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Original Article

Evaluation of predictive factors for conversion of laparoscopic cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy has now replaced open cholecystectomy for the treatment of gallbladder diseases. However, certain cases still require conversion to open procedures. This study identifies and evaluates risk factors that may predict conversion from laparoscopic to an open procedure.

Objectives: To identify and evaluate the predictive factors for conversion of laparoscopic to open cholecystectomy.

Materials and methods: A total of 234 Laparoscopic cholecystectomies were attempted at the Kasturba Medical College Hospital, Manipal, from January 2003 to July 2005. Of these, 61 had to be converted to open cholecystectomy. A retro and prospective analysis of different parameters, including Patient factors, Intra-operative factors and Surgeon factors were performed.

Results: Sixty one (26.1%) laparoscopic cholecystectomies required conversion. Factors contributing to conversion included male sex, age group of 31-40 years, over weight and history of biliary pain within last two to four months, ultrasonography findings of multiple calculi and gall bladder wall thickness of more than 3 mm. Intraoperative gall bladder perforation with spillage of its contents in abdominal cavity and dense adhesions with difficult anatomy resulted in higher conversion rates. Surgery performed by surgeons in learning phase of laparoscopic surgery was more prone to conversion.

Conclusion: Patient factors, presentation, preoperative ultrasonography findings and surgeon's experience, all contribute to the possibility of conversion of laparoscopic cholecystectomy. Knowledge of these factors may help in preinformation to patient for psychological preparations for conversion and an experienced surgeon can plan to operate on these patients.

Key words: Cholecystectomy, laparoscopy, conversion.

Laparoscopic cholecystectomy, since its advent in 1987, has dramatically replaced the conventional open cholecystectomy. It decreases postoperative pain and ileus, allows earlier oral intake, shortens hospital stay and enhances earlier return to normal activity and improves cosmesis[1]. Conversion to open cholecystectomy is neither a failure nor a complication, but an attempt to avoid complications. It may be helpful to determine the risk of conversion before hand. This may allow patients to have adequate psychological preparation, to be better prepared for surgery and to plan their convalescence. Such predictions may allow a surgeon to be better prepared to convert from laparoscopic cholecystectomy to open at an earlier stage. Current study is aimed to evaluate the various factors that may have contributed in conversion of laparoscopic to open cholecystectomy.

Materials and methods

This study was conducted at the Kasturba Medical College Hospital, Manipal, India, an academic and tertiary care hospital. All patients who underwent laparoscopic cholecystectomy (n=234) from January 2003 to July 2005 were included in the study. Data of patients were collected from Medical Record Department of the hospital. All patients who were converted to open cholecystectomy (n=61) were considered as 'Converted'.

A detailed proforma was developed to record information on demographics including patient's age, sex, body mass index (BMI), presentation, past history of right upper abdomen pain or any abdominal operations. Investigation including ultrasonographic findings of

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gall bladder and intraoperative cause of conversion was noted. The operating surgeon's experience was recorded as number of laparoscopic cholecystectomies performed by the surgeon.

All elective laparoscopic cholecystectomy patients were included in the study. Laparoscopic cholecystectomy performed along with other laparoscopic intervention in the same setting and laparoscopic cholecystectomies along with common bile duct exploration were excluded from the study.

Results

Laparoscopic cholecystectomy was attempted in 234 patients during the time period of January 2003 to July 2005 (two and half years), at Kasturba Medical College Hospital, Manipal. Out of these 234 cases, 96 patients were males and 138 females. The Male: Female ratio was 1:1.4. Of these 234 cases, 61 (26.1%) were converted to open cholecystectomy. Conversion was required in 33% of males (n=32) and 21% of females (n=29), (Table 1). Largest number of patients were of the age group 41–50 years (n=69) but highest rate of conversion was seen in age group of 31–40 years (Fig 1).

Total 136 patients were with normal BMI, 88 were over weight and 10 were obese. The highest percentage of conversion (28%) was seen in overweight group of patients (Table 1). Mean age of converted patients was 46.9 years and mean BMI 24.65.

At the time of presentation, 102 patients had right upper quadrant pain. A total of 209 (89%) patients had history of biliary colic in past. Patients were divided into different groups according to the duration of onset of pain. Highest number of patients (n=87) had pain within last two months, but highest rate of conversion (49%) was noted in the group of patients who had pain in last two to four months. None of the patients had previous upper abdominal surgery.

Ultrasonography (USG) of gall bladder showed that 131 patients had distended gall bladder, of which 32% had conversion. A total of 228 patients had evidence of gall bladder calculi. Three had gall bladder polyps, two had porcelain gall bladder and one had haemolytic disorder. One hundred and twenty six patients had multiple calculi in gall bladder. A higher rate of conversion (34%) was seen in patients with multiple calculi. Sixty patients had gall bladder wall thickness of more than 3 mm, of which 60% (n=41) had conversion.

