Predictability of Conversion From Laparoscopic to Open Cholecystectomy: Retrospective Analysis of Risk Factors

Mumtaz K. Hanna, Mohammed K. Mohammed, Layth N. Hindosh

ABSTRACT:

BACKGROUND:

Laparoscopic Cholecystectomy (LC) is the gold standard operation for cholelithiasis; however, conversion to "Open Cholecystectomy (OC)" is still required in some patients.

OBJECTIVE:

Is to assess the predictability of conversion by recognition of probable risk factors, a fact that would be beneficial for patient selection and planning of laparoscopic procedures.

PATIENTS AND METHODS:

Retrospective analysis of data concerning 1350 cases of LC in the last 8 years from 2001 to 2008.

RESULT:

A total of 28 patients required conversion (overall conversion rate of 2.1%). Preoperative clinical, laboratory and radiological data were evaluated with regard to conversion. Six factors; male gender, age above 45 years, presentation as acute cholecystitis(ACs) , history of repeated attacks of ACs, ultrsonographic gall bladder wall thickness of more than 3 mm. and previous history of upper abdominal operation; showed a statistically significant effect on conversion. Three other factors; raised white Blood Cell (WBC) count, Common Bile Duct (CBD) stone(s) and experience of the surgeon; failed to reach significance. On the basis of Univariate analysis results, all significant predictors were allocated a score, which indicate risk score for conversion. Increasing score was associated with a significantly increased probability of conversion. The optimal cutoff score was 2 with a conversion rate of 3.05 %. Conversion rate was 20% with a score of 8.

CONCLUSION:

Risk of conversion is predictable on basis of this scoring. Patients predicted to have high risk of conversion may be informed and scheduled appropriately.

KEYWORDS: laparoscopic cholecystectomy, open cholecystectomy, acute cholecystitis, chronic cholecystitis, conversion.

INTRODUCTION:

In spite of the mounting experience and outstanding results of LC, there remains an inherent risk of conversion to OC which varies widely from 1% to 20% of patients [(1)].

Recently; there has been an increasing demand by the patients for this procedure and a more liberal attitude of surgeons in selecting cases for LC[(2)]. Because unexpected conversion has socioeconomic and medico-legal implications[(3)], it has become apparent that prediction of the risk by operating surgeons is of paramount importance;it would provide short term benefits regarding patient education and postoperative expectations [(3)].

Recently; many scoring systems were developed to help predicting conversion and information was useful for comparison of patient series and for quality assurance studies [(4,5)].

This paper aims at identifying possible preoperative indicators of conversion and scores them in order to assess the predictability of conversion from LC to OC.

Al Kindy Teaching Hospital/ Baghdad/Iraq.

PATIENTS AND METHODS:

The study included a retrospective analysis of data concerning all patients who underwent LC in two settings; a teaching hospital (Al Kindy Teaching Hospital in Baghdad) and a private hospital (Al Rahbat Private Hospital in Baghdad) during the last 8 years from 1st of Feb. 2001 to the 30th of Dec. 2008.

Multiple preoperative factors were considered for analysis; including age, sex, documented previous history of acute cholecystitis, previous history of upper abdominal surgery and the mode of presentation, such as ACs, CCs, and obstructive jaundice.

The laboratory data included were WBC count, liver function tests, serum amylase, and other biochemical tests.

The ultrasonic parameters included were evidence of thickened gall bladder wall, features suggestive of ACs, the presence of gall bladder mass, CBD dilatation and the presence of stone(s).

Age cutoff value was taken at 45 years. The presentation of all patients was categorized as

chronic (when there is history of recurrent biliary colic or clinical and ultrasonic evidences of CCs) and acute (presentation as ACs or empyema of the gall bladder). An acute attack was defined when documented acute abdominal pain is associated with right upper quadrant peritoneal signs, fever and raised WBC count. Supportive evidences registered were urgent admission and ultrasonic evidence of ACs. In our setting, most of the patients with ACs were subjected to LC within 10 days of presentation.

Past history of previous attacks was considered when patient have a documented history and treatment of similar previous episodes. Documented evidence of a scar for any upper abdominal operation was noted.

