

Predicting difficulties during laparoscopic cholecystectomy by preoperative ultrasound

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Abstract

Background: The aim of this study was to determine whether the preoperative USG finding can predict the risk of conversion or difficulty during the laparoscopic cholecystectomy.

Materials and methods: 200 patients undergoing Laparoscopic cholecystectomy at Kathmandu Medical College Teaching Hospital were included. Sonographic parameters like size of gall bladder, wall thickness, distance between hepaticoduodenal ligament and Hartmann's pouch and the size of stone were taken into consideration and difficulties in terms of adhesions around gall bladder, anatomy of calot's triangle and difficulty in peeling off gall bladder from the bed and retrieval were analyzed.

Result: In 8 of 200 patients (4%), LC was converted to open procedure. In univariate analysis all the sonographic parameters we had included in this study were statically significant (p value <0.05).

Conclusion: Preoperative sonographic signs can predict the difficulty in laparoscopic cholecystectomy

Laparoscopic cholecystectomy (LC) is considered the treatment of choice for cholelithiasis. It has advantages over traditional open cholecystectomy in terms of minimal post operative pain, shorter hospital stay, better cosmesis and earlier recovery. With growing experience and overcoming the learning curve, a selection criterion has become more liberal. Most of the previous contraindications such as morbid obesity, previous upper abdominal surgery and acute cholecystitis are no longer absolute. Attempts can be made in all cases of gall stone diseases with laparoscopic procedure except for patients with bleeding diathesis, carcinoma gallbladder and patient not fit for general anaesthesia. However, of all LC 1-13% requires conversion to an open if the anatomy of calot's triangle is not clear or an uncontrolled bleeding occurs¹. Thus, for surgeons it would be helpful to establish criteria that would assess the risk of conversion preoperatively. This would be useful for informing patient and a more experienced surgical team could be assembled when risk for conversion appears significant.

Materials and methods

From December 2003 to April 2004, total of 200 patients with known cholelithiasis were studied prospectively. Among them 22 had asymptomatic gallstones diagnosed incidentally in ultrasonography and rest had symptoms.

Surgical procedure

LC were performed by a trained laparoscopic surgeon or general surgeons under supervision. Difficulties were assessed in terms of adhesions, unclear calot's anatomy, bleeding or perforation during peeling off gallbladder from the bed and difficulty in retrieval of gallbladder specimen from the port either because of stone size or gallbladder size. Time was not considered as a factor to define difficult surgery.

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Sonographic examination

All patients were examined on fasting state with 3.5 MHZ scanner. Sonographic examinations were performed by a single consultant radiologist. Following parameters were assessed - contracted or

normal gallbladder, wall thickness, relation of neck with hepaticoduodenal ligament, gallbladder size, number and size of stones. Statistical analysis was done using chi-square test.

Table 1: Adhesion around the gall bladder

No. of cases-200	No adhesion	Minimal adhesion	Dense adhesion
Contracted gallbladder 43	-	40 (93.3)	3 (6.7)
Normal gallbladder 126	97 (76.6)	28 (22.6)	1 (0.8)
Distended gallbladder 31	5 (16.1)	25 (80.6)	1 (3.3)

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Table 2: Adhesion around the gall bladder

Wall thickness	No adhesion	Minimal adhesion	Dense adhesion
<3mm 133	99 (74.4)	33 (24.8)	1 (0.8)
>3mm 67	3 (4.5)	60 (89.5)	4 (6)

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Table 3: Anatomy of calot's triangle

No. of cases 199	Clear	Clear after dissection	Not clear after dissection
Contracted gallbladder 42	12 (28.5)	27 (64.3)	3 (7.2)
Normal gallbladder 126	95 (75.3)	31 (24.7)	-
Distended gallbladder 31	15 (48.3)	12 (38.7)	4 (13)

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Table 4: Anatomy of calot's triangle

Wall thickness 199	Clear	Clear after dissection	Not clear after dissection
<3mm 133	107 (80.7)	25 (18.7)	1 (0.9)
>3mm 66	15 (22.7)	45 (66.1)	6 (0.2)

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Table 5: Anatomy of calot's triangle

Relation of hepaticoduodenal ligament and gallbladder neck	Clear	Clear after dissection	Not clear after dissection
<5mm 18	-	12 (66.7)	6 (33.3)
5-10mm 41	3 (7.3)	37 (90.2)	1 (2.5)
>10 mm 140	119 (85)	21 (15)	-

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Table 6: Difficulty in peeling off from the bed

Gallbladder wall thickness 192	Easy	Bleeding from the bed	Perforation of the gallbladder
Wall thickness <3mm 132	112 (84.8)	5 (3.9)	15 (11.3)
Wall thickness >3mm 60	45 (75)	8 (13.3)	7 (11.7)

P value with confidence interval 95%, $p \leq 0.05$ (alpha = 0.05)

