

Preoperative prediction of difficulty during laparoscopic cholecystectomy

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Abstract

Introduction: To determine the risk factors predicting difficulty during laparoscopic cholecystectomy (LC). **Experimental:** Surgical V, Civil Hospital and Surgical II, Fatima Hospital (Karachi) between January and November 2008. There were 100 cases of cholelithiasis admitted through out-patient department (OPD) for elective surgery. Clinical features, laboratory investigations and outcome of surgery were recorded on a data collection form. Conversion to open surgery and long operating time were the indicators of difficult laparoscopic dissection. A p-value of <0.05 was considered significant. **Results and Discussion:** Nine patients required conversion to open surgery, and seven of them were predicted for difficulty. Factors strongly predicting conversion, having p-value <0.05, were: vomiting, previous acute cholecystitis, previous jaundice, tenderness in right hypochondrium, leucocytosis, gallbladder wall thickness of 2mm or more, contracted gallbladder, pericholecystic fluid, and gallbladder adhesions. **Conclusions:** Operative difficulty of laparoscopic cholecystectomy can be predicted with careful preoperative assessment.

Keywords: Cholecystectomy; Laparoscopic cholecystectomy; Prediction of difficulty; Conversion

1. Introduction

Laparoscopic cholecystectomy (LC) is now the gold standard treatment of gallstones [1,2]. But still in cases of difficulty in dissection, conversion to open surgery is required. The most common reason for conversion was inability to define anatomy in patients with inflamed contracted gallbladder (GB). Significantly independent predictive factors for conversion were male gender, previous abdominal surgery, and acute cholecystitis [3]. A white blood cell count >9000/cc and gallbladder wall thickness >0.4 cm predicted conversion to open cholecystectomy [4]. In patients with acute cholecystitis, a body mass index >30 kg/m predicted conversion [4]. Older patients (65 years or older, and patients with multiple attacks (ten or more) of biliary colic had a greater risk for conversion [5]. Preoperative ultrasonographic parameters predicting conversion were gallbladder wall thickness, contracted gallbladder, impaction of gallstones at the neck of the gallbladder, and common bile duct (CBD) stones [6].

If such cases can be predicted with the help of clinical data and some laboratory investigations, it will help in planning patient management [4,7]. It would allow the surgeon to discuss the higher risk of conversion with the patient and also allow for an earlier intraoperative decision to convert if difficulty was encountered [7]. This study therefore aims to identify the factors which predict difficult dissection and therefore conversion to open surgery.

2. Experimental

The study was conducted in Surgical unit V of Civil Hospital Karachi (attached to Dow University) and Surgical unit II of Fatima Hospital Karachi (attached to Baqai University). This prospective descriptive study was done from January to November 2008. The sample size was 100 cases, and the sampling technique used was non-probability purposive sampling. The sample size though small, it was thought to prove both ends of our study ie prediction of safe LC as well as prediction of difficult LC/conversion; further this study will open the avenues for further research with more number of patients. All cases of cholelithiasis proven on ultrasound scan were included. The

exclusion criteria were patients with acute cholecystitis, obstructive jaundice and history of upper abdominal surgery; we foresee these as major factors that can lead to operative difficulty and so conversion.

Data about all patients with cholelithiasis admitted for elective surgery were entered on a detailed proforma which includes personal bio-data, chief symptoms, signs and relevant investigation like total leukocyte count (TLC), erythrocyte sedimentation rate (ESR), serum bilirubin level, and serum alkaline phosphatase. Ultrasound findings recorded were size of gallbladder, thickness of its wall, number of stones present, any pericholecystic fluid or adhesions, CBD diameter, and liver parenchyma. Operative details recorded include operating time (from first port incision to last port closure), operative findings (ie gallbladder size, adhesions, number of stones), any complication and whether converted to open surgery or not.

The pre-operative risk factors were matched against the outcome of surgery. Long operating time and conversion to open cholecystectomy were the two indicators of difficult dissection.

Data analysis was performed through SPSS 12. Pearson's Chi-square test were applied to all categorical variables including sex, signs and symptoms, ultrasound findings, operative details and factors predicting conversion. Student's t-test was applied to qualitative variables including operative time and CBD diameters and was presented by Mean \pm SD (standard deviation). A P-value of <0.05 was considered significant.

3. Results

The mean age of converted cases was slightly higher than non-converted cases, 47 years \pm 12.247 vs. 41.47 years \pm 13.182. Male to female ratio was 1:5, with 16 males and 84 females. The mean weight of converted cases was also slightly higher than non-converted cases, 70.67 Kg \pm 14.213 vs. 65.30 Kg \pm 10.137.

