

Role of Ultrasonography in Prediction of Technical Difficulties in Laparoscopic Cholecystectomy - Clinical Research

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ABSTRACT

Background: Laparoscopic surgery widely, known as single incision laparoscopic cholecystectomy (LC), has been proved as the gold standard surgical technique and is now considered the treatment of choice as well as preferred surgical technique in cholecystectomy. The use of laparoscopic technique in cholecystectomy is widely used for cholelithiasis patients. An abdominal ultrasonography (USG) often precedes this surgery and can verify the diagnosis, as well as help in showing possible complications during the perioperative period. **Aim:** A prospective study was conducted to evaluate the pre-operative with and without (based on clinical findings) USG findings and predictive difficulties in cholelithiasis patients comparing with surgical findings in LC. The post-operative evaluating criteria were as follows: (1) Duration of surgery, (2) Bleeding, (3) Dissection of Calot's triangle, (4) Dissection of gallbladder wall, (5) Spillage of bile and stone, (6) Difficulty of gall bladder stone. **Methods:** We studied and evaluated surgical difficulties in 150 patients of cholelithiasis who underwent abdominal USG test for surgical LC. Variables such as identification and amount of gallstones involved were evaluated, both in pre-operative USG and during surgery to evaluate sensitivity, specificity, concordance and positive and negative predictive values. All patients had routine blood tests (including liver function tests), electrocardiography, chest X-ray, and abdominal ultrasound scan performed preoperatively. All patients received general anesthesia, and the standard Reddick and Olsen technique was performed. The harmonic scalpel was used in all cases. **Results:** On evaluation of surgical difficulties in cholelithiasis patients, we found 135 females and 15 males for surgical LC. Out of which 36 (24.0%) cases to be predicted as difficult, 26 (17.33%) were laparoscopic converted for open surgery, 36 (24.0%) were technically difficult. 54 (36.0%) cases were predicted easy to perform on USG. On evaluation, our findings were found to be significant, and hence, we concluded that pre-operative ultrasound examination if of importance for predicting difficulties in LC, but still required further studies.

Key words: Cholecystectomy, gall stone, laparoscopic, ultrasonography

INTRODUCTION

There has been a revolutionary change in the surgery after the introduction of laparoscope. The first surgical open cholecystectomy was performed in 1882^[1] and George Kelling, a surgeon from Dresden was the first to perform laparoscopy approximately after 100 years.^[2] However, Mouret a French

surgeon performed the first laparoscopic cholecystectomy (LC). Introduction of LC brought a revolutionary change in general surgery. Laparoscopic surgery in its starting time has gone through many obstacles such as cost, operating time, and possible increased risk of complications. Nowadays, the laparoscopic surgery has gone widened and the gold standard for gallstone diseases. There are many advantages of LC over open cholecystectomy in terms of better cosmetic, less pain, short hospital stay, early return to work.

It has been noticed by different surgeons that there are increased risks of common bile duct (CBD) stone and bowel injuries in laparoscopy as compared to the open procedure. There are also high chances of conversion to open technique, mainly in the cases of acute cholecystitis.

Access this article online	
Publisher 	Website: www.renupublishers.com
	DOI: 10.5958/2394-4196.2016.00002.9

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Submission: 17 Feb 2016; **Revision:** 24 Mar 2016; **Acceptance:** 28 Apr 2016

Ultrasonography (USG) is the procedure of choice for identifying gallstones. High resolution, USG can detect gallstones as small as 2 mm with sensitivity >95%. The investigation is rapid, none invasive and does not involve ionizing radiation. The normal gallbladder wall appears as a pencil thin echogenic line at sonography. The thickness of gall bladder wall depends on degree of gallbladder distension. On the basis of different ultrasonographic findings of gallbladder, surgeon can predict the difficulty to be faced during laparoscopic surgery. By this, the surgeon can select appropriate cases, thus reducing the complication rate and operative time and cost. An accurate communication between operator and assistant is vital as movements of the camera can easily impede the operating surgeon. Instruments often interfere with each other within the abdomen and extracorporeally, where attachments such as the camera light lead often restrict movement. These difficulties may be partially alleviated by instruments such as in-line laparoscopes with a longer shaft to allow the assistant to position his or her hands away from those of the operating surgeon.

The aim of our study was to search for predictive factors on USG of gall bladder that can give some idea to the surgeon about the difficulty to face during LC.

