International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 08-10-2018; Accepted: 10-11-2018
www.medicalsciencejournal.com
Volume 4; Issue 12; December 2018; Page No. 36-39

Evaluating clinical and radiological parameters for predicting the difficult laparoscopic cholecystectomy and its conversion: A prospective study

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Abstract
Background: Forecast of a difficult laparoscopic cholecystectomy (LC) can help the surgeon as well as the patient to prepare better for any intra-operative risk and its effective management.
Objectives: To assess the clinical and radiological parameters for predicting the difficult laparoscopic cholecystectomy and its conversion
Materials and Methods: Hundred patients of gallstone disease undergoing LC were studied from September 2013 to July 2014 at Department of Surgery, BRD Medical College Gorakhpur. All the patients underwent detailed pre-operative history, clinical examination, lab investigations and transabdominal sonography. The study group was subjected to LC using the general anesthesia. Per-operative degree of difficulty was evaluated depending on objective variables which included presence of adhesions at Calot's triangle and between omentum and gall bladder, obvious injury to gall bladder, biliary ducts, bowel, diaphragm or other abdominal viscera, stone/biliary spillage, Injury to vessels, need of conversion to open procedure and post-operative complications in the early post-operative period arising as a result of intra-operative difficulty e.g. biliary fistula, bilioma, biliary peritonitis and bowel injury unmasking after surgery.
Results: Female (n=82) preponderance was observed. Mean age and BMI was 38.60±11.62 years and 27.29±3.59 kg/m^2 respectively. Incidence rate of difficult LC was 34% whereas conversion rate to open cholecystectomy was 11%.Rate of difficult LC was significantly more in patients with history of previous abdominal surgery (n=34, p<0.001), tenderness in right hypochondrium (n=31, p=0.003) and thickening of GB (n=19, p <0.001) whereas Conversion to open procedure was significantly high in patients with thickening of GB (n=19, p=0.001) and distended or contracted gallbladder (n=18, p=0.001). Most common intra-operative findings which made the procedure difficult was Dense adhesions at Calot's triangle (n=32). Most common reason for Conversion to Open Procedure was Stone/biliary spillage (36.4%).
Conclusion: BMI, history of previous abdominal surgery, tenderness in right hypochondrium and thickening of gallbladder are the significant predictive factors for difficult LC whereas conversion to open procedure was high in patients with thickening of gallbladder and gallbladder contracted.

Keywords: body mass index, laparoscopic cholecystectomy, conversion, open procedure

Introduction
In the treatment of patients with gallbladder stones minimal invasive surgery has contributed a revolutionary change. Laparoscopic cholecystectomy (LC) was first introduced to world in 1987 by Mouret since then it is still evolving. It has quickly replaced the open cholecystectomy as the standard treatment [1, 2].
LC offers several advantages which include reduced hospitalization, decreased morbidity and short recovery time. Prevalence of gallstone disease in general population is 3% - 20% of the total population worldwide [3-5].
Sometime, the LC may pose undue difficulties during access or dissection and it is considered as a "difficult" when safe completion of the laparoscopic procedure cannot be ensured8. Difficulties encountered in cholecystectomy are due to anatomical ductal and vascular anomaly or distorted anatomy following acute or chronic inflammation [6, 7].
Now-a-days LC is the standard procedure for the treatment of symptomatic gallbladder stone, although few require conversion to open cholecystectomy [6-8]. The basis of radiological findings, surgeons can select the cases appropriate for their skills aiming at reducing complications and minimizing the waste of operating time available.
Hence present study was aimed to assess the clinical and radiological parameters for predicting the difficult laparoscopic cholecystectomy and its conversion

Materials and Methods
Present prospective study was performed on 100 patients of gallstone disease undergoing laparoscopic cholecystectomy in the Department of Surgery, BRD Medical College Gorakhpur from September 2013 to July 2014.
College Ethical Committee approval and a written informed consent about participating in the study as well as about the chances of conversion to open cholecystectomy was obtained from each patients before starting the study.
All patients with symptomatic cholelithiasis (confirmed on USG), patients presenting with acalculouscholecystitis and

having age >18 years were included, whereas patients below 18 years, patients with CBD calculus, raised ALP, dilated CBD/hepatic ducts/IHBR (where CBD exploration was indicated), features of obstructive jaundice, unfit for general anesthesia, refusing laparoscopic cholecystectomy, having asymptomatic gallstone disease and patients with chronic diseases and metabolic disorders were excluded from the present study.

