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Conversion rate and the probable factors for conversion from laparoscopic to open cholecystectomy

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Abstract

Background and objective: In western countries, the incidence of Cholelithiasis is found to be more than 10% in general populations. After performing the first successful laparoscopic cholecystectomy (L.C.) in Germany by Muhe in 1986, it rapidly became the procedure of choice in treating symptomatic gall stone. L.C. has a lot of advantages, including minimal trauma, rapid recovery, less analgesic requirement with a good esthetic outcome, however even in the hands of a best surgeon still there is a small percentage of conversion to open laparotomy, some risk factors has been recognized as a reason for the conversion to open laparotomy. This study aims to evaluate the rate with the underlying risk factors that increase the chance of conversion to open cholecystectomy.

Methods: A total of 1400 patients for whom L.C. was attempted, 54 were enrolled in this prospective study from January 2014 to January 2020. The exclusion criteria were malignancy or existence of gallbladder polyps detected pathologically. Patient demographics, indications for cholecystectomy, concomitant diseases, and histories of previous abdominal surgery were collected. The rates of conversion to open cholecystectomy with the underlying reasons for conversion were analyzed.

Results: The overall rate of conversion to open cholecystectomy was 3.86% (54 patients). Out of 54 cases nearly two-thirds (61.1%) of the patients (33) were males and 38.9% of the patients (21) were females. Male: female ratio is 1.57:1. In the study sample, the conversion rate among obese (14/54) patients was 25.9% compared with the rate of 74.1% among non-obese (40/54) patients. Out of 3.86% of the conversion rate, 2.86% were non-obese and 1% were obese patients. The commonest etiology for conversion was thickened gall bladder due to severe gall bladder inflammation with fibrosis (21 patients) 38.9% followed by Acute cholecystitis (8 patients) 14.8%, then fibrosis (7 patients) 13% with aberrant anatomy at the calot's triangle (6 patients) 11.1%.

Conclusion: A thickened gall bladder was found to be the commonest risk factor for conversion to open cholecystectomy, the conversion from L.C. to O.C. should not be regarded as a failure of the procedure or as a complication, rather it should be regarded as a prudent maneuver for achieving the desired objective namely safe removal of the gall bladder.

Keywords: Laparoscopic cholecystectomy; Gallbladder; Conversion to open.

Introduction

Cholelithiasis is considered one of the most common problems affecting the gastrointestinal system, the incidence of this condition varies from place to place depending on many factors like gender, age, and ethnic variation.[1]

Laparoscopic cholecystectomy (L.C.) is regarded as the gold standard treatment for symptomatic gall stone disease in both elective and emergency conditions.[2, 3] from the time of introduction of the L.C. nearly two decades ago, nowadays L.C is considered by many surgeons as

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a relatively simple day case procedure, with a short hospital stay (and thus more rapid return to normal daily activity and work), decreased post-operative pain, and a better cosmesis, with a lower cost.[4]

In spite of that there is a reported incidence of conversion to an open procedure in 4-15% of cases.[5] There are many reasons an (L.C.) may be converted to an open cholecystectomy (O.C.),[6,7] common reasons include obscured Calot's anatomy, a gallbladder wrapped with dense adhesions due to previous surgery or cholecystitis, internal fistulation (colonic / duodenal), vascular or biliary injury and suspicion of malignancy.[8,9] Conversion should not be regarded as a technical failure but, rather a sound judgment for reducing patient's morbidity and mortality. This study aims to evaluate the probable factors and the rate of conversion from laparoscopic to open cholecystectomy.

Methods

This is across a sectional study performed upon 1400 L.C. Cases with confirmed gall stone disease in the period from January 2014 to January 2020. The study was performed at Rizgary Teaching Hospital/ Erbil/Iraq. All cases included in this study were subjected to preoperative clinical evaluation (detailed history with complete physical examination).