History of obstructive jaundice was categorized as CCs and patients were subjected to LC. Obstructive jaundice associated with biliary colic due to the passage of tiny stones in to the CBD was treated initially by antispasmodics, Isordil and antibiotics till jaundice was cleared clinically and biochemically then recheck US performed. Patients were subjected to LC within two weeks.

Ultrasonic finding of gall bladder wall thickness of more than 3 mm. was considered as a "thickened" gall bladder wall.

All statistical analyses were performed by applying chi-square test. Fisher's exact test was used whenever chi-square test was inapplicable. All significant factors from Univariate analysis were scored according to their significance.

Finally; the risk of conversion according to score was again evaluated by chi-square tests and results are presented as p Value and Odds ratio with 95% confidence intervals.

RESULTS:

Included in this retrospective analysis; a total of 1350 patients who underwent LC in the period between the 1st of Feb. 2001 to the 30th of Dec. 2008. There were 1215 (90%) females and 135 (10%) males; a female to male ratio of 9:1. The ages ranged from 25 to 78 years; mean of 35.6 years. Conversion to OC was required in 28 (2.1%) patients.

The most frequent reason for conversion was difficult dissection with failure to recognize a clear anatomy either due to sever inflammation, adhesions or uncertainty of anatomical land marks. Complications, in the form of bleeding, accidental CBD injury or bowel injury, come next. The different reasons and details of conversions were summarized in Table No. 1.

Table No. 1: Reasons for conversion from laparoscopic to open cholecystectomy among 28 patients

Cause	No. converted
I. Difficult dissection	20
• Severe inflammation	14
• Adhesions	5
• Uncertain anatomy	1
II. Complications	5
• Bleeding	3
• CBD injury	1
• Bowel injury	1
III. Miscellaneous	3
• Malignant Gall bladder mass	1
• Mirizzi's Syndrome	1
• Cholecysto-Duodenal fistula	1

According to Univariate analysis; 6 factors among the evaluated preoperative data were found to have a significant relation ship with conversion, whereas 3 factors failed to demonstrate a significant association with the likelihood of conversion (Table No. 2).

The following independent variables, which had been identified as predictors of conversion, were allocated a score according to their significance (p Value); male sex was given a score of 1. Past history of ACs (single or repeated attacks), presentation as ACs and ultrasonic evidence of gall bladder wall thickness equal or more than 3 mm.

were given a score of 2 each, while age equal to or above 45 and previous upper abdominal surgery were given a score of 3. (Table No. 2).

Accordingly; all patients were scored and grouped in to 5 cohorts for comparison. Conversion rate according to scores were calculated and compared, probability of conversion according to score was also calculated. Results of multivariate analysis are presented as the Odds ratio with a 95% confidence interval as shown in Table No. 3.

It is apparent that the higher the score the higher the rate of conversion. Again; the impact of having multiple risk factors is also clear. The cutoff score for the lowest rate of conversion was 2, with a conversion rate of 3.05%, for a score of 3 to 6; conversion rate was between 7.46-8.33%. Scores exceeding 6 demonstrate a sharp rise in the probability of conversion which reaches up to 20%. This figure is significantly higher than 7.46%. (Table No. 3).

It should be noted that patients who collected high score of 7-8 could not be regarded as a contraindication for LC as 80% of cases can still be completed (12 out of 15 cases) (Table No. 3).

The majority; 1230 (91.1%) patients have a score of less than 3 and only 120 (8.9%) patients have a score of 3 and above. This explains the low total conversion rate (of 2.1%) in this series. Among patients who required conversion; 16 (50%) have a score of less than 3 while 12 (46.4%) have a score of 3 and above (Table No. 3).

