Preoperative Risk Factors Affecting Conversion of Laparoscopic to Open Cholecystectomy

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ABSTRACT

Background: Conversion from laparoscopic cholecystectomy to an open procedure is necessary in 5-10% of patients, and is associated with increased morbidity, prolonged hospitalization and longer recovery compared to a laparoscopic approach.
Objectives: To evaluate the preoperative risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy.
Methods: A cross-sectional case series study included 100 patients who underwent laparoscopic cholecystectomy conducted in the surgical unit, department of surgery, Al-Khidhir Hospital in Al-Muthanna province during a period of 18 months from July 2016 to January 2018. Patients diagnosed with malignancy and patients with incomplete information with respect to anthropometry, laboratory investigations, and ultrasound findings were excluded from the study. Preoperative variables were compared between those patients who underwent laparoscopic surgery, and those that required conversion to open surgery. The operative findings and intraoperative complication was recorded.
Results: The most common cause of conversion from laparoscopic cholecystectomy to open cholecystectomy was dense adhesion with unclear Calot's triangle (66.7%). The rate of conversion to open cholecystectomy was significantly higher among patients aged ≥ 50 years (17.1%, P=0.048), male patients (30.4%, P=0.002), patients with history of previous scar (66.7%, P=0.001), with a history of ERCP (37.5%, P=0.003), with gall bladder thickness of ≥ 4mm (44.4%, P=0.001), with dilated CBD (50%, P=0.001) and with previous attacks of acute cholecystitis (26.3%, P=0.003).
Conclusion: Major risks for conversions in this study is due to disturbed anatomy either from dense adhesions or anatomical variations, and in male gender, aging, previous abdominal scar, recurrent attacks of acute cholecystitis, history of ERCP and dilated CBD.
Keywords: Laparoscopic Cholecystectomy, Open Cholecystectomy, conversion rate.

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Laparoscopic cholecystectomy (LC) has become the gold standard for treatment of symptomatic gallstones, due to lower morbidity, shorter hospital stay, earlier return to regular daily activities, less postoperative pain and a significant reduction in the incidence of wound complications and postoperative ileus has been documented in patients undergoing LC[1,2]. Although acute cholecystitis was considered a relative contraindication for LC in the early years, recent literature has shown that it can be performed safely for this indication[3].

The general indications for LC are the same as those for the corresponding open procedure. Including: Asymptomatic (silent) gallstones, [4] symptomatic gallstone disease, biliary colic with sonographically identifiable stones[5], biliary dyskinesia (ejection fraction lower than 35% at 20 minutes)[6], gallstone pancreatitis (once the clinical signs of mild-to-moderate biliary pancreatitis have resolved) and chole-docholithiasis (single laparoscopic procedure that treats both cholelithiasis and choledocholithiasis)[7]. Absolute contra-indications for LC include an inability to tolerate general anesthesia and uncontrolled coagulopathy. Patients with severe obstructive pulmonary

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disease or congestive heart failure (e.g. cardiac ejection fraction <20%) may not tolerate carbon dioxide pneumoperitoneum. Gallbladder cancer must be considered a contraindication for laparoscopic cholecystectomy and if diagnosed intraoperatively, the operation must be converted to an open procedure, since an open procedure allows a more controlled performance, with less chance of spillage[8]. Many conditions once felt to be contraindications for LC (e.g. gangrenous gallbladder, empyema of the gallbladder, bilioenteric fistulae, obesity, pregnancy, ventriculoperitoneal shunt, previous upper abdominal procedures, cirrhosis, and coagulopathy) are no longer considered contraindications but are acknowledged to require special care and preparation of the patient by the surgeon and careful weighing of risk against benefit[9].

The complications encountered during LC are numerous: including [10]: complications related to anesthesia, complications related to peritoneal access (e.g., vascular injuries, visceral injuries, and port-site hernia formation), complications related to pneumoperitoneum (e.g., cardiac complication, pulmonary complications, and gas embolism), complications related to thrombo-coagulation and specific complications of LC like hemorrhage, gall bladder perforation, bile leakage, bile duct injury) and others such as external biliary fistula, wound sepsis, hematoma and foreign body inclusions.

Conversion to an open procedure is necessary in 5-10% of patients, and is associated with increased morbidity, prolonged hospitalization and longer recovery compared to a laparoscopic approach[11].

Common indications for conversion include: failure to demonstrate the 'critical view of safety[12], the presence of an intraoperative complication, such as intestinal perforation, hemorrhage or bile duct injury[13]. Several factors increase the risk of conversion to open, including age[14], male sex[15], obesity [1,11], cholecystitis proved by ultrasound finding (thickened wall, edema and pericholecystic fluid[16] and previous ERCP[17].

