A Prospective Analysis of Factors determining Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy.

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Abstract : *This study was conducted to identify and analyze the factors determining conversion of laparoscopic cholecystectomy to open cholecystectomy and formulate some guidelines to prevent complications by rectifying the factors. This would reduce the morbidity and mortality associated with this procedure and would make laparoscopic cholecystectomy a safe procedure. In addition, this will help the surgeons to prepare the patient psychologically, arrange operating schedule accordingly, ensure the availability of a more experienced laparoscopic surgeon for the procedure and the patient will have a chance to make the necessary arrangements regarding their work and family. This was a prospective study that was held during a period of 1st January 2012 to 30th June 2013. Total of 229 patients were included in this study. Patients were assessed on the basis of history, clinical examination, hematological, biochemical, and ultrasonographic findings prior to surgery. Patients of all age groups undergoing laparoscopic cholecystectomy were included in this study. Out of these 229 laparoscopic cholecystectomy, twelve (5.24%) were converted to open cholecystectomy. The reasons for conversion were adhesions (75%), obesity (50%), history of previous hospitalization (33.3%), contracted gall bladder (33.3%), acute cholecystitis (25%), raised TLC (25%), intra hepatic gall bladder (16.7%), bleeding (16.7%), emergency cholecystectomy (16.7%), impacted stone (16.7%), thickened abdominal wall(50%), history of supraumbilical surgery (16.7%), and "other" indications (33.3%) (Included two cases with short cystic duct, one was because of hemodynamically instability due to pneumoperitonium and one was because of slipped clip from cystic artery). Recognition of these factors are important for understanding the characteristics of patients at a higher risk of conversion since they require longer hospital stay and place more demands on the health care facilities. It is concluded from the study that adhesions, obesity, history of previous hospitalization, contracted gall bladder, acute cholecystitis, raised TLC, intra hepatic gall bladder, bleeding, impacted stone at Hartmann's pouch, thickened abdominal wall, history of previous supra-umbilical surgery are significant factors which can determine conversion of laparoscopic cholecystectomy to open cholecystectomy. More than 70% of the conversions were preventable if we assume that the inability to define anatomic structures can be prevented.*

INTRODUCTION

Laparoscopic surgery as we witness today is the result of simultaneous developments in the field of optics, physics, instrumentation and computerization. As advances in laparoscopic surgery took place, Philippe Mouret of France described the first laparoscopic cholecystectomy in 1987[1]. In India T.E. Udwadia performed the first Laparoscopic Cholecystectomy in 1989 at J.J. Hospital, Bombay[2]. In September 1992, a NIH consensus conference held in Bethesda (U.S.A.) concluded that laparoscopic cholecystectomy is the treatment of choice for gall bladder stone[1]. Currently, over 90% of cholecystectomies are performed laparoscopically making it the most common procedure performed in general surgery practice. Laparoscopic cholecystectomy has become the gold standard in the treatment of symptomatic cholelithiasis. It has replaced open cholecystectomy as the therapeutic modality in the treatment of cholelithiasis[3]. Although the initial reports regarding laparoscopic cholecystectomy suggested a high incidence of procedure related complications, recent studies have shown that the complications rates have gone down significantly. In spite of increasing expertise and advances in technology, conversion rate is still at 2-15% in different centers[4]. The importance of risk factors predisposing to conversion from laparoscopic to open cholecystectomy has been emphasized in several studies reported from developed countries. Increased risk of conversion with statistical significance ($P<0.05$) was found in those patients who were older than sixty five years, obese, had history of acute cholecystitis or acute pancreatitis or history of prior hospitalizations and upper abdominal surgery. Some study showed increased risk of conversion with statistical significance was found in patient who had cholangitis, deranged liver function test, showed ultrasonographic findings of thickened gallbladder wall and when surgery was done by a junior surgeon. Some patients require conversion because of difficulty in delineate anatomy, bleeding and suspected CBD injury. It is important to identify the preoperative risk factors for conversion from laparoscopic to open cholecystectomy. It is important to realize that the need of conversion of a laparoscopic procedure to laparotomy is neither a failure nor a complication, but an attempt to avoid complication, and ensure patient safety [5,6].

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MATERIALS & METHODS

This study included one & half year prospective analyses and included all patients undergoing laparoscopic cholecystectomy from 1st January 2012 to 30th June 2013 in Department of General Surgery, Christian Medical College & Hospital, Ludhiana. Standard laparoscopic cholecystectomy was done using four ports. The timings were noted from the first port site incision till the last port closure. All the intraoperative events were recorded and all

patients received standard postoperative care.

Inclusion criteria: Patients of all age groups undergoing laparoscopic cholecystectomy at Christian Medical College & Hospital, Ludhiana were included in this study.

