e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2022; 12(3); 127-134

Original Research Article

An Observational Utility of Pre-Operative Abdominal Ultrasound to Predict Conversion to Open Cholecystectomy

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Received: 13-01-2022 / Revised: 20-02-2022 / Accepted: 10-03-2022

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Conflict of interest: Nil

Abstract

Aim: To establish a radiologic view on prediction of conversion from laparoscopic cholecystectomy to open surgery.

Methodology: This observational study was conducted 12 months in Jagannath Gupta institute of medical sciences and Hospital, Budge Budge, Kolkata, West Bengal, India. Written informed consent was obtained from all the patients prior to enrollment. Patients were explained the risks and benefits of the procedure. Patients aged between 20 and 75 years with a diagnosis of cholelithiasis/cholecystitis were included. Patients with choledocholithiasis on USG, having co-morbid conditions like uncontrolled diabetes mellitus, uncontrolled hypertension, coagulopathies, chronic obstructive pulmonary disease, severe cardiac failure, jaundice, cholangitis, body mass index (BMI) >30 kg/m2 and a history of upper abdomen surgery were excluded. The data was collected by pre-tested study proforma, which included general information, clinical details of the patient and investigations. Every patient underwent USG. The USG findings such as gallbladder wall thickness, presence or absence of stones, number of calculi, the size of the calculi, presence of adhesions/fibrosis, pericholecystic fluid collection and common bile duct diameter was recorded. All the patients underwent diagnostic laparoscopy. If feasible, laparoscopic cholecystectomy was performed. If not, the procedure was converted to open. All patients' findings at laparoscopy were compared to USG findings and the reason for conversion in each patient was documented in detail. Association of USG findings was correlated with conversion to open cholecystectomy.

Results: The present research was an observational study to find the utility of abdominal USG parameters which can predict the conversion from laparoscopic to open cholecystectomy. A total of 100 patients were included in the study. Of 100 patients, 11% had a conversion to open cholecystectomy. There was no statistically significant difference between the two groups in relation to age groups and gender. There was no statistically significant difference between the two groups in relation to abnormal gallbladder, presence and number of calculi, size of the calculus (>6 mm), gallbladder thickness (>4 mm), pericholecystic collection, adhesions/fibrosis and size of the common bile duct.

Conclusion: 11% patients had a conversion to open cholecystectomy. There was no statistically significant difference of USG parameters studied such as gallbladder wall thickness >4 mm, pericholecystic fluid collection, common bile duct diameter >7 mm, presence of calculus,

number of calculi, size of calculus >6 mm and adhesions/fibrosis in patients who required conversion to open cholecystectomy and who were operated laparoscopically.

Keywords: Laparoscopy, cholecystectomy, gall bladder.

Introduction

Laparoscopic cholecystectomy has proved to be an effective and safe procedure both in elective and emergency conditions; however, conversion to open surgery is inevitable in some cases. The conversion causes elongation of hospital stay, increased total cost, and dissatisfaction of the patients [1]. The common etiologies of such a conversion are uncontrollable bleeding, adhesions, inflammation, anatomical variations, entailed common bile duct (CBD) exploration, trauma of bile duct and other hollow viscera, presence of malignant pathologies, and technical failures. These causal variables are intra-operative events and could not be used as factors to predicate conversions before operations [2, 3]. Pre-operative prediction of a laparoscopic cholecystectomy (LC) can assist the surgeon to prepare better for the risk of conversion to open cholecystectomy[4].

Gallbladder stone disease is seen in one of every third woman and fifth man, although half of the stone carriers become symptomatic [5]. Laparoscopic cholecystectomy (LC) is the gold standard therapy method in gallbladder diseases. It is widely used in routine treatment choice instead of open surgery (OS). LC improves not only patient satisfaction, but also shortens hospitalization period. Smaller scar tissue formation is the other cosmetic advantage of LC [6, 7]. Calot's triangle is the main area between common bile duct, cystic duct and cystic artery in LC. The adhesions of pericholecystic area and the Calot's triangle, injury of gallbladder and/or bile ducts, risk of bleeding may lead the surgeon to OS [7, 8]. Preoperative ultrasonography (US) is a valuable method that may indicate the surgical difficulties and predict the potential conversion from LC to OS [9, 10].