Conversion from laparoscopic to open procedure should not be considered as a failure, in fact it is an option which should be considered under certain circumstances for the sake of patient's safety, and timely conversion to open surgery can avoid complications of LC[18].

The aim of this study is to evaluate the incidence and preoperative risk factors for conversion of LC to OC in the hope that the prediction of a difficult procedure would allow the surgeon to discuss the likelihood of conversion with the patients and prepare them psychologically as well as plan their recovery.

Methods

This is a cross-sectional case series study that was conducted in the surgical unit, department of surgery, Al-Khidhir Hospital in Al-Muthanna province during a period of 18 months from July 2016 to January 2018.

The study population included patients who underwent LC during the study period, so the total number of included patients was 100. All cases were operated upon as elective cases; those patients with history of acute attack of cholecystitis were treated conservatively first and operated upon after at least six weeks of the attack with abdominal ultrasound confirming the subsiding of the acute inflammatory changes. Patients diagnosed with malignancy and patients with incomplete information with respect to anthropometry, laboratory investigations, and ultrasound findings were excluded from the study.

Preoperative variables included patient demographics (age and gender of the patient, body mass index, presence of diabetes mellitus), ultrasound for abdomen findings of gallbladder wall thickness, presence of stones, CBD diameter and presence of pericholecystic fluid, ERCP (endoscopic retrograde cholangio-pancreaticogram), and type of surgery. Preoperative variables were compared

between those patients who underwent laparoscopic surgery, and those that required conversion to open surgery. The operative findings and intraoperative complications were recorded.

A standard technique for LC was practiced; nasogastric tube was not used routinely but occasionally. Following general anesthesia and positioning of the patient and draping, insufflation was achieved through a Veress needle. Carbon dioxide used as the insufflation gas. A 30 degrees' camera used through 10 mm port. Standard procedure was done through four ports technique, but three ports technique was also practiced.

The data analyzed using Statistical Package for Social Sciences (SPSS) version 25. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Pearson's Chi–square test was used to assess statistical association between certain variables and study groups. A level of p – value less than 0.05 was considered significant.

Results

This study involved 100 patients who underwent LC. Nine patients were converted from LC to open surgery with a conversion rate of 9%.

The mean age of patients was 43.2 ± 8.4 years; 77% were females and 41% were overweight and 33% were obese; 22% were diabetics; 6% had previous abdominal scar; 8% had previous ERCP; 19% had previous attacks of acute cholecystitis and 88% of operations were elective, (Table 1) and by ultrasound, 8% had thickened gall bladder wall and 5% had pericholecystic fluid.

Figure 1 shows the causes of conversion from LC to OC. We noticed that the most common cause of conversion from LC to OC was dens adhesion with unclear Calot's triangle (66.7%).

The findings of ultrasound are shown in table (2). In this study, 82% of patients showed gall bladder thickness < 4 mm and 5% of them showed pericholecystic fluid. Regarding CBD diameter, 6% were showed dilated CBD and 89% reported presence of multiple stones.

The conversion rate and association between prevalence of conversion from LC to OC with certain information is shown in table (3). In this study, the rate of conversion to OC was significantly higher among patients aged ≥ 50 years (17.1%, P=0.048), male patients (30.4%, P=0.002), patients with history of previous scar (66.7%, P=0.001), patients with a history of ERCP (37.5%, P=0.003), and patients with previous attacks of acute cholecystitis (26.3%, P=0.003).

Table 4 shows the conversion rate and association between prevalence of conversion from LC to OC with ultrasound findings. We noticed that the rate of OC was significantly higher among patients with gall bladder thickness of ≥ 4mm (44.4%, P=0.001) and patients with dilated CBD (50%, P=0.001).