All the patients underwent detailed pre-operative history including age, sex, duration of pain in the right upper abdomen, previous episodes of similar pain, history of diabetes mellitus, pancreatitis, and episodes of acute cholecystitis, clinical examination including body mass index, also noted if gall bladder was palpable per abdominally and if tenderness was present in right hypochondrium, lab investigations including blood sugar level (fasting) and estimation of serum level of liver enzymes [aspartate transaminase (AST), alanine transaminase (ALT) and alkaline phosphatase (ALP)] and transabdominal sonography was also done as a routine.

Patients were fasted overnight to see for maximal distension of the gall bladder. The ultrasonography was done on B mode, grey scale and real time scan with 3.5 MHz probe. The observations included number and size of gallstones, if the gallstones were impacted at the neck of GB or cystic duct, if the gall bladder was contracted, wall thickness of GB, presence of mucocoele, presence of pericholecystic fluid and evidence of fatty liver.

The study group was subjected to laparoscopic cholecystectomy using the American set up of cables under general anesthesia. The video equipment used were – 10 mm 30° wide angle telescope, light transmission cable, three chip video camera, light source and monitors. The laparoscopic instruments used were Verres needle, carbon dioxide insufflator with monitoring of abdominal pressure and gas flow, trocar sheath 5 mm and 10 mm size, curved dissecting forceps, grasping forceps, clip applicators and clips, extraction forceps, scissors and conventional instruments and sutures to close the fascia and skin.

All surgeries were done by a single surgeon to avoid surgeons' bias. Per-operative degree of difficulty was evaluated depending on objective variables which included presence of adhesions at Calot's triangle and between omentum and gall bladder, obvious injury to gall bladder, biliary ducts, bowel, diaphragm or other abdominal viscera, stone/biliary spillage, Injury to vessels, need of conversion to open procedure and post-operative complications in the early post-operative period arising as a result of intra-operative difficulty e.g. biliary fistula, bilioma, biliary peritonitis and bowel injury unmasking after surgery. The patients with presence of any/all of the above factors were considered to have undergone a difficult laparoscopic cholecystectomy.

The statistical analysis was done to investigate a significant association between the study variables (pre-operative clinical and sonological findings) and per-operative difficulty in the surgery (evaluated as stated above), using chi- square test and student t test. P value<0.05 was considered to be significant (CI=95%).

Results

Mean age and BMI of study cohort was 38.60±11.62 years and27.29±3.59 kg/m^2 respectively. There were 18males and 82 females.

Out of 100 patients, 34 had a difficult LC. Therefore an incidence rate of 34% for difficulty during surgeries was encountered in present study. Out of the 34 difficult LC, 11patients had the procedure converted to open cholecystectomy, hence conversion rate was 11%.

Mean age for the patients undergoing a difficult LC was 38.14±10.45 years while for those having an uneventful LC was 38.83±12.25 years (p=0.781). Mean age for patients undergoing conversion to open procedure was 40.55±9.17 years while for those not having conversion was 38.36±11.91 years (p= 0.587).Out of 100 patients, 6 males and 28 females underwent a difficult LC (p=0.947) whereas, 2 males and 9 females underwent a conversion to open procedure (p=0.987).

Mean BMI for the patients undergoing a difficult LC was 30.96±2.12 kg/m^2 while for those having an uneventful LC was 25.40 (±2.57) kg/m^2 (p<0.001). Mean BMI for patients undergoing conversion to open procedure was 32.00±1.21 kg/m^2 while for those not having conversion was 26.71 (±3.34) kg/m^2 (p<0.001).

