

Assessment of the Efficacy of a Score based System used for Assigning Various Specific Scores for Predicting Difficult Laparoscopic Cholecystectomy

Ashwani Kumar¹, Sarabjit Singh², Ashish Chhabra³, Shobhit Kumar Nemma⁴

ABSTRACT

Introduction: After its introduction in 1987, laparoscopic cholecystectomy (LC) brought a radical change in the treatment of patients with gallstones. Various studies have quoted that significant risk and complications have been found to be associated with LC. Hence, we planned the present study to assess the efficacy of a score based system used for assigning various specific scores for predicting difficult laparoscopic cholecystectomy.

Material and methods: The present study included assessment of 112 patients that presented with chief complaint of history of symptomatic Gallstone Disease were enrolled and elective surgery was performed after clinical assessment, Routine Investigations and Ultrasonography of the abdomen. In this study various clinical and biochemical entities were given equal score of 1 each, with a total score of 10. Pre-operatively patients were given score accordingly. Patients having less than 4 scores were group into easy (Laparoscopic cholecystectomy was expected to be without difficulty) and patients with >4 scores were group as difficult. At the end of the surgery, all data were analysed to see how this scoring system can predict which patients will have easy or difficult laparoscopic cholecystectomy basing on the pre-operative score each patient had. All the results were recorded and analyzed by SPSS software. Chi-square test and student t test were used for the assessment of level of significant.

Results: Cases with history of upper abdominal surgery had adhesion of bowel loops and omentum with gall bladder which leads to increase risk of bowel injury. Sensitivity was 97.9% and positive predictive value was 91.5%. p value was 0.002. Conversion rate among these cases was 66.6% and those cases without history of abdominal surgery was 8.4%.

In this study raised serum alkaline phosphatase (Alp) >150 iu/l was associated with higher rate of conversion/difficult laparoscopic cholecystectomy. Conversion rate among cases with Alp <150 iu/l was 5%. Cases with a score of 4 or more had higher rate of conversion to open cholecystectomy. In these cases sensitivity was 97.9% and positive predictive value was 97.9%.

Conclusion: Pre-operative score of 4 or more had higher rate of conversion to open cholecystectomy and use of this pre-operative scoring system is feasible with further refinement for prediction of difficult Laparoscopic Cholecystectomy

Keywords: Cholecystectomy, Laparoscopic, Score

INTRODUCTION

After its introduction in 1987, laparoscopic cholecystectomy (LC) brought a radical change in the treatment of patients with gallstones. Apart from offering numerous advantages over open cholecystectomy technique, it is associated with certain adverse effects and risk factors which includes increased risk of injury to common bile duct (CBD), duodenum, bowel, iliac vessels, and so on; high conversion rate in acute cholecystitis, and difficulty

in management of simultaneous CBD stones.^{1,2}

For the accurate screening of the cholecystitis and cholelithiasis, one of the most common noninvasive and safe tests is the Ultrasonography.³ It can also help surgeons to get an idea of potential difficulty to be faced during surgery in that particular patient.⁴

Various studies have quoted that significant risk and complications have been found to be associated with LC. Although it is not an easy job for the associated surgeon, significant improvement in the post-operative results is bought by the thorough instruction and the experience of the surgeon.⁵ Contrary to initial reports of an increased complication rate, recent data show that LC entails lower morbidity and mortality rates than open operation.⁶ Hence, we planned the present study to assess the efficacy of a score based system used for assigning various specific scores for predicting difficult laparoscopic cholecystectomy.