Sixty one patients (26.1%) had conversion of laparoscopic cholecystectomy to open surgery due to various reasons (Fig 2). Gall bladder perforation with spillage of bile and calculi into the peritoneal cavity was the commonest cause of conversion (32.8%), followed by dense adhesions around the gall bladder and the Calot's triangle area causing unclear anatomy.

In this study, surgeons who had performed more than 20 laparoscopic surgeries were considered as 'experienced', whereas those who had performed less than 20 were considered to be in a 'learning phase' of laparoscopic surgery. Experienced surgeons had conversion rate of 19% (n=25) whereas learning phase surgeon had conversion rates of 35% (n=36).

Table 1: Distribution of different variables in total and converted patients.

Variables	Total (n=234)	Converted (n=71)
Male	96	32 (33%)
Female	138	29 (21%)
Age 31-40 years	42	18 (43%)
BMI 25-30 kg/m^2	88	25 (28%)
Pain in last 2-4 months	35	17 (49%)
Distended gall bladder	131	42 (32%)
Multiple calculi	126	42 (34%)
Thickened GB wall (> 3mm)	68	41 (60%)

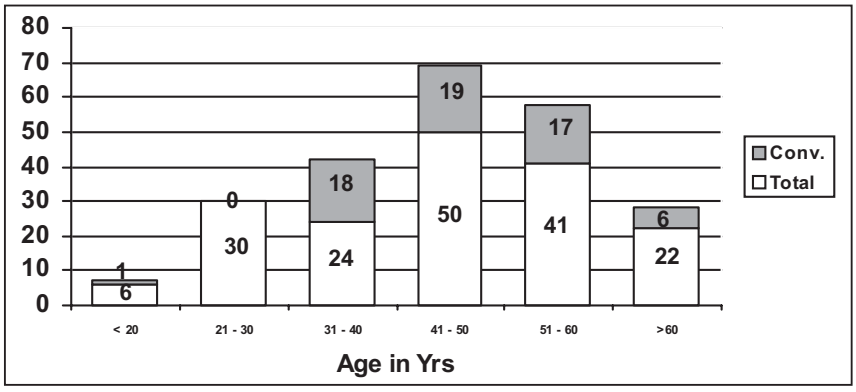

Fig 1: Age group wise distribution of total patients and conversion.

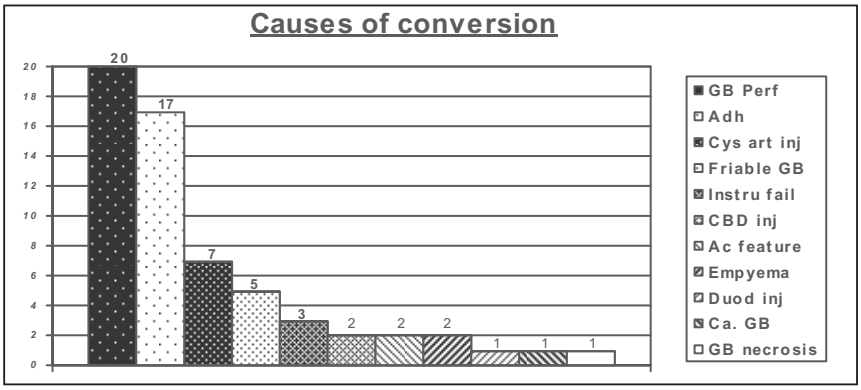

Fig 2: Intraoperative causes of conversion.

Discussion

A total of 234 patients were taken up for laparoscopic cholecystectomy in our center in a time frame of two and half years, of which, 26.1% (n=61) were converted to open surgery. The conversion rate in studies carried by *Chi-leung Liu et al*[1] in 1996, incorporating 500 patients, was 9%. Similarly, *Rosen et al*[2] in their study of 1347 patients in 2002, had conversion rate of 5.3%. A study by *Nachnani et al*[3] in India in 2005, including 105 patients, had a conversion rate of 11.4%. The higher conversion rate in current study may be due to several surgical units with most of the surgeons in learning phase of laparoscopic cholecystectomy operating independently in this institution.

In current study, the Male: Female ratio was 1:1.4 and Male:Female ratio in converted group was 1.1:1. In a study by *Rosen et al*[2] they found Male: Female ratio in the converted patients to be 1:1.4. Similarly, *Liu et al*[1], in their study, found that 10.5% males and 8.1% of females required conversion. In the present study, 33% (n=32) of males and 21% (n=29) of females required conversion. The reason for higher conversion rates in male patients remains unexplained, though males are at significant risk for conversion according to most of these studies as it has been observed that male patients have more intense inflammation or fibrosis, resulting in more difficult dissection in the Calot's triangle and through the plane between the gall bladder and liver[4, 5].