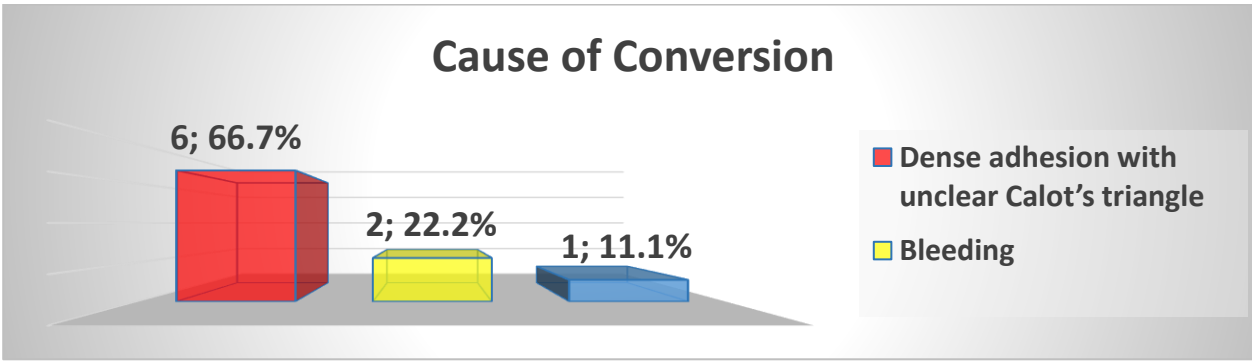

Figure 1: Causes of conversion from LC to OC

Table 1: Distribution of study patients by certain information

Variable	No. (n=100)	Percentage (%)
Age (Years)		
< 40	23	23.0
40 - 49	36	36.0
≥ 50	41	41.0
Gender		
Male	23	23.0
Female	77	77.0
BMI level		
Normal	26	26.0
Overweight	41	41.0
Obese	33	33.0
DM		
YES	22	22.0
NO	78	78.0
Previous abdominal scar		
YES	6	6.0
NO	94	94.0
History of ERCP		
YES	8	8.0
NO	92	92.0
Recurrent attacks of acute cholecystitis		
YES	19	19.0
NO	81	81.0

Table 2: Ultrasound finding

Ultrasound Finding	No. (n= 100)	Percentage (%)
Gall Bladder Wall Thickness (mm)		
< 4	82	82.0
≥ 4	18	18.0
Pericholecystic fluid		
YES	5	5.0
NO	95	95.0
CBD		
Normal	94	94.0
Dilated	6	6.0
Stone		
Single	11	11.0
Multiple	89	89.0

Table 3: Conversion rate and association between prevalence of conversion from LC to OC with certain information

Variable	Outcome		Total (%) n= 100	Conversion Rate (%)	P- Value
	Successful LC n= 91	Converted to OC n= 9			
Age (Years)					
< 40	23 (100.0)	0 (0)	23 (23.0)	**0**	**0.048**
40 - 49	34 (94.4)	2 (5.6)	36 (36.0)	**5.6**	
≥ 50	34 (82.9)	7 (17.1)	41 (41.0)	**17.1**	
Gender					
Male	16 (69.6)	7 (30.4)	23 (23.0)	**30.4**	**0.001**
Female	75 (97.4)	2 (2.6)	77 (77.0)	**2.6**	
BMI Level					
Normal	25 (96.2)	1 (3.8)	26 (26.0)	**3.8**	**0.531**
Overweight	37 (90.2)	4 (9.8)	41 (41.0)	**9.8**	
Obese	29 (87.9)	4 (12.1)	33 (33.0)	**12.1**	
DM					
YES	19 (86.4)	3 (13.6)	22 (22.0)	**13.6**	**0.389**
NO	72 (92.3)	6 (7.7)	78 (78.0)	**7.7**	
Previous abdominal scar					
YES	2 (33.3)	4 (66.7)	6 (6.0)	**66.7**	**0.001**
NO	89 (94.7)	5 (5.3)	94 (94.0)	**5.3**	
History of ERCP					
YES	5 (62.5)	3 (37.5)	8 (8.0)	**37.5**	**0.003**
NO	86 (93.5)	6 (6.5)	92 (92.0)	**6.5**	
Recurrent attacks of acute cholecystitis					
YES	14 (73.7)	5 (26.3)	19 (19.0)	**26.3**	**0.003**
NO	77 (95.1)	4 (4.9)	81 (81.0)	**4.9**	

Table 4: Conversion rate and association between prevalence of conversion from LC to OC with ultrasound findings

Variable	Outcome		Total (%) n= 100	Conversion Rate (%)	P- Value
	Successful LC n= 91	Converted to OC n= 9			
Gall Bladder Wall Thickness (mm)					
< 4	81 (98.8)	1 (1.2)	82 (82.0)	**1.2**	**0.001**
≥ 4	10 (55.6)	8 (44.4)	18 (18.0)	**44.4**	
Pericholecystic fluid					
YES	4 (80.0)	1 (20.0)	5 (5.0)	**20.0**	**0.377**
NO	87 (91.6)	8 (8.4)	95 (95.0)	**8.4**	
CBD					
Normal	88 (93.6)	6 (6.4)	94 (94.0)	**6.4**	**0.001**
Dilated	3 (50.0)	3 (50.0)	6 (6.0)	**50.0**	
Stone					
Single	9 (81.8)	2 (18.2)	11 (11.0)	**18.2**	**0.259**
Multiple	82 (92.1)	7 (7.9)	89 (89.0)	**7.9**	

