariq et al, Mukherjee et al and Kalwaniya et al who had conversion rates of 7%, 7.3% and 8.54% respectively. ^{11,14,18}

CONCLUSION

Inflammation, adhesions, and anatomic difficulty continue to challenge the use and safety of laparoscopic approach in a small number of patients but its multiple advantages over the open method have made it the treatment of choice in all cases of symptomatic cholelithiasis. In certain difficult cases, it becomes

necessary to convert the laparoscopic cholecystectomy into an open procedure.

From present study it was concluded that adhesions at the Calot's triangle and obscure anatomy are the two main intra-operative factors responsible for conversion of laparoscopic cholecystectomy to open cholecystectomy. Achievement of critical view of safety and positive identification of common bile duct are important factors to ensure completion of safe laparoscopic procedure.

It is essential for a surgeon to understand that in difficult cases, conversion of a laparoscopic cholecystectomy into an open procedure is not a complication but a sound judgement so as to prevent complications and ensure safe completion of the procedure. The willingness and ability of surgeons to convert timely to open cholecystectomy continues to be important to the safety of this operation.

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