Table 1 shows statistical analysis of history and examination findings. Right upper quadrant (RUQ) pain was reported by 92% patients in the series, including all of the converted cases (statistically not significant). Dyspepsia was present in 5 of the converted patients (statistically not significant). There were 3 patients (3%) having history of vomiting, and all 3 were converted (statistically significant). Eight patients (8%) in the series gave history of hospitalization ranging between 2 to 8 days duration for acute cholecystitis; seven of them were converted (statistically significant). None of the patients had jaundice at the time of surgery, but 7 patients (7%) gave history of jaundice over past one-year period; five of them were converted (statistically significant). History of previous abdominal surgery was present in 14 patients: Pfannenstiel incision for Caesarian section 8, lower midline incision for Caesarian section 2, paraumbilical hernia repair 2, and tubal ligation 2. Only one patient with lower midline incision was converted; however the operative difficulty was not because of the scar, but because of inflammation in Calot's triangle. Parity-wise 84 female patients were divided into 3 groups: 'group A' having 23 patients (27%) were nulliparous, 'group B' 32 patients (38%) had 1-3 children, and 'group C' 29 patients (35%) had more than 3 children. Those in 'group A' posed comparatively more difficulty in making first port (infraumbilical). The patients in other groups had relatively lax anterior abdominal wall, and thinned out muscles so that first entry was easier. GB dissection although seem to be unaffected by the number of pregnancies. All of the patients had temperature recording of $<99^{\circ}\text{F}$ (afebrile). Twelve patients (12%) had mild tenderness on deep palpation in RUQ (positive Murphy's sign); seven of them were converted (statistically significant).

Table 2 and 3 shows statistical analysis of abdominal ultrasound findings. In this series, 55% patients had GB wall thickness of 2mm or less, while 45% patients had $>2\text{mm}$. Seven (77%) out of 9 who got converted had wall thickness of more than 2mm (statistically significant). GB distension was found in 90% of cases, and 7 conversions had distended GB (statistically non-significant). In 5% patients GB was seen fibrosed, shrunken or contracted; 2 out of them got converted to open surgery (statistically significant). Single stone was present in 9% patients, while 91% patients had multiple stones in GB; out of 9 converted cases, 2 had single stone and 7 had multiple (statistically non-significant). Only one patient had small pericholecystic fluid collection, who was converted to open (statistically significant). Ultrasound suggested adhesions around GB in 4 patients (4%) and 3 of them

Table 1. History and examination findings.

Clinical findings		Conversion		P-value
		Yes	No	
Pain in RUQ	Yes	9	83	.354
	No	0	8	
Dyspepsia	Yes	5	65	.322
	No	4	26	
Vomiting	Yes	3	0	.000
	No	6	91	
Fever	Yes	0	0	
	No	9	91	
Past history of acute cholecystitis	Yes	7	1	.000
	No	2	90	
Past history of jaundice	Yes	5	2	.000
	No	4	89	
Past history of abdominal surgery	Yes	1	13	.793
	No	8	78	
Jaundice	Yes	0	0	
	No	9	91	
BMI < 30	Yes	1	2	.135
	No	8	89	
Tenderness in RHC	Yes	7	5	.000
	No	2	86	

Table 2. Abdominal ultrasound findings.

		Conversion		P-value
		Yes	No	
GB wall thickness	1 mm	0	15	.000
	2 mm	2	38	
	3 mm	2	32	
	4 mm	3	6	
	5 mm	1	0	
	6 mm	1	0	
GB distension	Yes	7	83	.200
	No	2	8	
Contracted GB	Yes	2	3	.013
	No	7	88	
No. of stones	No	0	0	.146
	Sludge	0	0	
	Single	2	7	
	Multiple	7	84	
Pericholecystic fluid	Yes	1	0	.001
	No	8	91	
GB adhesions	Yes	3	1	.000
	No	6	90	
GB mass	Yes	0	0	
	No	9	91	

Table 3. Comparative analysis of factors predicting conversions.