All patients were fit for general anesthesia, routine available pre-operative investigations were done including (CBC, Blood group & RH typing, Prothrombin time, Liver function test including ALT, AST, ALP, GGT, TB, renal function test, Virology screen (HIV, HBS, HCV), CXR, ECG and Echocardiography for cases with comorbidity with an abdominopelvic ultrasound scan, and the patients were divided into 2 groups with body mass index <30 and ≥30. written informed consent was obtained from all patients, the existence of previous upper abdominal surgery including any abdominal surgical procedure above the umbilicus was recorded and patients with gallbladder polyps or malignancy were excluded from the study along with patients if simultaneous procedures were performed at the time of cholecystectomy (i.e.: ventral hernia repair).

Operation done under general anesthesia with endotracheal intubation, using a standard four –ports technique, a single dose of ceftriaxone 1g iv was given to all patients with the induction of anesthesia, access to the abdomen was obtained typically using the modified Hasson cut-down technique in the supra umbilicus area to achieve carbon dioxide insufflation. The surgical dissection of the calot's triangle was conducted using both the direct infundibular approach and the critical view of safety, usually in L.C. we used a monopolar hook for precise dissection, but in an emergency situation we also preferred blunt dissection using a sucker head or gauze dissection held by Maryland forceps to prevent vasculobiliary injury and to take advantages of anatomical planes concealed from the inflammatory response. After identification, the cystic duct and cystic artery were clipped and divided and we performed retrograde cholecystectomy. The surgeon documented whether the procedure was completed laparoscopically or converted to open. In addition, the definitive type of procedure performed whether total or subtotal cholecystectomy was noted, in the case of open conversion the abdomen is explored through an oblique subcostal incision of sufficient length, all the superficial and deep fascia incised including the parietal peritoneum, then the peritoneal cavity is widely explored and the technique of open cholecystectomy conducted through the fundus first approach isolating the fundus of the gall bladder from the liver bed, coming downwards till calot's triangle is reached then searching for the identification of both cystic duct and cystic artery performed, after identifying both of these two structures ligation and incision done, followed by complete separation ofthe gall bladder from its bed,

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a tube drain is inserted in most of the cases, then the abdominal wall is closed in layers.

Statistical analysis

The Statistical Package for Social Sciences (SPSS, version 26) was used for data entry and analysis. Two approaches were used; descriptive and analytic. The descriptive approach included the calculation of frequencies, percentages, means, and S.Ds. while in the second approach; Chi-square test of association was used to test the significant association between categorical variables. A *P* value of ≤0.05 is regarded as statistically significant.

Results

In this study, L.C. was initiated in 1400 patients with symptomatic gallstone disease between the years 2014-2020 of which only 54 (3.86%) cases were converted to open classical cholecystectomy. All operations were performed by senior surgeons with a good experience in both laparoscopic and open conventional cholecystectomy.

Out of 54 cases nearly two-thirds (61.1%) of the patients (33) were males and 38.9% of the patients (21) were females. Male: female ratio is 1.57:1 (Figure 1).

In our series the youngest patient was 35 years of age and the oldest was 70 years of age. Half of the patients in the present series were in the age group of ≥60 years of age as shown in Figure 2, The mean age ± S.D. was 58.2 ± 8.5 (ranged from 35-70) years,