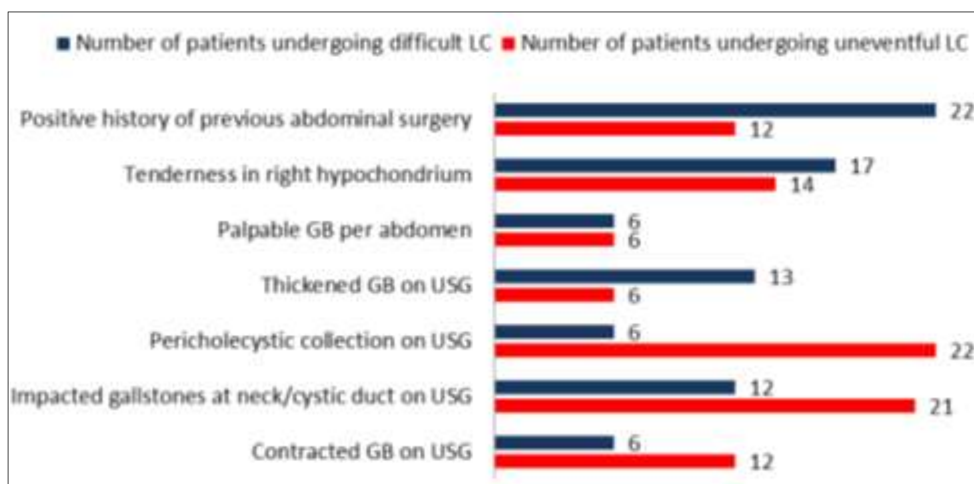

Fig 1: Frequency of Difficult LC in Relation with Study Variables

History of previous abdominal surgery(n=34); p<0.001, tenderness in right Hypochondrium (n=31); p=0.003, palpable gallbladder per abdomen (n=12); p=0.212, thickening of GB (n=19);p <0.001, pericholecysticcollection (n=28); p=0.098, impacted gallstones on neck of GB and cystic duct (n=33); p=0.726, gallbladder distended or contracted (n=18); p=0.947. Laparoscopic Cholecystectomy; LC

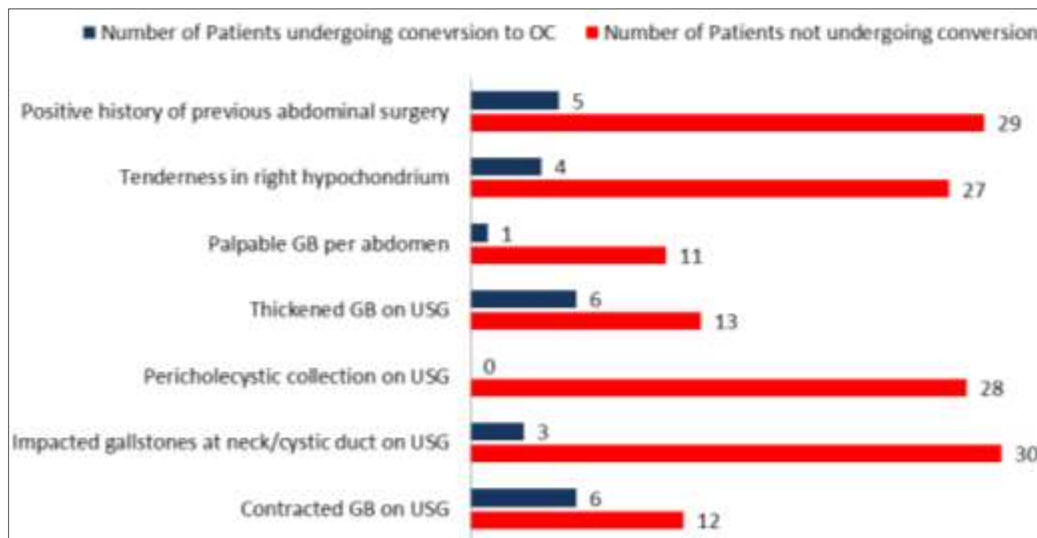

Fig 2: Frequency of Conversion to OP in Relation with Study Variables

History of abdominal surgery (n=34);p=0.395, tenderness in right hypochondrium (n=31); p=0.683, palpable gallbladder per abdomen (n=12); p=0.753, thickening of GB (n=19); p=0.001, pericholecystic collection (n=28); p>0.05, impacted gallstones on neck of GB and cystic duct (n=33); p=0.668, Gallbladder distended or contracted (n=18); p=0.001. Open procedure; OP.

