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Original Research Article

Efficacy of the risk score for conversion from laparoscopic to open cholecystectomy in determining the difficulty of laparoscopic cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy has become the treatment of choice for symptomatic cholelithiasis with ever rising numbers of surgeons receiving hands on training in its techniques and even greater numbers of patients demanding laparoscopy to avoid the discomfort and scar of open surgery. However, sometimes conversion to open cholecystectomy (OC) becomes necessary. The difficulty of LC or the risk of conversion to OC can be predicted before surgery by assessing certain preoperative variables which have been grouped together into a unified scoring system: Risk score for conversion from laparoscopic to open cholecystectomy (RSCLO). This study was undertaken to evaluate the efficacy of the RSCLO scoring system in determining the difficulty of LC and the risk of conversion to OC.
Methods: This was a prospective observational study in 50 consecutive patients posted for laparoscopic cholecystectomy in a tertiary teaching hospital. All patients were evaluated using the risk score. The duration of surgery, complications and rate of conversion to open surgery was studied.
Results: Male patients, patients with thickened gall bladder wall, acute cholecystitis had longer operating times and patients with high RSCLO score had a significantly longer operating time.
Conclusions: The RSCLO score efficiently assesses patients posted for laparoscopic cholecystectomy with regards to difficulty and risk of conversion to open surgery.

Keywords: Laparoscopy, Cholecystectomy, Score

INTRODUCTION

Cholecystectomy was established as the surgical treatment for cholelithiasis in 1882 by Langenbuch C and was the status of treatment of choice for gall stone disease till the advent of Laparoscopic cholecystectomy in 19874.[1-3] In the present era of minimal acccess surgery, laparoscopic surgery has emerged and rapidly become established as the gold standard in the treatment of symptomatic gall stone disease. Not only does it offer the patient the advantage of lesser postoperative pain, fewer intra-abdominal adhesions, shorter hospitalisation and better cosmetic results, it also allows the surgeon better visualisation and access to the Calot's triangle.

Nevertheless, conversions from LC to OC sometimes become inevitable. This conversion may be appropriate and necessary in a particular setting; it would be extremely reassuring if we could have a system for preoperative assessment of the level of difficulty of LC and the risk of conversion to OC.

Objectives

- To assess the efficacy of the RSCLO scoring system in predicting the risk of conversion of LC to OC.
- To use the RSCLO system to define Difficult Laparoscopic Cholecystectomy(DLC)
- Based on the RSCLO score, to discuss with the patient before surgery, the expected level of difficulty of LC and the possibility of conversion.
- To utlise the preoperative RSCLO score as an indicator of difficulty of LC and for rational and early decision to convert.

METHODS

This study was designed as a prospective observational study and was conducted over a 16 month period in a tertiary teaching hospital in Mumbai. The indications for laparoscopic cholecystectomy included

- Symptomatic, ultrasonographically proven cholelithiasis
- Asymptomatic gall bladder calculi, large gall bladder polyp (>1cm), h/o gall stone pancreatitis

Contraindications for LC

- Patients unfit for general anesthesia.
- Patients having cirrhosis, portal hypertension, pregnancy, cholangitis.

Inclusion criteria

All patients undergoing laparoscopic cholecystectomy performed by a technically skilled laparoscopic surgeon were included in the study.

Exclusion criteria

- Presence of CBD stones, patients with jaundice, portal hypertension, pregnancy.
- LC performed by surgeons who did not fulfill the requirement for technical skill as laid down in this study.

Collection of data

All relevant clinical, biochemical and radiological parameters were noted down.

Ultrasonography of abdomen included gall bladder size, wall thickness, number and size of gb calculate, diameter of common bile duct and presence/absence of ductal calculi.

Definition of variables

Increased gall bladder wall thickness

- Wall thickness more than 4mm

Acute cholecystitis

- Acute pain in right hypochondrium,fever more than 38.5 C,Leucocytosis (.12,500/mm3) and cholelithiasis.
- Technically skilled laparoscopic surgeons were defined as those who had performed at least 75 successful laparoscopic cholecystectomies prior to the commencement of the study.

The RSCLO score was calculated for all patients preoperatively using the following scoring pattern.

Table 1: Risk score for conversion from laparoscopic to open cholecystectomy.