The revolution in laparoscopic surgery began three decades ago when laparoscopic cholecystectomy was introduced. It did not take long for a consensus to develop and for the national institute of health to pronounce laparoscopic cholecystectomy, as the procedure of choice for patients with symptomatic cholelithiasis [11]. Retrospective data show that laparoscopic cholecystectomy is safe and effective when compared to open cholecystectomy. The advantages of laparoscopic cholecystectomy have been described as obvious and compelling. Laparoscopic cholecystectomy reduces hospital stay, decreases morbidity, has a short recovery time and better cosmesis [12, 13].

In spite of the advances in technique, visualization and instrumentation in laparoscopy, there still are 1% to 13% of patients, who need an open procedure to complete the removal of the gallbladders during laparoscopic cholecystectomy [14]. This happens because of many factors like unclear Calot triangle anatomy, intensely inflamed and thick gallbladder, dense adhesions in the operative area, obscure biliary tree anatomy, local inflammation like pancreatitis and others [15]. Since many of these factors cannot be determined clinically, a precise abdominal sonographic examination sheds light on various such conditions. A well-informed surgeon can then make

appropriate choices of proceeding with laparoscopic cholecystectomy or offering elective open cholecystectomy in such patients [13]. The purpose of this study was to establish a radiologic view on prediction of conversion from laparoscopic cholecystectomy to open surgery.

Materials and methods

This observational study was conducted 12 months in Jagannath Gupta institute of medical sciences and Hospital, Budge Budge, Kolkata, West Bengal, India. Written informed consent was obtained from all the patients prior to enrollment. Patients were explained the risks and benefits of the procedure. Patients aged between 20 and 75 years with a diagnosis of cholelithiasis/cholecystitis were included. Patients with choledocholithiasis on USG, having co-morbid conditions like uncontrolled diabetes mellitus, uncontrolled hypertension, coagulopathies, chronic obstructive pulmonary disease, severe cardiac failure, jaundice, cholangitis, body mass index (BMI) >30 kg/m2 and a history of upper abdomen surgery were excluded.

The data was collected by pre-tested study proforma, which included general information, clinical details of the patient and investigations. Every patient underwent USG. The USG findings such as gallbladder wall thickness, presence or absence of stones, number of calculi, the size of the calculi, presence of adhesions/fibrosis, pericholecystic fluid collection and common bile duct diameter was recorded. All the patients underwent diagnostic laparoscopy. If feasible, laparoscopic cholecystectomy was performed. If not, the procedure was converted to open. All patient's findings at laparoscopy were compared to USG findings and the reason for conversion in each patient was documented in detail. Association of USG findings was correlated with conversion to open cholecystectomy.

Procedure:

Pneumoperitoneum was created by insufflating the peritoneal cavity with CO2 gas by using a verses needle inserted through the sub-umbilical port site. Electronic insufflators produced pneumoperitoneum to a pressure of 12-15 mm of Hg. A 10 mm trocar was inserted through the sub-umbilical incision using a rotatory movement and entry into the peritoneal cavity was confirmed. The telescope with the camera mounted was inserted through the cannula and initial diagnostic laparoscopy was carried out visualizing the gallbladder and abdominal viscera. The other three ports were inserted under vision. The port in the epigastrium was a 10 mm cannula inserted just below the xiphisternum based on the inferior liver edge. This port was used for dissection of the Calot triangle, application of various clips, suction irrigation and for extraction of the gallbladder specimen. The port in the mid-clavicular line (5 mm) was inserted through a right sub-costal incision slightly lateral to the fundus of the gallbladder. This was used to pass a grasper to manipulate the gallbladder (body and neck) for dissection of the Calot triangle. The final port, another 5 mm cannula, was placed laterally in the anterior axillary line at the level of the umbilicus. This port was directed towards the fundus of the gallbladder and used for its retraction.