METHODS

The study was conducted at our hospital in Lucknow from May 2009 to April 2014. One hundred and fifty patients with symptomatic cholelithiasis of both sexes and of all ages were included in the study. The exclusion criterion of the study was the following section.

Exclusion Criteria

Patients having:

1. CBD stones
2. Abnormal liver function tests or jaundice
3. Pregnancy
4. Morbid obesity
5. Previous upper abdominal surgery
6. Acute cholecystitis
7. Portal hypertension
8. Carcinoma gallbladder
9. Empyema of gall bladder
10. Unfit for general anesthesia.

USG was done in all the patients after overnight fasting by ultrasonologist having more than 5 years of experience. The following criteria were assessed which may predict difficult LC:

1. Gall bladder wall thickness >4 mm
2. Stone impacted at the neck of gall bladder
3. Contracted gall bladder
4. CBD size >7 mm.

LC was done in all the patients by the same surgeon and following observations were made during surgery to label the cases as difficult:

1. Time taken in surgery is more than 90 min from insertion of veress needle to extraction of gall bladder
2. Time taken to dissect the Calot's triangle is more than 20 min
3. Time taken to dissect the gallbladder from the liver is more than 20 min
4. Perforation of gall bladder
5. Spillage of stones and bile in the peritoneal cavity.

The patients were divided into two Groups A and B. On the basis of USG and pre-operative examination (which was completely based on clinical examination) the two groups were formed. Group A consists of the patients who were evaluated preoperatively on USG test, and Group B consists of those patients who were evaluated on the basis of clinical features.

RESULTS

The age of the patients ranged from 16 to 65 years with mean (\pm standard deviation) 47.24 ± 3.86 years. Among patients, 135 (90%) were females and 15 (10%) were males.

Table 1 Shows Ultrasonography criteria for prediction of difficulty in gall bladder surgery. Out of 150 patients 36 were found to be difficult on basis of USG and 33 were actually found to be difficult during surgery. In USG criteria 81 [54%] patients were ruled out who were not found to be difficult in USG.

Table 2 Showing pre-operative evaluation based on clinical features involving suggestive of gall stones, wall thickening etc. Out of 150 case predicted to be difficult was 42 and sensitivity of prediction was 75 [50%]

Of total, 138 patients had wall thickness <4 mm, of which 114 were easy and 24 patients were difficult intraoperatively. Rest 12 patients were having gall bladder wall thickness >4 mm [Table 3], and all the cases were difficult on laparoscopy. Thus, the accuracy rate was 83%.

A number of patients having contracted gall bladder were 15. All the cases of contracted gall bladder were found to be difficult on laparoscopy.

About 135 patients having normal size gall bladder of which 114 patients had performed easy LC. The success rate was 84%.

Of total, 9 cases had impacted stone at the neck of gallbladder. The all 9 cases were found difficult on laparoscopic removal of gall bladder. In the rest, 141 cases stone was mobile and found difficulty only in 27 cases. The accuracy was 82%.

Table 1: USG criteria

Total number of cases	Cases predicted to be difficult on USG	Cases actually found to be difficult USG	Cases not found to be difficult USG (%)
150	36	33	81

USG: Ultrasonography

Table 2: Pre-operative evaluation

Total number of cases	Cases predicted to be difficult preoperatively	Cases actually found to be difficult on preoperatively	Sensitivity of prediction of preoperatively
150	42	33	75

Table 3: Accuracy of USG based on gall bladder wall thickness

Wall thickness <4 mm, (n=138)		
Easy	Difficult	Accuracy (%)
114	24	84

USG: Ultrasonography

Table 4: Open, laparoscopic converted to open and laparoscopic

Open	Laparoscopic converted to open	Laparoscopic
26	24	100

In our study, none of the patient had CBD diameter more than 7 mm. Out of 150 cases, 36 were difficult and 114 patients were easy on laparoscopy. The accuracy was 76%.

The number of cases predicted to be difficult on USG was 36. The cases found to be difficult were 33 and 81 cases were easy during surgery.

Around 150 cases were included in the study; out of these, 57 were difficult. 26 cases were converted to open technique. Table 4 shows surgery who were chosen for open were 26, laparoscopic surgery converted to open was 24 and only laparoscopic surgery was 100 in cholelithiasis patients.