Table 7: Retrieval of gallbladder specimen

No. of cases	Easy	Retrieved after decompression	Retrieved after increasing the port size
192			
Size of stones <10mm 179	131(73.1)	37 (20.6)	11 (6.3)
Size of stones >10mm 13	-	4 (30.7)	9 (69.3)

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Table 8: Retrieval of gall bladder specimen

No of cases	Easy	Retrieved after decompression	Retrieved after increasing the port size
192			
Contracted gall bladder 39	36 (92)	-	3 (8)
Normal gall Bladder 126	93 (73.8)	21 (16.6)	12 (9.6)
Distended gall bladder 27	2 (7.4)	20 (74)	5 (18.6)

P value with confidence interval 99.9%, $p \leq 0.001$ (alpha = 0.001)

Results

We included 200 patients undergoing laparoscopic cholecystectomy in this study out of which 8 were converted to open. Adhesions around the gall bladder were dense in 3/43 cases (p value with confidence interval 99.9%) with contracted gall bladder, and 4/67 patients with gall bladder wall thickness >3 mm (p value with confidence interval 99.9%). Only one required conversion due to this reason.

Contracted gallbladder shown in ultrasound done in fasting state of patient also showed unclear anatomy of calot's triangle. 3/42 patients required conversion. At the same time distended gall bladder in USG findings in postprandial state 4/32 patients needed conversion because of unclear calot's triangle (p value being <0.001). Unclear anatomy of calot's triangle was present in 1/133 cases with normal gallbladder wall and 6/66 cases with thick gallbladder wall >3 mm for which they were converted (p value <0.001). Hepaticoduodenal ligament and Hartmann's pouch relation was calculated by ultrasonography and 6/18 cases with this distance <5 mm had unclear calot's triangle in spite of dissection and one of the cases with this distance >10 mm required conversion due to unclear anatomy (p value <0.01). Total number of seven cases were converted due to this reason.

Difficulty in peeling off gall bladder from the liver bed was assessed in terms of bleeding and bile leak from the gall bladder due to perforation and were analysed with the gallbladder wall thickness described in USG report. Bleeding was significant in

5/132 cases with gall bladder wall thickness <3 mm and 8/60 cases with gall bladder wall thickness >3 mm. However, conversion was not required for the bleeding. Perforation was almost in same proportion in both the groups.

Retrieval of the specimen was assessed in terms of maximum size of stones and size of gall bladder shown in USG. Retrieval was done after increasing the size of the port in case with stone size >10 mm was 9/13 and stone size <10 mm were 11/179 (p value <0.05). USG evaluated size of gall bladder in terms of retrieval of the specimen was also statistically significant. Difficulty while retrieving the gall bladder were similar irrespective of their size.

Discussion

Since the introduction in 1989, laparoscopic cholecystectomy had been the procedure of choice in the treatment of symptomatic gall stone². But some of the planned LC needs conversion due to various factors. It would be useful in advance to know which ones would require conversion so that experienced laparoscopic surgeon could be scheduled to minimize conversion rate.

Conversion from LC to OC was required in 4% of our patient. This is comparable with the published reports in literatures³. As stated by others we do accept that it is imperative to view conversion to an open procedure a sign of experience in order to avoid ductal injuries and not as a complication⁴.

Predicting conversion from laparoscopic to open cholecystectomy had been conducted in various centres. Ahmet Apont et al in his study of 783 patients showed that acute cholecystitis, thickened gallbladder wall on ultrasonography, elevated ALP, and WBC count determine conversion⁵. Gall bladder wall thickness on preoperative USG represents the presence of inflammation or fibrosis due to previous attacks of cholecystitis⁶. In this study gall bladder wall thickness significantly determines the difficulty during surgery. Gall bladder adherent to hepaticoduodenal ligament found in USG had slight connection with the degree of surgical difficulty⁷. In our study sonographic parameter was statistically significant to predict difficult surgery. Large stones requiring extension of the umbilical incision has been quoted by Roberto Santambrogio et al⁷.

Scherk et al have analyzed pre and perioperative risk factors for conversion to OC in 1300 patients and found that rigidity in right upper quadrant, thickened gall bladder on USG, evidence of dense adhesions and acute cholecystitis were significant indicators for conversion to OC in 4.3% converted cases¹.

On the basis of preoperative USG evaluation, surgeons should be aware of the potential problems during LC and maintain a reasonable threshold of conversion if technical problems arise. This study also confirms the significant association between preoperative US evaluation and the risk of difficult surgery and other difficulties. However some advocate that to improve the predictability of operative difficulty of LC other nonultrasonographic factors must be included as independent variables such as age, sex, body mass index of the patient and the presence of adhesions⁸.

Conclusion

This study identified various sonographic findings which determined increased chance of conversion from LC to OC and predicted difficulties during surgery. Thus, in elective laparoscopic cholecystectomy, it would help counsel patients undergoing laparoscopic cholecystectomy with regards to probability of conversion to an open procedure. It would also help to assemble more experience surgical team if difficulty is preoperatively anticipated.

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