Scoring factor	Variables	Coefficient
Age (years)	>= 60 < 60	5 0
Sex	Male Female	11 0
Previous upper abdominal operation	Yes No	8 0
Abdominal tenderness	Present Absent	9 0
Gall bladder wall (USG)	Thickened Normal	13 0
Acute cholecystitis	Present Absent	15 0
Constant		-20

All patients were operated under general anesthesia, after informed valid consent. Prophylactic antibiotic of Ceftriaxone 1g was given 30 minutes prior to surgery.

Laparoscopic cholecystectomy was performed by a technically skilled surgeon using a 3 CCD camera and 4 standard ports. The cystic duct and artery were identified and clipped after obtaining critical view. The gall bladder was extracted using an endobag and a ryles tube was placed as a drain in the right subhepatic space. 10 mm ports were closed with No 1 polyglycolic acid sutures.

Patient was started on oral fluids on the same day and the drain removed when the output was insignificant usually by POD 2. The decision of conversion to open surgery was left to the discretion of the individual surgeon. None of the operating surgeons were aware of the RSCLO scoring system used in the study.

The operative time was recorded as the time interval between the insertion of the first port till removal of the last port at the end of the procedure or conversion to open surgery.

Statistical analysis

Divided groups of patients

- Patients in whom LC was completed successfully were designated Successful Laparoscopic Cholecystectomy (SLC) group.
- Patients in whom LC was converted to OC were designated Open Cholecystectomy (OC) group.
- Patients with LC completed succcessfully with RSCLO score more than -3 were designated Difficult Laparoscopic Cholecystectomy (DLC) group.
- Patients with LC completed successfully with RSCLO score less than -3 were designated Easy Laparoscopic Cholecystectomy (ELC) group.

The distribution of patients was determined according to the six variables of RSCLO scoring system and the mean operating time in each case were compared using the student-t test.

Similarly in each of the above 4 groups i.e. LC, SLC, DLC, OC the mean RSCLO score and the mean operative time was determined and compared using the student-t test. For data analysis, the statistical package for social sciences (SPSS) software was utilized and p value of < 0.05 was considered to indicate significant difference. The number of patients with RSCLO score more than -3 was determined and the percentage of these in whom conversion to OC occurred was determined. Similarly the number of patients in the OC group with RSCLO score >3 was determined and the predictive value of the RSCLO score in predicting the risk of conversion to OC was calculated.

RESULTS

A total of 50 patients were included in the study with a mean age of 40.02 years, consisting of 15 males (30%) and 35 females (70%). The mean RSCLO score was 5.14 (range -20 to +15) and the mean operative time was 59.52 minutes (range: 40 to 95). 3 patients required conversion to open cholecystectomy (conversion rate 6%). The mean age was 64.3 years and all 3 were females. The reasons of conversion were obscure anatomy, extensive adhesions and necrotic gall bladder. 2 of these patients had increased drain output (bilious) which stopped spontaneously in 7 days.

4 of the 50 patients were aged more than 60 years and had a mean operating time of 78.25 min and the remaining 46 patients who were less than 60 years of age had a mean operating time of 57.89 min. This difference in the operating time was significant with p value of 0.002 (<0.05) (Table 2).

Table 2: Age distribution.

Age (years)	Number	Percentage	Mean operating time(min)	Standard deviation
>= 60	4	8.00%	78.25	18.56
<= 60	46	92.00%	57.89	11.27

*P value 0.002

Table 3: Sex distribution.

Sex	Number	Percentage	Mean operating time minutes	Standard deviation
Male	15	30.00%	65.93	10.43
Female	35	70.00%	56.77	13.41

*P value: 0.021

Table 4: Distribution of thickened GB wall.

GB wall thickened yes/no	Number	Percentage	Mean operating time minutes	Standard deviation
Yes	19	38.00%	68.16	11.97
No	31	62.00%	54.22	10.66

*P value: 0.0001

Table 5: Distribution of acute cholecystitis.

Acute cholecystitis	Number	Percentage	Mean operating time minutes	Standard deviation
Present	3	6.00%	76.67	4.16
Absent	47	94.00%	58.43	12.6

*P value of 0.017

Table 6: Distribution of RSCLO variables and mean operating times by group.