Table No. 2: Univariate analysis of risk factors for conversion from LC to OC

Predictive Factor	Total No. of patients (n=1350)	Converted (n=28)	Percentage	p Value	Score
Age (years) = or Above 45 Below 45	 735 615	 26 2	 3.54 0.33	0.000001	3
Sex Male Female	 135 1215	 10 18	 7.41 1.48	0.00025	1
WBC Count Above 11000 Below11000	 332 1018	 6 22	 1.9 2.2	0.02	0
Past history of ACs (single or repeated) Positive Negative	 598 752	 20 8	 3.34 1.06	0.0004	2
Presentation ACs CCs	 112 1238	 13 15	 11.61 1.21	0.00001	2
Previous upper abdominal Laparotomy Positive Negative	 18 1332	 6 22	 33.33 1.65	0.000004	3
CBD Stones (History or presentation) Positive Negative	 240 1110	 5 23	 2 2.1	0.01	0
Ultrasonic Gall bladder wall thickness = or Above 3mm Below 3mm	 512 838	 22 6	 4.3 0.72	0.00001	2
Operator Reg. / SR. Consultant	 408 942	 12 16	 2.94 1.7	0.151	0

*p-Values less than 0.05 are significant. Reg. = Registrar. SR. = Senior Registrar

Table No. 3: Risk of conversion according to score

Score	Total No. of patients (n=1350)	Converted (n=28)	Percentage	Odds Ratio	95% Confidence Interval	p Value
0 - 0	794	3	0.38	0.179	0.0698 – 0.4592	0.000325
1 - 2	426	13	3.05	2.4881	1.1074 – 5.59	0.015901
3 - 4	67	5	7.46	8.8199	1.8973 – 21.9356	0.000216
5 - 6	48	4	8.33	8.9695	1.166 – 68.9969	0.056249
7 - 8	15	3	20	10.5084	0.2856 – 386.6053	0.230685

DISCUSSION:

LC has become the gold standard in the treatment of symptomatic cholelithiasis. However; some patients still require conversion to open surgery. Conversion is neither failure nor a complication, rather a way to secure the safety of the procedure but for all practical purposes for a patient, this is very unpleasant. Several preoperative variables have been identified as risk factors that are helpful in predicting the probability of conversion[5,6]. Consequently; many studies devise a risk-scoring system based on identified risk factors in order to predict conversion preoperatively for selected patients, to prepare the patient psychologically, to arrange operating schedules accordingly and to minimize procedure-related costs [6].

Risk factors for conversion have been investigated in many studies, which have reported variables that may appear significant in one study but not in another [7,8,9]. Perhaps; such variations may be related to the particular population, differences in surgical expertise, selection criteria and differences in training systems [9].

The most frequently reported major risk for conversion is ACs and changes suggestive of this pathology[10,11,12]. The most common cause for conversion is failure to identify the anatomy; a frequent occurrence in relation to ACs. Adhesions, increased vascularity and bleeding, all are obstacles to a clear visualization of the field[13]. Furthermore; a large impacted stone in the gall bladder neck or Hartmann's pouch, edematous, friable or gangrenous gall bladder wall each produce technical difficulties that further jeopardizes exposure [14].

Although mounting experience and improvement in laparoscopic instrumentation may improve the result, this variable still remain the most common reason for conversion even in our recent experience. The incidence of conversion was 11.61% for ACs in contrast to elective LC for CCs which reported a risk of 1.21% in our series. These results are comparable to those of other investigators [12,13,14].

Previous history of ACs is a greater risk for conversion; probably because of dense adhesion formation in the area of Calot's triangle. Difficult dissection is mainly due thickened shrunken gall bladder and shortened cystic duct from previous attacks[12,13,14]. In the present work; this factor reflected a relatively higher rate of conversion (3.34% Vs 1.06%), and recorded a statistically significant result by Univariate analysis and this was in consistence with other's reports [12,13,14].

Another risk factor identified is ultrasonic evidence of increased thickness of the gall bladder wall (more than 3 mm.), either due to edematous thickening or fibrosis due to chronic inflammation, which indicate the chronicity of the disease and is liable to increase the risk of conversion [15,16,17]. The present study reported a conversion rate of 4.3% Vs 0.72% when it is less than 3 mm. this observation is lower than the reported rate which ranges from 8.2% to 30.8% [7,8,9,17].

Age carried a greater risk of conversion in our analysis. The cutoff value for age was 45 years and age above 45 years significantly increased the risk (3.54% Vs 0.33%). The suggested reasons are long standing disease with recurrent attacks of ACs and higher chance of complicated pathology [18,19].