Predictive Values of Various Parameters

Gall bladder wall thickness for difficult surgery

The number of patients with gall bladder wall thickness >4 mm was 12. The intraoperative difficulty was found in 9 patients. The positive predictive value of gall bladder wall thickness for difficult surgery was 75%. The sensitivity of USG for difficult surgery was 23%.

Gall bladder contraction for difficult surgery

We have found 15 cases of contracted gall bladder on USG. All the 15 patients were found to be difficult on laparoscopy. The positive predictive value was 100%. The sensitivity was 39%.

Impacted stone for difficult surgery

Impaction of the stone at gall bladder neck was found in 9 patients. In all the cases, we have found difficulty in removal of gallstone laparoscopically. The positive predictive value was 100%. The sensitivity of USG was 27%.

The overall positive predictive value of ultrasound for difficult LC is 92%.

DISCUSSION

Laparoscopy is not easy for the surgeon, thorough instruction as well as experience being crucial for the improvement of results. Contrary to initial reports of an increased complication rate, recent data show that LC entails lower morbidity and mortality rates than open operation. In the comparative study by Jatzko *et al.*, open operation was associated with a 7.7% morbidity rate, compared with 1.9% for LC, and a 5% mortality rate versus 1% for LC.^[3-8]

Koulas, *et al.*,^[9] in year 2006, had done a study on LC performed by surgical trainees on 1370 cholelithiasis patients in two groups. The surgery was performed by consultants, specialist egitras, senior huse officer, and concluded that mean operative time was 57 min (range, 33-97) while for the consultants it was 49 min (range, 27-78, $P = 0.25$). The complications, in his study, were bowel thermal injury, bile duct injury, hemorrhage, hematomas, inflammation of the port site at the umbilicus, and paralytic ileus.

Schol *et al.*,^[10] and Böckler *et al.*^[11] in their studies in the early 1990s tried to evaluate the integration of the new surgical procedure into the training program of residents within 2 years of its introduction. They both concluded that the operator's grade does not affect the conversion rate or the number of complications. Despite the fact that the above-mentioned studies were conducted within the initial phase of the technique, it is quite impressive that their results were similar. As a consequence, the exposure of residents to these techniques was obligatorily limited, and thus, they performed 172 and 89 LC, respectively. Similar studies comparing outcomes in patients after colorectal,^[9,10] vascular,^[11] and breast^[12] surgery show that no difference exists in outcomes between patients operated on by consultants and junior surgeons.

Friedman and Pace^[12] in their study found no significant difference between residents who were trained on animal models and those who were trained first as the camera operator and progressing to first assistant, without any

training on a simulator.^[12-17] On the other hand, several authors have complained that the laparoscopic generation of surgeons starts their training in biliary surgery without any experience with the open technique; however, less experience in open biliary surgery, apparently, does not influence the safety of LC.^[13] As a matter of fact, surgeons who started LC after their residency had a higher rate of biliary complications than did colleagues who learned LC during their residency.^[2]

Newman *et al.*,^[18] in the year 2016, done a study on laparoscopic surgery in which the compare cost analysis of traditional 4-port versus single-incision and robotically assisted cholecystectomy in 50 laparoscopic and non-laparoscopic surgeries and concluded that non-traditional, minimally invasive gallbladder removal (SILS and ROBOSILS) offers significantly less surgical value for elective, outpatient gallbladder removal.

CONCLUSION

The general principles in laparoscopy and the critical view of safety should always be born in mind. The surgical team of laparoscopic especially the cameraman should be properly trained. The instruments should be quite friendly and a surplus of them should be available. The surgeon should have had a good amount of experience with simple gallbladders before handling the difficult ones. With the advent of gratifying improvements in the imaging technology, instrumentation and innovative techniques, the difficult gallbladders now fall in the domain of simple surgeries. However, the intrinsic error in the surgical technique cannot be avoided and whenever it comes onto that open approach should always be given a weightage. On the basis of clinical evaluation, we concluded that single incision laparoscopic surgery for cholelithiasis patient's alternative surgical procedure for the management of gastrointestinal.

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How to cite this article: Husain A, Firdaus H, Pathak S. Role of Ultrasonography in Prediction of Technical Difficulties in Laparoscopic Cholecystectomy - Clinical Research. *Int J Dent Med Spec* 2016;3(1):2-5.

Source of Support: None; **Conflict of Interest:** None