The patient was positioned in the reverse Trendelenburg position with a tilt to the left of approximately 30 degrees to the horizontal for better visualization of the gallbladder. A grasping forceps was inserted and the gallbladder fundus was held and pushed upwards and laterally towards the patient's right shoulder (superolateral). After the fundus of the gallbladder was retracted up and to the right over the liver using an atraumatic forceps, the further retraction was accomplished by a second atraumatic grasping forceps holding the gallbladder neck and retracting it laterally to expose the Calot triangle for achieving the critical view of safety (Figure 1). Once adhesions from

neighboring structures were released from the gallbladder and peritoneal lining was taken down, gentle anterior and posterior dissection with straight and curved blunt dissector (Maryland forceps) was continued with alternating inferolateral and superomedial retraction of the neck until the gallbladder was dissected away from the liver, creating a "window" crossed by two structures: the cystic duct and artery. The cystic duct was skeletonized and exposed up to its junction with the common bile duct. Polymer clips were applied to the cystic duct and it was divided. The cystic artery was doubly clipped and divided similarly. The gallbladder was lifted from its bed, exposing the connective tissue between it and the liver. Using the grasping forceps, the gallbladder was held close to the area to be dissected and traction was maintained to expose the fibrous tissue, which was then divided by a diathermy hook. Thus, the gallbladder was gradually dissected until completely freed and placed on the surface of the liver for easy access. Extraction of the dissected gallbladder was done through the epigastric port. The gallbladder extraction forceps were passed through the port and the neck of the gallbladder was grasped in the region of the previously applied cystic duct clips. The neck of the gallbladder was then gently maneuvered into the port and the port was slowly extracted from the abdomen. The gallbladder was externally held with artery forceps and opened externally while continuing a laparoscopic visualization of it. The suction cannula was inserted and gallbladder decompression was done. The gallbladder was then gradually removed. Once the specimen was extracted, the 10 mm epigastric port was placed back in position. If laparoscopic cholecystectomy was not possible, it was converted to open cholecystectomy

The closure of 10 mm ports with 1-0 or 2-0 absorbable, synthetic, braided polyglactin 910 sutures (Vicryl) and skin closure with 3-0 non-absorbable-synthetic- monofilament nylon sutures (Ethilon) were done. Pain relief was obtained by intravenous (IV) diclofenac or paracetamol injections. IV antibiotics were continued for 48-72 hours. Patients were ambulated on the first post- operative day and were discharged on the 3rd or 4th post-operative day in most of the cases.

Results:

The present research was an observational study to find the utility of abdominal USG parameters which can predict the conversion from laparoscopic to open cholecystectomy. A total of 100 patients were included in the study. Of 100 patients, 11% had a conversion to open cholecystectomy. There was no statistically significant difference between the two groups in relation to age groups and gender (Table 1). There was no statistically significant difference between the two groups in relation to abnormal gallbladder, presence and number of calculi, size of the calculus (>6 mm), gallbladder thickness (>4 mm), pericholecystic collection, adhesions/fibrosis and size of the common bile duct (Table 2).

Table 1: Baseline characteristics

Variables	Conversion to open cholecystectomy, n (%)			P value
	Yes	No	Total	
Age group (years)				
≤30	2 (20.0)	8 (80.0)	10 (100)	
>31-40	2 (14.3)	12 (85.7)	14 (100)	
41-50	3 (15.8)	16 (84.2)	19 (100)	
51-60	1 (14.8)	20 (95.2)	21 (100)	0.962
61-70	2 (8.3)	22 (91.7)	24 (100)	

>70	1(8.3)	11 (91.7)	12 (100)	
Gender				
Male	7 (11.9)	52 (88.1)	59 (100)	0.698
Female	4 (9.8)	37 (90.2)	41 (100)	