Discussion

Conversion of LC to open cholecystectomy (OC) is not a sign of failure, safety of the patient comes first, it is considered as a sound judgement rather than failure of laparoscopic surgery to avoid complications and reduce morbidity[19]. One hundred patients underwent LC involved in the current study, nine of them were converted to an open surgery with a conversion rate 9%, this result is in consistent with an Indian one conducted in 2017 with a report of conversion rate of 10%[20] and to that conducted in USA in 2010 were the rate was 9% [21], while different results noticed in two local studies in Iraq in 2007 [22] and in 2014 [23] where the rate was lower than the current result (i.e. 5% and 2.7%, respectively) and in an Iraqi one conducted in 2013, in which the rate was higher[24]. These differences observed might be attributed to different sample size, selection of patients and to the surgeon's experience.

In the current study, LC converted to OC due to dense adhesions with unclear Calot's triangle (66.7%), was the most common cause of conversion, in agreement to an Iraqi study (in Al-Dewaniyiah 2015), where dense adhesion and loss of anatomy was an important risk factor for conversion[2] and was in accordance with several other studies, in Pakistan (2005)[25], USA 2010 [26] and in Netherlands (2011) [16] where adhesion was the most important risk factor for conversion.

So, it is obvious that adhesion and loss of anatomy due to infiltration, fibrosis or adhesions, indicating recent inflammation as can be expected with (recent) acute cholecystitis was a hallmark obstacle for LC. In concern to the radiological findings in the current study, the rate of conversion to open cholecystectomy was significantly higher among patients with gall bladder thickness of ≥ 4mm (44.4%, P=0.001) and patients with dilated CBD (50%, P=0.001). Similarly, a study conducted in Pakistan in 2005 showed that gall bladder wall thickness in ultrasound finding was strongly associated with conversion on univariate analysis, in which 58% of patients with a thickness >3 mm had to be converted [2], in contrary to the belief that this is a weak predictor of conversion from LC to open cholecystectomy as concluded in two Turkish studies conducted in (2001)[16,27].

In the current study, a significant association has been noticed between the age and conversion rate were the highest prevalence was at age group ≥ 50 (17.1%, P 0.048) which is similar to that done in the United Kingdom in 2016, as patients ≥ 70 were the most prevalent group and significantly related (7%, P < 0.001) [28]. In an Italian study in 2011 concluded that age group older than 60-years has a significant relation to conversion rate (P < 0.01) [29]. Another Italian study in 2014 concluded that conversion was significantly higher in patients ≥ 60 years old (60%, P < 0.001) [30]. The increased risk of conversion in elderly patients (sixth decade) might be due to complications of metabolic decompensation and recurrent attacks of cholecystitis and complicated biliary tract disease. In the current study, we observed that male gender significantly increased the rate of occurrence of difficulties during LC (P 0.001).

These findings are consistent with Saudi Arabia study, who found that male patients have longer operation time and higher conversion rate than females [31] and Turkish one (2006) considered males more liable for difficulties because they had more pericholecystic and tissue collagen levels both in the submucosa of gall bladder and in pericholecystic tissue and are significantly higher in men than women (p-value 0.05) [32]. These findings are explained by the fact that male patients have more intense inflammation or fibrosis, leading to dissection difficulties in Calot's triangle and through the plane between gallbladder and liver[33].

In this study, the rate of OC was significantly higher among patients with history of previous scar (66.7%, P=0.001), patients with a history of ERCP (37.5%, P=0.003), and patients with previous

attacks of acute cholecystitis (26.3%, P=0.003) in agreement to many studies as in an Italian study 2011, in which significant relation was noticed to preoperative ERCP, previous abdominal surgery (supramesocolic space) but disagreed in that DM was significantly related [(29)], furthermore, previous surgery of the upper abdomen is a risk factor for conversion to open cholecystectomy as concluded in a study from USA in 2012 [(34)], Turkey 2010 [(35)] and from Scotland (2006) [(36)]. In contrary to the current results, Italian researchers showed that there is no significant association regarding previous abdominal surgery and preoperative ERCP (P>0.05) but agreed in that acute cholecystitis, it was significantly related (P= 0.001) [(30)]. Furthermore past history of ERCP in an Iraqi study in 2013 in which there was difficulty in defining the anatomy and this was associated with scarred and fibrosed gallbladder (fibrous adhesions) rendering laparoscopic dissection difficult [(24)].

In conclusion; Major risks for conversions in this study were due to disturbed anatomy either from dense adhesions or anatomical variations, male gender, aging, previous abdominal scar, recurrent attacks of acute cholecystitis, history of ERCP and dilated CBD. These risk factors help to evaluate the difficulty of the procedure and this would allow the surgeon to better advice patients about the risk of conversion from LC to OC.

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