Group and number	Mean age	Sex distribution Male/ Female %	RHC tenderness present /absent	GB wall thickness Yes/No %	Acute cholecystitis Present/absent (%)	Upper abd surgery done/ not done	Mean RSCLO score	Mean operating time
OC 03	64.3	0/3 0/100	3/0 100/0	2/1 66.67/33.33	1/2 33.33/66.67	0/3 0/100	7.67	87
SLC 47	38.47	15/32 31.91/68.08	25/22 53.19/46.81	17/30 36.17/63.83	2/45 4.26/95.74	2/45 4.26/95.74	-5.96	57.77
DLC 19	44.26	11/8 57.89/42.11	15/4 78.95/21.05	11/8 57.89/42.11	2/17 10.53/89.47	2/17 10.53/89.47	3.53	68.58
ELC 28	34.54	4/24 14.29/85.71	10/18 35.71/64.29	6/22 21.43/78.57	0/28 0/100	0/28 0/100	-12.39	50.43

Table 7: Relationship between RSCLO score and conversion to open surgery.

	Converted to open surgery	Not converted to open surgery	Total
RSCLO > -3	3	19	22
RSCLO < -3	0	28	28
Total	3	47	50

Males formed 30% of the study group and the mean operative time was 65.93 minutes compared to 56.77 minutes in females. This difference was significant with p value of 0.021 (Table 3). 28 patients had right hypochondrial tenderness and the mean operative time was 62.25 compared to 56.04 minutes in patients without tenderness. This difference was not significant statistically. P value was 0.094. The operative time in patients with thickened gall bladder wall was significantly more than those with norml gall bladder walls. (68.16 min vs 54.22 min) with a p-value of 0.0001 (Table 4). Only 6% of patients were found to have acute cholecystitis and had a significantly longer operative time than those without acute cholecystitis (p-value of 0.017) (Table 5).

Only 2 patients in our series had previous history of upper abdominal surgery and the increase in operative time was insignificant. The mean RSCLO score of the OC group was +7.67±1.155 whereas the mean operating time ws 87.0±7.55 minutes compared to the SLC group which had a mean RSCLO score of -5.96±9.339 and a mean operating time of 57.77±11.181 minutes. This difference was statistically significant with p values of 0.016 and 0.0005 respectively (Table 6).

Within the SLC group the mean operating time in the DLC group was 68.58 with a mean RSCLO score of +3.53 compared to the ELC group in which the operating time was 50.43 minutes with mean RSCLO score of 12.39. This difference was statistically significant. As the RSCLO score increased the operating time increased showing a linear relationship.

All patients in the OC group had RSCLO score more than -3 which works out to be a sensitivity of 100%. 28 patients (ELC group) had RSCLO score olf ≤3 and all of them underwent successful laparoscopic cholecystectomy representing a negative predictive value of 100% (Table 7).

DISCUSSION

Patients with symptomatic gall stone disease can be offered two avenues for surgical cure- Open cholecystectomy and laparoscopic cholecystectomy. Mounting evidence in the form of retrospective and prospective trials including those by Cuschieri et al, Wherry DC, Dubois F et al, Shea JA et al and Arregui et al establishes LC irrevocably as the standard of cure for symptomatic cholelithiasis.[5-9] With ever expanding horizons of laparoscopic skills and expertise, laparoscopic cholecystectomy has emerged as the surgery of choice in conditions considered as relative contraindications for laparoscopy i.e. acute and gangreneous cholecystitis as evidenced by trials by Manger et al, Chahin et al.[10,11]

However there are times when, even with the best technical expertise, conversion from laparoscopic to open cholecystectomy becomes inevitable to ensure patient safety. Such a conversion should not be viewed as a failure, rather a matter of sound surgical judgement, as patient safety is of foremost importance. The rates of conversion quoted in various studies range from 2 to 15%. Several studies have evaluated the risk factors contributing to conversion from LC to OC. Kauvar D et al described increased risk of conversion in patients aged more than 65 years.[12] In our study the mean operating

time of patients aged 60 or older was significantly higher than in patients less than 60 years of age (p value <0.0002). The increased risk of conversion may be due to chronicity of gall bladder disease, recurrent attacks of cholecystitis and more fibrotic adhesions.

Epure et al described male gender as a difficulty factor for LC.[13] Our study agrees with them showing that the mean operating time in males is longer than that in females (p-value of 0.021). The exact reason for greater difficulty in males remains unexplained although most series report the same finding,[14-19] A number of sonographic parameters have been investigated to predict difficult LC. Daradekh SS et al found only 2 significant predictors thickness of GB wall and CBD diameter.[20] Increased GB thickness is an indicator of severe inflammation or fibrosis which in turn obsures the normal anatomy of the Calot's triangle and makes GB separation from liver bed difficult. In our study, GB wall thickening prolonged operating time significantly.