Table 2: Correlation of ultrasonographic findings of abdomen and conversion to open cholecystectomy

Variables	Conversion to open cholecystectomy, n (%)			P value
	Yes	No	Total	
Gallbladder				
Normal	5	62	67	0.198
Abnormal	6	27	33	
Presence of calculus				
Yes	11	84	95	0.999
No	0	5	5	
No. of calculi				
No	0	4	4	0.839
1-2	0	9	9	
Multiple	11	76	87	
Size of the calculus (mm)				
Small (≤6)	4	38	42	0.765
Large (>6)	7	51	58	
Gallbladder wall thickness (mm)				
≤4	2	26	28	0.670
>4	9	63	72	
Peri-cholecystitis collection				
Present	5	20	25	0.181
Absent	6	69	75	
Adhesion/fibrosis				
Present	7	82	89	0.067
Absent	4	7	1	
Size of common bile duct (mm)				
Dilated (>7)	3	13	16	0.999
Normal	8	76	83	

Discussion

Mouret introduced laparoscopic cholecystectomy in 1987, which brought a radical change in the treatment of patients with gallstones. Although laparoscopic cholecystectomy has numerous advantages including reduced hospitalization, decreased morbidity, short recovery time, and better cosmesis [16-20], it has 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 [21, 22]. Ultrasonography is the most common noninvasive, safe, and highly accurate screening test for cholecystitis and cholelithiasis. It can also help surgeons to get an idea of potential difficulty to be faced during surgery in that particular patient [22].

Laparoscopic cholecystectomy is the gold standard for symptomatic gallstones. The present study was conducted to evaluate some pre-operative abdominal USG findings, which can reliably predict the chances of conversion from laparoscopic cholecystectomy to open cholecystectomy. In the present study, there was no statistically significant difference between the two groups in relation to abnormal gallbladder, presence and number of calculi, size of the calculus, gallbladder thickness, pericholecystic collection, adhesions/fibrosis and size of the common bile duct.

In the present study, the conversion rate to open cholecystectomy was 11%. Rosen et al, Singh et al, Sultan et al, Liu et al, Ishizaki et al and Nidoni et al reported that the conversion from laparoscopic cholecystectomy to open cholecystectomy was 71 (5.3%), 19/255 (7.4%), 234 (5.3%), 45/500 (9%), 7.5%, and 10/180 (5.6%) respectively which is quite less than our study [15, 23-27]. Chindarkar et al, Ibrahim et al, Sikora et al, Lal et al and Yetkin et al reported that the conversion from laparoscopic cholecystectomy to open cholecystectomy was 9/60 (15%), 103/1000 (10.3%), 29/150 (19%), 17/73 (13.3%) and 19/108 (17.6%) respectively which was similar to our study [28-32]. Jansen et al reported conversion in 26/738 (3.5%) which is very lower than our study [33].

In the present study, there was no significant correlation between gallbladder wall thicknesses >4 mm with the conversion from laparoscopic cholecystectomy to open cholecystectomy. Rosen et al, Chindarkar et al, Liu et al, Ishizaki et al, Sikora et al and Jansen et al reported a significant correlation between gallbladder wall thicknesses >4 mm with the conversion from laparoscopic cholecystectomy to open cholecystectomy [15, 28, 25, 26, 30, 33]. In the present study, there was no significant correlation between the diameter of the common bile duct with the conversion from laparoscopic cholecystectomy to open cholecystectomy. Chindarkar et al and Jansen et al reported a significant correlation between the diameter of the common bile duct with the conversion from laparoscopic cholecystectomy to open cholecystectomy [28, 33,34].

Conclusion:

11% patients had a conversion to open cholecystectomy. There was no statistically significant difference of USG parameters studied such as gallbladder wall thickness >4 mm, pericholecystic fluid collection, common bile duct diameter >7 mm, presence of calculus, number of calculi, size of calculus >6 mm and adhesions/fibrosis in patients who required conversion to open cholecystectomy and who were operated laparoscopically.

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