Regarding sex, typically; gall stones are a disease of females; male gender has always been recognized as a risk factor although the reasons for this is not very clear. It can be attributed to delay in seeking medical advice or differences in disease patterns [20,21]. Male sex has been observed as an independent predictor (7.41% Vs 1.48%) in the present and other studies [8,9,20,21].

Leucocytosis (WBC count more than 11,000/mm^3) highlights the significance of underlying infection. It has been identified as a risk factor in some studies[6,7,8,9] but it fails to demonstrate a statistically significant risk (3.92% Vs 1.47%) in this study. Such a finding may be related to the larger number of patients with CCs and to the primary antibiotic therapy for ACs cases before LC but it may be related to the particular population of patient studied.

Although obstructive jaundice due to CBD stone(s) had been considered as a risk factor in some series, it did not show a considerable impact on

conversion in our analysis, so this variable was not found to be a higher risk for conversion and this was in consistence with other's reports [7,8,9,22].

In addition to age above 45 years, the most significant risk factor in the present work was history of upper abdominal surgery (33.33% Vs 1.65%). Previously; this was considered to be a contraindication to laparoscopic surgery but today, with increasing experience and more efficient laparoscopic techniques, surgeons are approaching more and more of these cases and this pays its price in the form of high conversion rate [22,23]. The incidence of 33.33% reported in this work is high when compared with others reports[9,22,23], but still; two thirds of the cases (12 out of 18) could be completed successfully. The probable reason for our high conversion rate was the less strict criteria for selection of these cases.

Finally; the experience of the surgical staff was evaluated as a predictor for conversion but did not prove to be significant. Probably, the responsible consultant had already passed a learning curve as he is in his second 5 years of laparoscopic surgery[24], in addition, differences in conversion rate between trainees (Registrars and Senior Registrars) and trainers (Specialist and Consultants)) also showed no statistical significance (2.94% Vs 1.7%) with regard to conversion. This is probably attributed to the supervision by a senior surgeon who will take over in case of any difficulty [24,25].

Following Univariate analysis results, and in order to evaluate the impact of multiple risk factors on rate of conversion, a scoring system is needed to assess this effect. In the literature, there are many complex scoring systems which involve a great deal of statistical calculations[7,8,9,22], thus we adopted a simple scoring system that reduces a large number of clinical variables and is applicable on routine bedside rounds without any statistical aid [26].

It has become obvious that predictability of the risk of conversion is fundamental for planning of laparoscopic surgery. Accurate prediction helps informing the patients on more solid grounds. Such information is helpful for organization of operating lists and allocation of cases according to surgeon experience[22,27]. Early conversion saves time and increases the safety of the procedure. Selection for day case surgery would be more appropriate for low risk patients[22,27]. Finally; setting a scoring system will form a basis for more precise categorization and comparison of patients groups for research purposes [27].

CONCLUSION:

The risk of conversion from LC to OC is predictable on basis of a scoring system for the risk factors. Probability of conversion is proportional to the score, the higher the score the more is the probability of conversion. Wider application and re-testing of these and other predictors may enable better planning of Laparoscopic procedures in our country.

REFERENCES:

1. Livingston EH; Rege RV. A nation wide study of conversion from laparoscopic to open cholecystectomy. *Am J Surg*. 2004; 188:205-11.
2. Ishizak Y; Miwa K; Yoshimoto J; et .al . Conversion of elective laparoscopic to open cholecystectomy between 1993 and 2004. *Br J Surg*. 2006; 93: 987-91.
3. Capizzi FD; Fogli L; Brulatti M; et. al. Conversion rate in laparoscopic cholecystectomy: evolution from 1993 and current state. *J Laporo Endosc Ad Surg Tech A*. 2003; 13: 89-91.
4. kama NA; Kologlu M; Dogaray M; et. al. A risk scores for conversion from laparoscopic to open cholecystectomy. *Am J Surg*. 2001;181: 520-5
5. Lipman JM; Claridge JA; haridas M; et. al. Preoperative findings predicting conversion from laparoscopic to open cholecystectomy. *Surgery*. 2007;142: 556-63.
6. Tayeb M; Raza SA; Khan MR; Azami R. Conversion from laparoscopic to open cholecystectomy; multivariate analysis of preoperative risk factors. *J Postgrad Med*. 2005; 51: 1720-22.
7. Ibrahim S; Hean TK; Ho LS; et. al. Risk factors for conversion to open surgery in patients undergoing laparoscopic cholecystectomy. *World J Surg*. 2006;30: 1698-704.
8. Pavlidis TE; Marakis GN; Ballas K; et. al. Risk factors influencing conversion of laparoscopic to open cholecystectomy. *J Laparo Endosc Adv Surg Tech A*. 2007; 17: 414-8.
9. Simopoulos C; Botaitis S; Polychronidis A; et. al. Risk factors for conversion of laparoscopic to open cholecystectomy. *Surg Endosc*. 2005;19: 905-9.
10. Borzellino G; Sauerland S; Minicozzi AM; et. al. Laparoscopic cholecystectomy for severe acute cholecystitis. A meta-analysis of results. Surg Endosc. 2008;22: 8-15.