The age group of patients in the present study ranged from 13 years to 70 years. In the conversion group mean age of Males was 48.3 years and that of Females was 45.5 years. In this study, 69 patients were in the age group of 41–50 years. However, highest conversion rate (43%) was in age group of 31 –40 years. *Liu et al*[1], in their study, found that age more than 65 years predicted conversion. Similarly, *Kaman ET al*[6] found age >60 years as a risk factor for conversion. But in the present study, 43% (n=18) out of 42 patients in age group 31–40 years had conversion surgery.

A total of 88 patients were over weight and ten were obese. In the conversion group mean BMI of male was 25 and female was 24.3, both being normal. *Michael R. et al*[2]**,** in their study, had found that mean BMI of the patients who had conversion surgery was 32 kg/m^2 whereas it was 24.7 in the present study. In the study by *Liu et al*[1], highest rate of conversion was seen in obese patients (25%). In the current study, highest rate of conversion was noted in over weight group, where 28%

(n=25) of the total over weight patients had conversion. This difference may be due to obesity being more in western countries where they make a majority of overall patients presenting for surgery, unlike in India where obesity is not as common[7].

A total 209 patients had a past history of biliary colic. Highest rate of conversion (49%) was noted in patients who had pain within last two to four months. This may be due to the pericholecystic inflammation that would have resulted into dense adhesion, resulting in a difficult dissection and visualizing the proper anatomy[8]. At the time of presentation for surgery, 5% (n=12) had a positive Murphy's sign, of which 58% (n=7) had conversion surgery. Conversion in these patients was due to features of acute cholecystitis, like friable and distended gall bladder. Within 72 hours of symptoms of acute cholecystitis, the tissue planes are edematous and inflamed but are easier to dissect, having no adhesions. But after 72 hours, the tissue becomes more friable and is dangerous and risky to dissect till three to four weeks time when inflammation subsides and fibrosis sets in[9,10]. Though, in our institution, acute cholecystitis is usually treated conservatively and surgery is deferred till the acute condition resolves, this small number of patients had the surgery when they had subtle features of acute cholecystitis.

All patients underwent routine blood tests, including complete blood count, liver biochemistry and USG as preoperative investigations. All the patients had normal liver function tests and a non dilated common bile duct. Preoperative USG revealed that 131 patients had distended gall bladder. Thirty two percent (n=42) of patients with distended gall bladder required conversion, whereas only 18% (n=19) of patients with contracted gall bladder required conversion. Out of 126 patients with multiple calculi, 34% (n=42) had conversion in comparison to 18% (n=19) patients having single calculus. In cases with multiple calculi, spillage of calculi in the peritoneum due to perforation of gall bladder was a leading factor to conversion whereas in solitary calculus, identification and extraction of spilled calculus was relatively easier.

Sixty eight out of 234 patients had gall bladder wall thickening, defined as maximal obtainable measurement of more than 3 mm. The gall bladder wall thickening was contributed by fibrosis in the wall due to previous inflammation[11]. In contrast, in acute cholecystitis, the wall is thickened due to oedema of wall in response of the inflammation. *Liu et al*[1] found in his study that 44.5% of the converted cases had thickened wall. Similarly *Rosen et al*[2] showed 32.8% and *Nachnani et al*[3] showed 30.5% having thickened wall. In the current study, rate of conversion was 60% (n=41) in case of thickened gall bladder whereas it was 12% (n=20) in case of normal gall bladder wall.

The most frequent cause of conversion was perforation of gall bladder with spillage of its content in the peritoneal cavity in 32.8% (n=20) (Fig 2). 27.9% (n=17) had dense adhesions causing difficult anatomy. A study by *Peters et al*[7] showed that the cause for conversion was inability to identify the anatomy correctly in 50% of patients. Cystic artery injury was seen in 11.5% (n=7). 4.9% (n=3) had conversion due to instruments failure like light failure, failure to insufflate the peritoneal cavity. These are avoidable causes of conversion.

Experience of operating surgeon also affected the conversion rates. Of the 234 cases, experienced surgeons performed a total of 131 surgeries and surgeons in learning phase of laparoscopic surgery performed 102. Rate of conversion was 19% (n=25) in case of experienced surgeon whereas it was 35% (n=36) in case of surgeon in learning phase.

Conclusions

Evaluation of the factors that predict the conversion in laparoscopic cholecystectomy in Kasturba Medical College Hospital, Manipal showed that conversion is more common if factors listed here are present. Patient factors included male sex, age group of 31–40 years, over weight patients, biliary colic within last two to four months, multiple gall bladder calculi and gall bladder wall thickness of more than 3 mm. Intraoperative factors included gall bladder perforation with spillage of its content, dense adhesions, difficult anatomy and cystic artery bleeding. Surgeries performed by surgeon in learning phase of laparoscopic cholecystectomy were prone to be converted to open surgeries.

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