Table 1: Frequency of intra-operative events leading to difficult procedure

Intra-operative findings which made the procedure difficult	Frequency of occurrence
Dense adhesions at Calot's triangle	32
Visceral injury	2
Stone/biliary spillage	25
Vascular injury/significant bleeding	16

Table 2: Reasons for conversion to open procedure in study cohort

Reason for conversion	Number of patients	Percentage
Frozen Calot's triangle	3	27.3
Visceral injury	2	18.2
Stone/biliary spillage	4	36.4
Significant bleeding	2	18.2
Total	11	100

Out of 100 patients, 8 patients had post-operative complications related to procedure (biliary leak, biliary fistula, bilioma formation, biliary peritonitis) in all of whom the procedure was considered difficult. Thus the complication rate in our study was 8%. Two patients (18.18%) out of the 11, who underwent conversion to open procedure, developed post-operative complications.

Discussion

LC is considered as the gold standard for the treatment of symptomatic cholelithiasis, preoperative prediction of difficult surgeries and its conversion is very important for planning LC [9, 10]. Preoperative prediction becomes more important so that surgeons can be requested to be present during surgery and to avoid unnecessarily prolonging the surgery and to prevent complications [11]. In present study difficult LC was significantly more in patients with history of previous abdominal surgery, tenderness in right hypochondrium and thickening of GB whereas Conversion to open procedure was significantly high in patients with thickening of GB and distended or contracted gallbladder.

A Bijapur study by Nidoni *et al.* on 180 patients reported that 24.44% were difficult and 5.56% patients required conversion to open cholecystectomy, in agreement to that in present study 34% were difficult LC cases whereas 11% were converted to open cholecystectomy [12]. Several authors have shown that conversion from LC to open procedure can results in a significant change in the outcome for the patient, as it has higher postoperative complications and requires longer hospital stay [13, 14]. The conversion rate in our study was 11% (11 of 100), which compares well with the incidence reported in the literature, which varies from 2% to 15% [15, 16]. In a similar study by Kumar *et al.* which included 536 patients who underwent laparoscopic cholecystectomy reported overall conversion rate of 7.81% [17]. Sharma *et al.* studied 200 patients undergoing LC at Kathmandu reported conversion rate of 4%. [18] Nidoni *et al.* also reported that more than 2 previous attacks of cholecystitis, GB wall thickness of >3mm and pericholecystic collection were all statistically significant for predicting the difficult LC and its conversion [12]. Similarly in present study history of previous abdominal surgery, tenderness in right hypochondrium and thickening of gallbladder were the significant predictive factors for difficult LC whereas conversion was high in patients with thickening of gallbladder and gallbladder contracted. Similarly Dhanke *et*

al. determined the predictive factors for difficult LC and reported that high BMI, history of prior hospitalization, palpable gallbladder, impacted stone and pericholecystic collection are significant predictors of difficult laparoscopic cholecystectomy which is in agreement with the present study findings, also in present study among demographic parameters BMI of >30 kg/m^2 was the significant predictor of difficult LC and conversion to open procedure [19]. Nachnani *et al*. also reported that body mass index >30 kg/m2, male gender, past history of acute cholecystitis or pancreatitis, past history of upper abdominal surgery and thickness of gall bladder wall more than 3 mm are significant predictable factors of difficult cases [20]. Similar findings were reported by Husain *et al*. [21] Ali Rizvi *et al.* studied 298 patients and reported that contracted gallbladder (< 5cm), stone impaction, thickened gall bladder wall, and cholecystitis were able to predict pre-operatively the need for conversion [1].

Small sample size is the main limitation of the present study; a large randomized clinical trial is required with greater number of factors affecting outcome. This can help to develop a universal scoring method for prediction of difficulty and chances of conversion during the procedure.

Hence it was concluded that history of previous abdominal surgery, tenderness in right hypochondrium and thickening of GB whereas conversion to open procedure was significantly high in patients with thickening of GB and distended or contracted gallbladder. Among demographic parameters BMI>30 kg/m was the significant predictor of difficult LC and conversion. This consequently increases the operating time of such patients. This can contribute to the quest for surgical excellence and better patient care for one of the most commonly performed surgical procedures in the world.

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