	Conversion	No. of cases	Mean	Std. Deviation	Std. Error Mean	P-value
Patient's age (years)	Yes	9	47.00	12.247	4.082	.000
	No	91	41.47	13.182	1.382	.000
Patient's weight (Kg)	Yes	9	70.67	14.213	4.738	.000
	No	91	65.30	10.137	1.063	.000
Parity	Yes	9	2.11	2.261	.754	.023
	No	91	2.26	2.059	.216	.000
Total leukocyte count (/mm ³)	Yes	9	9577.78	1509.783	503.261	.000
	No	91	7419.78	1105.061	115.842	.000
Erythrocyte sedimentation rate (mm/1 st hour)	Yes	9	20.78	7.259	2.420	.000
	No	91	25.71	13.015	1.364	.000
Serum bilirubin (mg/dl)	Yes	9	1.233	.1500	.0500	.000
	No	91	1.333	.1868	.0196	.000
Serum alkaline phosphatase (U/l)	Yes	9	140.00	51.988	17.329	.000
	No	91	101.49	38.134	3.998	.000
GB wall thickness (mm)	Yes	9	3.67	1.323	.441	.000
	No	91	2.32	.828	.087	.000
CBD diameter (mm)	Yes	9	4.444	1.5899	.5300	.000
	No	91	3.659	1.5436	.1618	.000
Operative time (minutes)	Yes	9	91.11	17.099	5.700	.000
	No	91	32.64	8.863	.929	.000

were converted to open cholecystectomy (statistically significant). The mean CBD diameter of converted cases was slightly larger than non-converted cases, 4.444 mm ± 1.5899 vs. 3.659 mm ± 1.5436.

Table 3 shows statistical analysis of TLC, ESR, serum bilirubin and serum alkaline phosphatase in converted and non-converted cases. Figure 1 shows the reasons of conversion in 9 patients (9%) who got converted to open surgery. These reasons were known preoperatively so no unnecessary time was wasted before deciding for conversion to open surgery in cases that were predicted for difficulty. The patient who got converted because of liver bed bleeding was not having prediction of difficulty. Similarly another patient with dense omental adhesions was not predicted because her preoperative ultrasound did not suggest any such finding. The mean operating time of converted cases was significantly higher than non-converted cases, 91.11 min ± 17.099 vs. 32.64 mm ± 8.863.

4. Discussion

LC has become the standard treatment for symptomatic GB disease [3,8] But still there is a substantial proportion of patient in whom LC cannot be successfully performed, and for whom conversion to open surgery is required. The prediction of a need to convert would allow the surgeons to discuss the higher risk of conversion with the patients and also allow for an earlier intraoperative decision to convert if difficulty is encountered [7].

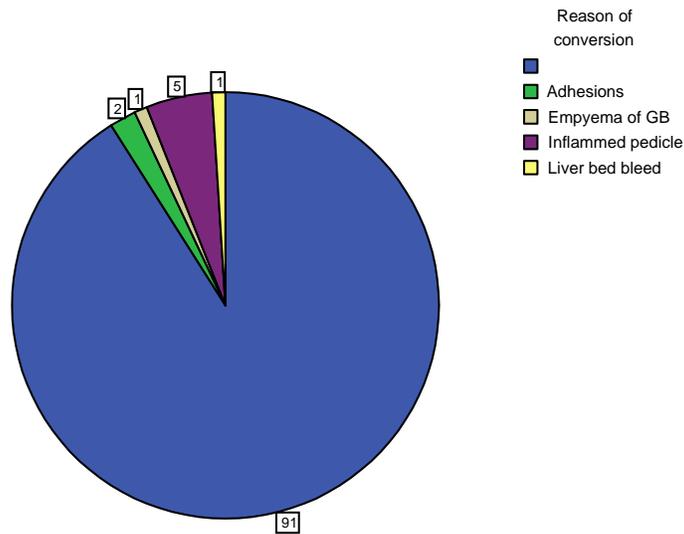


Figure 1. Reasons of conversion.

4.1. Demography

Hutchinson CH found male gender twice more likely to get converted [7]. Kama NA et al repeated the same in 2001 [9]. In our series out of 9 total conversions, four were males and 5 were females. Thus 5 out of 84 total females in this series makes them 16.8% who got converted, whereas 4 out of 16 total males make it 25%. This shows that overall male patients have higher conversion rate than females. The findings of higher conversion rate in males was based on the fact that male patients presented with more severe manifestations of disease [7, 10].

Elderly patients had a higher likelihood of complicated biliary tract disease because of recurrent attacks of cholecystitis. They also had a higher incidence of CBD stones. This might explain the increased risk of conversion in patients older than 65 years [10-13]. In this study, there was one patient aged 75 years, who was converted to open.

4.2. Factors predicting conversion

Identification of patients at greater risk of conversion remains difficult, however quite a few preoperative factors can now be implicated in the prediction of difficulty [4]. During the selection of the patients for LC, certain criteria were observed. All those patients having CBD stone, previous upper abdominal surgical scar, and acute cholecystitis were excluded. In all those patients in whom LC was performed many factors were found to be in correlation with conversion, which were listed in Table 4. The possible factors which showed strong positive correlation are listed at the top while those which are thought to have low positive correlation occupy the lower position in the table. In majority of the non-converted cases, these factors are found to be absent.