Statistical analysis: Data will be entered in Microsoft excel and will be analyzed using SPSS version16.0. Descriptive statistics will be computed and, univariate and multivariate analysis will be done through multiple logistic regressions.

Definition of variable: Body habitus was used as a dichotomous variable (obese [body mass index >30 Kg/m2] versus non-obese). Previous abdominal surgery was categorized as none versus any intra-abdominal surgery. Hematological parameter TLC was used as a dichotomous variable (d"11,000/mm3 versus >11,000/mm3). History of previous hospitalization was categorized as none versus e"1 (including patient who had previously hospitalized because of acute cholecystitis, acute gall stone pancreatitis etc). The gall bladder was defined as contracted or distended depending on the shape and transverse diameter. It was defined as distended if the transverse diameter was greater than five centimeters. GB wall thickness was estimated by using the maximal obtainable measurement classified as a dichotomous variable (d"4 mm versus >4 mm). The calculus size was evaluated as a dichotomous variable for the purpose of analysis (d"1 cm versus >1 cm). The number of calculi was classified as a dichotomous variable (solitary versus multiple).

RESULTS

Obesity: Body habitus was used as a dichotomous variable (obese [body mass index >30 Kg/m^2] versus non-obese). Among the 217 patients who were successfully treated, 195 (89.87%) patients had BMI d" 30mg/m^2, and 22 (10.13%) patients had BMI >30mg/m^2. Out of 12 patients who were converted, 6 (50%) patients had BMI >30mg/m^2 and 6 (50.0%) patients had BMI d" 30mg/m^2. In our study BMI was found to be have a statistically significant (p value = <0.0001) influence on conversion to open cholecystectomy on univariate analysis. (Figure 1)

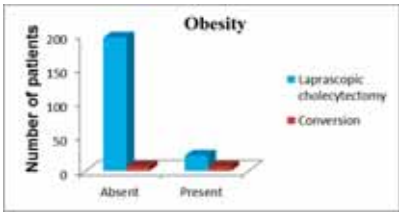

Figure 1: *Distribution according to Obesity*

History of acute cholecystitis: Among the 217 patients who were successfully treated, 13 (6.0%) patients had history of acute cholecystitis and 204 (94.0%) patients had no history of cholecystitis. Out of 12 patients who were converted, 9 (75%) had no history of cholecystitis while 3 (25%) patients had history of cholecystitis. History of acute cholecystitis was present in 25% of the converted group and 6% among the control group. In our study history of acute cholecystitis was found to be have a statistically significant (p value= 0.012) influence on conversion to open cholecystectomy. (Figure 2)

History of previous hospitalization: History of previous hospitalization was categorized as none versus e"1 (including patient who had previously hospitalized because of acute cholecystitis, acute gall stone, pancreatitis etc). Among the 217 patients who were successfully treated, 180 (82.9%) patients had no history of previous hospitalization and 31 (17.1%) patients had history of previous hospitalization. Out of 12 patients who were converted, 5 (41.7%) had history of previous hospitalization while 7 (58.3%) patients had no history of previous hospitalization. In our study history of previous hospitalization was found to be have a statistically significant (p value=0.03) influence on conversion to open cholecystectomy in univariate analysis. (Figure 3)

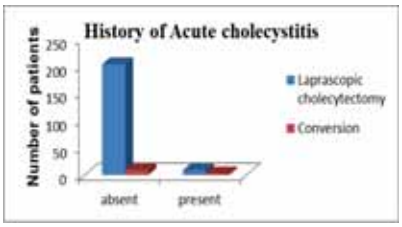

Figure 2: *Distribution according to history of acute cholecystitis*

Figure 3: *Distribution according to history of previous hospitalization*

History of previous supraumbilical surgery: Previous abdominal surgery was categorized as none versus any intra-abdominal surgery. Among the 217 patients who were successfully treated, 212 (97.7%) patients had no history of previous supraumbilical surgery and 5 (2.3%) patients had history of previous supraumbilical surgery. Out of 12 patients who were converted, 2 (16.7%) had history of previous supraumbilical surgery while 10 (83.3%) patients had no history of previous supraumbilical surgery. In our study history of previous supraumbilical surgery was found to be have a statistically significant (p value = 0.005) influence on conversion to open cholecystectomy. (Figure 4)