MATERIAL AND METHODS

The present study was conducted in the department of General surgery of the medical institute and included assessment of 112 patients that presented with chief complaint of history of symptomatic Gallstone Disease were enrolled and elective surgery was performed after clinical assessment, Routine Investigations and Ultrasonography of the abdomen. Ethical approval was taken from the institutional ethical committee and written consent was obtained from all the patients after explaining in detail the entire research protocol. Prior to starting of the surgery, all the haematological and various biochemical parameters were recorded. After the surgery, patients were group into 2 categories;

- Patients who had successful laparoscopic cholecystectomy
- Patients in which there was conversion to open cholecystectomy

Scoring system

Various clinical studies have found the following entity as factors for difficult Laparoscopic Cholecystectomy;

- Age

¹Assistant Professor, ²Associate Professor, ⁴PG Resident, Department of General Surgery, ³Assistant Professor, Department of Paediatric Surgery, GGS Medical College Faridkot, Punjab, India

Corresponding author: Ashwani Kumar, Assistant Professor, Department of General Surgery, GGS Medical College Faridkot, Punjab, India

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- Sex; male gender
- Body Mass Index (BMI)
- History of upper abdominal surgery
- Raise total leukocyte count
- Raise alkaline phosphatase
- Contracted gall bladder in ultrasonography
- Gall bladder wall thickness in ultrasonography
- Single large gallstone
- Peri-cholecystic fluid collection

In this study all the above entities were given equal score of 1 each, with a total score of 10. Pre-operatively patients were given score accordingly. Patients having less than 4 scores were group into easy (Laparoscopic cholecystectomy was expected to be without difficulty) and patients with >4 scores were group as difficult. At the end of the surgery, all data were analysed to see how this scoring system can predict which patients will have easy or difficult laparoscopic cholecystectomy basing on the pre-operative score each patient had.

Technique of laparoscopic cholecystectomy

Patient is asked to empty the bladder before anaesthesia or the bladder is catheterised. American approach of positioning is used, thus surgeon and assistant stand on the left whereas OT nurse stand on the right. Surgery is done under general anaesthesia. Air insufflations is done using veress' needle or the first port is inserted by open method / Hasson method. The air used is carbon dioxide and the pressure is usually below 14mm. 10mm port is inserted above or below the Umbilicus, incision size is about 11mm as larger incision leads to air leakage. The rest of the port are inserted under telescopic guidance, another 10mm port is inserted just below the Xiphisternum bone. One 5mm port is inserted right on top of the fundus of the gall bladder

usually below the right sub costal at the mid- clavicular line. Another 5mm port is inserted in the right mid axillary line at the level of Umbilicus/between costal margin and iliac crest. Patient is positioned in steep reverse Trendelenburg's position with a little left tilt i.e right side up (15 degree). With the help of a grasper gall bladder fundus is held and pulled to the right and upward toward the patient's right shoulder by the assistant, the telescope is also controlled by the assistant. Another grasper is held at the infundibulum and calot's triangle is exposed. Dissection is initially started 4-5 cm proximal to the neck and proceed distally (modified top down technique), cystic artery and cystic duct are dissected and critical view of safety is created where two and only two structures (the cystic duct and cystic artery) are crossing this window before clipping and

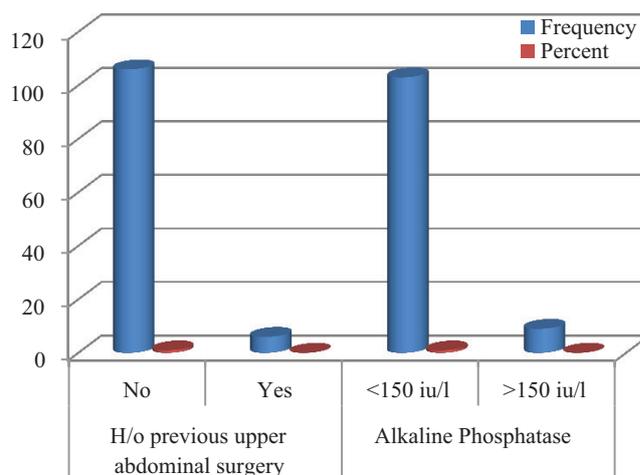


Table-1: Prediction of laparoscopic conversion on the basis of previous upper abdominal surgery