The overall conversion rates of LC have been clearly defined in previous studies [14,15]. Chi-leung Liu et al showed a conversion rate of 17% in his initial 100 patients and 4% in the last 100 patients [13]. Some of the conversions were caused by intraoperative bleeding from cystic artery, liver bed, or greater omentum that required laparotomy; these complications could have been managed readily by a laparoscope if the surgeon had adequate experience [13]. Similarly, an accessory cystic duct in the liver bed could be sutured by a laparoscope. However, conversion to laparotomy still appears inevitable in a certain percentage of patients because of other factors.

Table 4. Factors predicting conversions, with comments.

Factors predicting conversion	Comments
GB wall thickness on ultrasound	7 out of 9 who got converted had wall thickness of >2mm which makes this pre-operative factor a significant one to predict difficult dissection [16, 21, 22, 23].
Distension of GB	7 of those converted had distended gallbladders [24].
Abdominal tenderness	7 converted cases were tender on examination [9, 24].
Past history of abdominal surgery	Those having history of para-umbilical hernia repair posed difficulty in making first port [9, 17, 24].
TLC	6 out of 9 converted cases had TLC >9000/cc, which signifies an ongoing inflammation [21, 22, 24].
Past history of jaundice	5 converted cases had history of jaundice.
Adhesions	3 of the converted patients had adhesions reported on ultrasound [25].
Past history of acute cholecystitis	7 out of 9 converted cases had history of acute cholecystitis. ^{11, 23} [11, 23, 25].
Shrunken/Contracted/Fibrosed gallbladder	2 of them got converted to open [8, 12, 22].
CBD diameter	No difference [26].
Other reasons	Inflamed Calot's triangle [27].
Dyspepsia	5 converted patients had dyspepsia.
Pericholecystic fluid	One patient got converted [28].
Parity	Patients with no parity posed comparatively more difficulty in making first port. Those with multiple parities had relatively lax anterior abdominal wall, so that first entry was easier.
Number of stones	This was not implicated in terms of difficulty.
ESR	Converted cases had mixed pattern of ESR level.
Serum bilirubin level	None of the converted cases had hyperbilirubinemia
Fever	None of patients had fever in preoperative period [29].
Nausea and vomiting	No casual relation found.

Explanations for the higher conversion rate in the obese group include difficult cannula placement, obscure anatomy because of excessive intraperitoneal fat, inability to retract the liver sufficiently, and difficulty with instrument manipulation in an excessively thick abdominal wall [16,17].

These technical difficulties were at least partially overcome in this study, and obesity proved to be a less important factor for conversion. This was especially so because of increased laparoscopic experience and with improvement in laparoscopic instruments, e.g., a more sophisticated retractor and 30 degree laparoscope. In fact, laparoscopy has been recommended as the preferred method of cholecystectomy in morbidly obese patients [18].

A preoperative ultrasound finding of a thickened gallbladder wall, suggesting chronic cholecystitis is expected to predict difficult exposure of the anatomy during LC [19]. These patients would be expected to have more adhesions and thus a more challenging laparoscopic dissection. Complications of chronic cholecystitis are expected to be common in this group of patients. Patients who had had lower abdominal surgery were not found to have increased difficulty during LC in terms of adhesions in the upper abdomen. Therefore, an increased risk of conversion was not observed in this group.

There were 7 patients out of 9 converted cases who had history of acute cholecystitis. The risk of conversion to open cholecystectomy was significantly higher in this group of patients. Dense adhesions, fibrosis and contracted gallbladder with difficulty in exposing the anatomy were the usual findings in these cases. On the other hand, LC has been suggested as an effective treatment of acute cholecystitis [20].

As expected, an intraoperative finding of a chronically inflamed contracted gallbladder with a thickened wall during LC was associated with an increased conversion rate. In these cases dense adhesions at Calot's triangle and difficulty in grasping the gallbladder for retraction often made surgical anatomy difficult to define, resulting in difficult and sometime risky LC. However, as this was only an intraoperative finding it could not be used as a preoperative factor for conversion [13].

5. Conclusions

The factors which strongly predict the conversion of laparoscopic to open cholecystectomy are: increased GB wall thickness on ultrasound, GB distension, abdominal tenderness, previous history of upper abdominal surgery, increased leucocyte count, and previous history of jaundice and acute cholecystitis. Knowledge of these factors may help in arranging the operative schedule, psychological preparation for the procedure and planning of duration of convalescence.

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