11. Lim KR; ibrahim S; Tan NC; et. al. Risk factors for conversion to open surgery in patients with acute cholecystitis undergoing interval laparoscopic cholecystectomy. *Ann Acad Med Singapore.* 2007; 36: 631-5.

12. Sakuramoto S; Sato S; Okari T; et. al. Preoperative evaluation to predict technical difficulties of laparoscopic cholecystectomy on the basis of histological inflammation findings on resected gall bladder. *Am J Surg.* 2000;179:114-21.

13. Bove A; Bongarzoni G; Serafini FM; et. al. Laparoscopic cholecystectomy in acute cholecystitis: predictors of conversion to open cholecystectomy and preliminary results. *G Chir*. 2004; 25:75-9.

14. Bingener J; Stefanidis D; Richards ML; et. al. Early conversion for gangrenous cholecystitis: impact on outcome. *Surg Endosc*. 2005;19: 1139-41.

15. Lal P; Agarwal PN; Malik VK; et. al. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. *J S L S*. 2002;6: 59-63.

16. Nachnani J; Supe A. Preoperative prediction of difficult laparoscopic cholecystectomy using clinical and ultrasonic paprmeters. *Indian J Gastrenterol*. 2005; 24:16-8.

17. Majeski J. Significance of preoperative ultrasound measurement of gall bladder wall thickness. *Am Surg*. 2007;73:926-9.

18. Annamaneri RK; Moraitis D; Cayten CG. Laparoscopic cholecystectomy in the elderly. *J S L S*. 2005;9:408-10.

19. Kauvar DS; Brown BD; Braswell AW; et. al. Laparoscopic cholecystectomy in the elderly: Increased operative complications and conversion to laparotomy. *J Laparo Endosc Adv Surg Tech A*. 2005;15: 3798-82.

20. Yol S; Kartal A; Vatansev C; et. al. Sex as a factor in conversion from laparoscopic to open surgery. *J S L S*. 2006;10:359-63.

21. Botaitis S; Polychronidis A; Pitiakoudis M; et. al. Does gender affect laparoscopic cholecystectomy? *Surg Laparosc Endosc Percutan Tech*. 2008;18:157-61.

22. Tang B; Cuschieri A. Conversions during laparoscopic cholecystectomy: risk factors and effects on patient outcome. *J Gastrointest Surg*. 2006;10:1081-91.

23. A Kyurek N; Salman B; Irkorucu O; et. al. laparoscopic cholecystectomy in patients with previous abdominal surgery. *J S L S*. 2005;9:178-83.

24. Buchmann P; Dinclers S; Learning curve - calculation and value in laparoscopic surgery. *Ther Umsch.* 2005;62:69-75.

25. Koulas SG; Tsimoyiannis J; Koutosourdakis T; et. al. Laparoscopic cholecystectomy performed by surgical trainees. *J S L S.* 2006; 10 (4): 484 -7.

26. Mirza MM; Saleh MS. Risk prediction for conversion from laparoscopic to open cholecystectomy. *Em Med J*. 2003;21:140-45.

27. Shamiyeh A; Danis J; Wayand W; et. al. A 14-year analysis of laparoscopic cholecystectomy: Conversion – When and Why? *Surg Laparosc Endosc Percuten Tech*. 2007;17: 271 -6.