Acute cholecystitis is not a contraindication for LC, but is associated with increased risk of conversion as described by Cox MR et al, Chahin F et al and Singer JA et al.[11,21,22] Our study found significantly longer operating times in patients with acute cholecystitis. This may be due to friable tissues, hypervascularity, necrosis, induration are responsible for inability to retract the gall bladder and to deelineate the calots's triangle. Previous upper abdominal surgery might herald problems in inserting a Verres needle or might indicate distortion in the anatomy of the Calot's triangle. There are a number of studies evaluating the composite role of multiple risk factors in predicting difficult LC and convesion to OC. Shrenk et al assessed 1300 patients who underwent LC and described the following risk factors- rigidity in the right upper quadrant, increased thickness of GB wall, dense adhesions and the presence of acute cholecystitis.[11]

Fried et al found that factors determining conversion to OC in 90 of 1676 patients included age of patient (>65years), acute cholecystitis, increased gall bladder wall thickness, obesity and male gender.[23] Alponat et al described 4 risk factors for conversion- acute cholecystitis, increased GB wall thickness, raised leucocyte count and high blood alkaline phosphatase level.[24] They reported conversion rates of 1.5% when there are no risk factors, 9.3% in the presence of only acute cholecystitis and 58 % when all 4 risk factors were present. Supe et al reported that clinical and ultrasongographic factors can help predict conversion of LC to OC- BMI > 30kg/m^2, male gender, past history of acute cholecysitis or acute pancreatitis, past upper abdominal surgery and gall bladder thickness exceeding 3 mm. Kanaan SA concluded that older men, presence of cardiovascular disease, male gender, acute cholecystitis and severe inflammation determine risk of conversion to OC.[19]

The weightage to be given to each risk factor was not described in the above studies, although Supe et al did formulate an equation to derive P the conversion factor.[19] Therefore there was no objective way to utilize the presence or absence of these factors in a particular patient to predict difficulty and risk of conversion. In 2001, Kama et al analysed the data of 1000 patient and devised the RSCLO score using univariant and multivariant analysis.[14] They also suggested that RSCLO jwould lbe helpful in determining the level of difficulty of the operation and the risk of conversion from LC to OC, based on pre-operative data assessment. A score of more than -3 would be preditive of increased difffiulty of surgery and increased risk of conversion.

A precise scoring system would provide a reliable method of evaluation and promote better surgical jpractice, by enabling the surgeon to make a standard prediction independent of their own experience. The RSCLO also clearly defines the term 'Difficult Laparoscopic Cholecystectomy' and its prediction may be used to inform the patient about the most appropriate operation, the risk of LC being converted to OC during the operation and the operative risks involved.

The difficult laparoscopic cholecystectomy as defined by this system should be performed by an experienced surgeon to keep the rate of conversion at an acceptable level. There is also a need to be vigilant while operating patients with RSCLO score ≥3 to prevent complications and to keep a lower threshold for conversion. Conversion to open surgery should not be considered a complication but as a prudent and conscious attempt to avoid complications in the best interest of the patient.

In 2003, Kama et al applied the RSCLO score system to a new patient population of 400 LC's for a prospective study to validate the scoring.[14] They confirmed that the RSCLO scores correlate well with conversion rates and operating times. Bulbuller N et al reported sensitivity and specificity rates of 100% and 96%respectively for predicting conversion to open surgery.[25] Our study results compare favourably with both the above series. Increasing RSCLO scores were associated with corresponding longer operative times, with an almost linear relationship. The mean RSCLO sore of patients who needed conversion to OC was +7.67±1.155 which was significantly higher than that of patients who underwent successful LC 5.96±9.339 (p <0.05). In our study the sensitivity of the RSCLO score in predicting risk of conversion to OC was 100% with a negative predictive value of 100%.

CONCLUSION

The RSCLO scoring system is able to assess the patients posted for laparosopic cholecystecomy accurately with regard to the prediction of difficulty of the planned laparoscopic procedure and the likelihood of conversion to open surgery. Patients with a high risk score need to be

counselled regarding the risks involved and the chances of conversion to open surgery. They must be operated by an experienced surgeon with a low threshold for conversion to open surgery.

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