H/o previous upper abdominal surgery	Prediction		Total	Chi Sq.	P value
	Laparoscopic	Conversion			
No	97	9	106	18.732	0.002*
Yes	2	4	6		
Total	99	13	112		

*: Significant

Table-1: Prediction of laparoscopic conversion on the basis of previous upper abdominal surgery

Prediction	Actual Outcome		Total	Chi Sq.	P value
	Laparoscopy	Conversion			
Laparoscopic cholecystectomy.	97	2	99	76.406	0.000*
Conv.	2	11	13		
Total	99	13	112		

*: Significant;

Sensitivity of prediction using scoring system = $\left(\frac{a}{a+c}\right) \times 100\% = 97.9\%$

Specificity using prediction score system = $\left(\frac{d}{b+d}\right) \times 100\% = 84.6\%$

Positive predictive value = $\left(\frac{a}{a+b}\right) \times 100\% = 97.9\%$

Negative predictive value = $\left(\frac{d}{c+d}\right) \times 100\% = 84.6\%$

Percentage of false negative in score system = $\left(\frac{c}{a+c}\right) \times 100\% = 2\%$

Percentage of false positive in score system = $\left(\frac{b}{b+d}\right) \times 100\% = 15\%$

Chi square value = 76.406

p- value = 0.000

Table-2: Prediction Using Score System

dividing any structure. This critical view of safety is essential to minimise injury to the common bile duct or hepatic artery. Gall bladder is dissected from liver bed by electrocautery and extracted through one of the 10mm port site.

STATISTICAL ANALYSIS

All the results were recorded and analyzed by SPSS software. Chi-square test and student t test were used for the assessment of level of significant.

RESULTS

Cases with history of upper abdominal surgery had adhesion of bowel loops and omentum with gall bladder which leads to increase risk of bowel injury. Sensitivity was 97.9% and positive predictive value was 91.5%. p value was 0.002. Conversion rate among these cases was 66.6% and those cases without history of abdominal surgery was 8.4%.

In this study raised serum alkaline phosphatase (Alp) >150 iu/l was associated with higher rate of conversion/difficult laparoscopic cholecystectomy. Sensitivity was 97.9% and positive predictive value was 94.1%. p value was 0.000, conversion rate among Alp>150iu/l was 66.6%. Conversion rate among cases with Alp <150 iu/l was 5%.

A score system to predict difficult laparoscopic cholecystectomy or conversion to open cholecystectomy using these parameters was found to be similar with other studies.⁷⁻⁹ Cases with a score of 4 or more had higher rate of conversion to open cholecystectomy. In these cases sensitivity was 97.9% and positive predictive value was 97.9%. The p- value was 0.000.

DISCUSSION

Various studies have been conducted for pre-operative prediction of difficult Laparoscopic cholecystectomy using a score system. Sugnie et al gave a score of <2 as mild difficulty, 2-4 moderate, 5-7 severe and 8-10 extreme.⁷ Vivek et al reported a grading system using 22 parameters with maximum score of 44, a score of 9 predicting difficult laparoscopic cholecystectomy.⁸ Gupta et al allotted a score 0-15 to predict difficult laparoscopic cholecystectomy.⁹ Randhawa et al also studied the scoring system and allotted a maximum score of 15.¹⁰ Marek et al took 9 parameters for scoring system to predict difficult laparoscopic cholecystectomy and found score 4 or more had 100% conversion rate.¹¹ This study was also conducted using these parameters to see the association between these parameters and the difficulty of laparoscopic cholecystectomy and the application of a score system to pre-operatively predict the difficulty and risk of conversion to open cholecystectomy. The findings in this study are similar with the other studies.