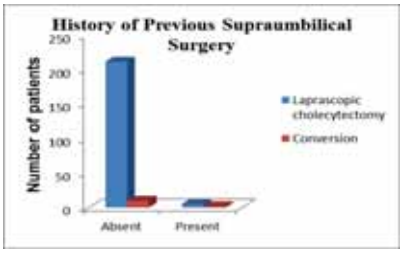

Figure 4: *Distribution according history of previous supraumblical surgery*

Total leucocyte count: Hematological parameter TLC was used as a dichotomous variable (d"11000/mm3 versus >11000/mm3). Among the 217 patients who were successfully treated, 204 (94.9%) patients had TLC d" 11,000 and 11 (5.1%) patients had TLC >11,000/mm^3.Out of 12 patients who were converted, 3 (25%) had TLC >11,000 while, 9 (75.0%) patients had TLC d" 11,000/mm^3. The mean total leucocyte count in the conversion group was 10000 ± 3124 ranging from 7100 to 16800/mm^3, the mean of the counts in the non-conversion group is 7643.26 ± 2553 ranging from 3600 to 28500/mm^3. In our study TLC count

was found to be have a statistically significant (p value = 0.005) influence on conversion to open cholecystectomy. (Figure 5)

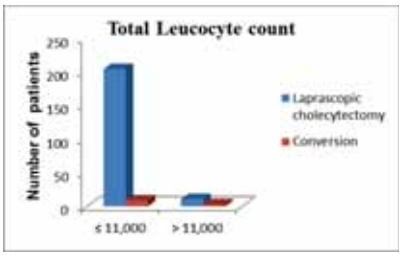

Figure 5: *Distribution according to total leucocyte count*

Impacted stone in Hartmann's pouch: Among the 217 patients who were successfully treated, 213 (98.15%) patients had no impacted stone in Hartmann's pouch and 4(1.85%) patients had presence of impacted stone in Hartmann's pouch. Out of 12 patients who were converted, 2 (16.7%) had presence of impacted stone in Hartmann' pouch while 10 (83.3%) patients had no impacted stone in Hartmann' pouch. In our study impacted stone in Hartman's pouch was found to be have a statistically significant (p value 0.002) influence on conversion to open cholecystectomy. (Figure 6)

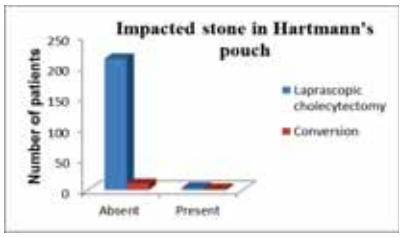

Figure 6: *Distribution according to Impacted stone in Hartmann's pouch*

Vascular Injury: Among the 217 patients, who were successfully treated, 212 (97.7%) patients had no vascular injury and 5(2.3%) patients had vascular injury. Out of 12 patients who were converted, 2 (16.7%) had presence of vascular injury while 10 (83.3%) patients had absence of vascular injury. In our study vascular injury was found to be have a statistically significant (p value 0.005) influence on conversion to open cholecystectomy. (Figure 7)

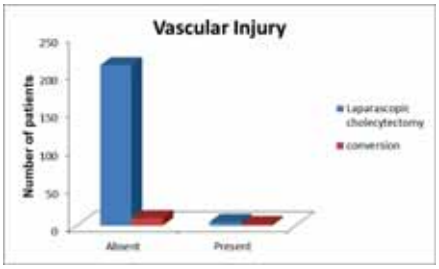

Figure 7: Distribution according to Vascular Injury

Contracted gallbladder: Among the 217 patients who were successfully treated, intraoperatively 209 (96.31%) patients had no contracted gall bladder and 8 (3.69%) patients contracted gall bladder. Out of 12 patients who were converted, 4 (33.3%) had contracted gall bladder while 8 (66.7%) patients had absence of contracted gall bladder. In our study contracted gall bladder was found to be have a statistically significant (p value =<0.0001) influence on conversion to open cholecystectomy. (Figure 8)

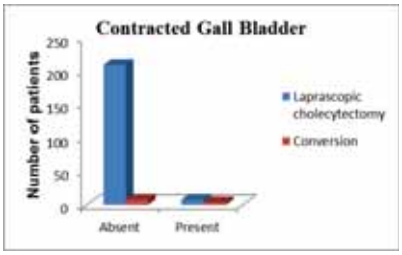

Figure 8: *Distribution according to contracted gallbladder*

Fibrosis/adhesions of calot's triangle: Among the 217 patients who were successfully treated, 178 (82.02%) patients had no fibrosis/adhesions of Calot's triangle, 39 (17.98%) patients had presence of fibrosis/adhesions of Calot's triangle .Out of 12 patients who were converted, 9 (75.0%) had presence of fibrosis/adhesions of Calot's triangle while 3 (25%) patients had no fibrosis/adhesions of Calot's triangle. In our study fibrosis/adhesions of Calot's triangle was found to be have a statistically significant (p value =<0.0001) influence on conversion to open cholecystectomy. (Figure 9)