Using these parameters, many studies⁷⁻¹⁰ have reported a scoring system to accurately predict the risk of conversion of laparoscopic to open cholecystectomy. Most studies used both pre-operative and intra-operative findings to allot score to these parameters. The reported accuracy rate of prediction varies from 85 to 100% in these studies. In our study only the pre-operative factors were used and it shows that patients with 4 or more parameters i.e. risk factors had higher rate of conversion, the sensitivity of this score system was 97.9% with a positive predictive value of 97.9% (p-value = .000). This finding was similar to those earlier studies.⁸⁻¹¹

A working space is required intra-abdominally during

laparoscopic surgery; this space is created by insufflating the abdominal cavity with a gas i.e pneumoperitoneum. The most commonly used gas is carbon dioxide (CO₂). Carbon dioxide is chosen because it is non-combustible and rapidly absorbed, but instances of hypercapnia, CO₂ embolism and capnothorax have been reported with the use of carbon dioxide.^{12,13} In Young and healthy patients, insufflations of peritoneal cavity with carbon dioxide cause no significant physiological changes except hypercarbia with increase carbon dioxide production,¹² these individuals probably adapt to the extra carbon dioxide load by maximising plasma and intracellular buffering systems and accelerating CO₂ transport and elimination. In other patients who may have a compromised reservoir can easily overwhelmed by the increased CO₂ load, placing them in increase risk of hypercarbia and acidosis. These groups of patients include patient with high metabolic and cellular respiratory rate, impaired regional blood flow, COPD patient or Patient with poor cardiac output. The elevated intra-abdominal pressures restrict the diaphragmatic movement, increase pulmonary pressure and decrease the pulmonary compliance. This may worsen as during surgery patient is kept in steep reverse Trendelenburg's position. Patient may also have increased chances of gastro-oesophageal reflux with increase risk of aspiration. There are changes in hemodynamic of the patient depending on the base line hemodynamic function and volume status. Alterations in mean arterial blood pressure and systemic vascular resistance occur uniformly and cause an increase in cardiac after load for patient with inadequate cardiac reserve due to cardiovascular disease. The increase in after load may be poorly tolerated and may place the patient at risk for left ventricular de-compensation and peri- operative cardiac morbidity. The pressure within the abdomen from pneumoperitoneum decreases the venous return by collapsing the intra abdominal veins, especially in volume depleted patient which may lead to decrease cardiac output. CO₂ embolism may lead to unexplained hypotension and hypoxia during surgery. The incidence of CO₂ embolism is rare,¹³ the presence of characteristic mill-wheel murmur may help in the diagnosis clinically. Massive subcutaneous emphysema during pneumoperitoneum has been reported, this may be due to gas leakage to the soft tissues^{7,12} and if there is extensive CO₂ sequestration into the soft tissues than it may lead to hypercapnia, acidosis and CO₂ narcosis. The steep reverse Trendelenburg's position leads to venous pooling in the lower extremity and the prolong duration of surgery can be a factor for thromboembolism, but the study about this is controversial.¹³ Schrenk et al conducted a modified logistic regression analysis of 24 variables in 300 patients undergoing laparoscopic cholecystectomy and found the following parameters independently predictive for a difficult operation: right upper quadrant pain, rigidity in right upper abdomen, previous upper abdominal surgery, biliary colic within the last 3 weeks, white blood cell count > 10 x 10(9)/l, thickening of the gallbladder wall, hydroptic gallbladder, pericholecystic fluid, shrunken gallbladder, and no filling of the gallbladder in preoperative intravenous cholangiography. Based on these variables a diagnostic model was developed to predict the difficulty of a laparoscopic cholecystectomy, with scores ranging from 0 (ideal case) to IV (conversion to open cholecystectomy expected) prior to surgery. When the reliability of our model

was examined in a second study in 340 consecutive patients undergoing laparoscopic cholecystectomy 80% of the patients were predicted correctly. Their model should help to select patients for either laparoscopic or open cholecystectomy based on the expected difficulties and the experience of the surgeon.¹⁴⁻²⁰

CONCLUSION

From the above results, the authors concluded that pre-operative score of 4 or more had higher rate of conversion to open cholecystectomy and use of this pre-operative scoring system is feasible with further refinement for prediction of difficult Laparoscopic Cholecystectomy. However, future studies are recommended.

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