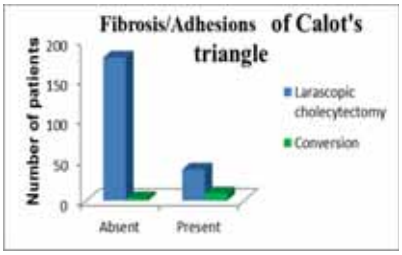

Figure 9: Distribution according fibrosis/adhesions of calot's triangle

Intrahepatic gallbladder: Among the 217 patients who were successfully treated, 212 (97.7%) patients had absence of intrahepatic gallbladder, 5 (2.3%) patients had presence of intrahepatic gallbladder. Out of 12 patients who were converted, 2 (16.7%) had presence of intrahepatic gallbladder while 10 (83.3%) patients had absence of intrahepatic gallbladder. In our study intrahepatic gallbladder was found to be have a statistically significant (with p value =<0.005) influence on conversion to open cholecystectomy. (Figure 10)

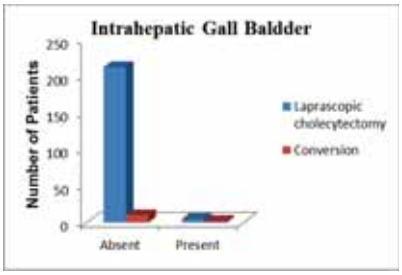

Figure 10: *Distribution according to Intrahepatic gallbladder*

Thickened anterior abdominal wall: Among the 217 patients who were successfully treated, 192 (88.47%) patients had no thickened anterior abdominal wall, 25 (11.53%) patients had presence of thickened anterior abdominal wall. Out of 12 patients who were converted, 6 (50.0%) had thickened anterior abdominal wall while 6 (50.0%) patients had no thickened anterior abdominal wall. In our study thickened anterior abdominal wall was found to be have a statistically significant (with p value =<0.0001) influence on conversion to open cholecystectomy. (Figure 11)

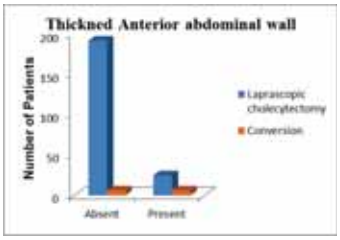

Figure 11: *Distribution according to thickened anterior abdominal wall*

Multivariate analysis showed that intraoperative finding of fibrosis/ adhesion at Calot's triangle has a 5.9 times increased risk for conversion to open cholecystectomy compared to the patients who underwent successful laparoscopic cholecystectomy (or : 5.914; P value : 0.039; CI : 1.096 – 31.92). (Table 1)

Table 1: *Multivariate logistic regression analysis*

Parameters	P Value	Odds Ratio	95% confidence Ratio
Thick anterior abdominal wall	0.384	3.851	0.185-80.079
Contracted gall bladder	0.083	5.804	0.793-42.461
Fibrosis/adhesion of Calot'sTriangle	0.039	5.914	1.096-31.92
Obesity	0.515	2.635	0.143-48.703
Intrahepatic gall bladder	0.373	3.199	0.247-41.411
Vascular injury	0.337	3.387	0.281-40.885
Impacted stone	0.861	0.758	0.034-16.698
TLC	0.158	5.046	0.534-47.658
H/OSupraumbilical surgery	0.236	4.428	0.378-51.894
Acute Cholecystitis	0.822	1.291	0.139-11.967
H/O prior hospitalization	0.422	2.043	0.357-11.674

DISCUSSION / CONCLUSION

It is concluded from the above study that adhesions, obesity, history of previous hospitalization, contracted gall bladder, acute cholecystitis, raised TLC, intra hepatic gall bladder, bleeding, impacted stone at Hartmann's pouch, thickened abdominal wall, history of previous supra-umbilical surgery are significant factors in determining conversion of laparoscopic cholecystectomy to open cholecystectomy. There should be no hesitation to convert to open in unclear anatomy and dense adhesions. The causes of conversion from laparoscopic to open cholecystectomy are worthy of study because patients who undergo conversion are deprived of the advantages of the laparoscopic technique, including shorter hospital stay, earlier return to full activity, less pain, and the absence of a large scar. Surgeons who perform cholecystectomy have witnessed the disappointment of patients and their families when conversion is necessary. Our study emphasizes the importance of proper selection and pre-operative preparation of patients to minimize the complications following laparoscopic cholecystectomy. Finally, it is concluded that the major complications in laparoscopic cholecystectomy are preventable by proper selection of patients, strictly following the basic principles of laparoscopic cholecystectomy and keeping low threshold to convert when anatomy is unclear. Finally an accepting attitude towards conversion to open cholecystectomy can avoid unwanted incidents after laparoscopic cholecystectomy.

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