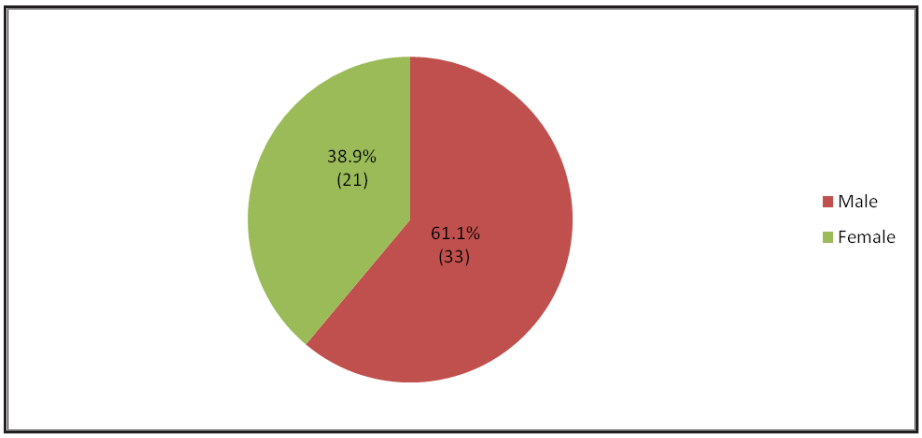

Figure 1 Gender of the patients

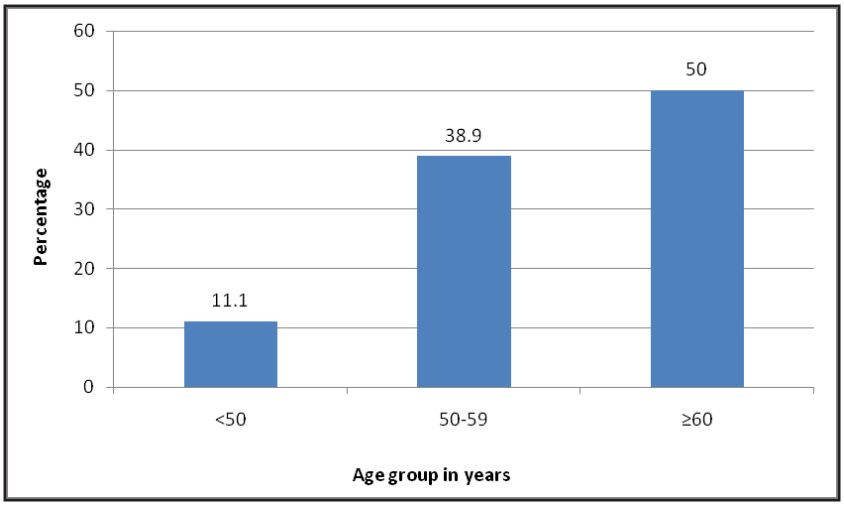

Figure 2 Age Distribution of Patients

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In the study sample, the conversion rate among obese (14/54) patients was 25.9% comparing with the rate of 74.1% among non-obese (40/54) patients. The result revealed that out of 3.86% of the total conversion rate, 2.86% was non-obese and 1% was obese patients (*P* value < 0.001).

The most common reasons for conversion were thickened gall bladder due to severe gall bladder inflammation with fibrosis (21 patients) 38.9% followed by acute cholecystitis (8 patients) 14.8% (Table 2).

When complications arising during CO2 insufflation and trocar insertion were analyzed, colon injury by trocar was seen in only 1 case (1.9%) with intense abdominal adhesions due to the previous laparotomy, while duodenal laceration at the time of calot's triangle dissection occurred in 2 cases (3.7%) mainly resulting from dense fibrous adhesion and scarring between the Hartmann's pouch and the duodenum, uncontrolled intraoperative bleeding requiring conversion to open laparotomy occurred in 1 patient (1.9%) ,the hemorrhage was due to the opening of a venous sinus from the gallbladder bed of the liver, the hemorrhage was unable to be controlled with thermocoagulation and/or suturing since the liver was cirrhotic.

Extrahepatic bile duct injury occurred in 2 patients (3.7%), and all of the injuries were identified intraoperatively, the reason behind these injuries was obscured anatomy and fibrosis of the Calot's triangle. In 1 patient, intraoperative T-tube drain was sufficient to manage the injury, the T tube was removed 10 days later, the patients recovered completely, and in the other case bile flow was established by Roux-en-Y hepaticojejunostomy.

Conversion to O.C. caused by a gangrenous gall bladder and emphysematous cholecystitis were seen in 2 cases (3.8%), both patients were suffering from uncontrolled type 2 diabetes mellitus in which medical treatment started initially for a period of 2 weeks then the patients scheduled for surgery. Acute cholecystitis as the main cause for conversion to O.C. was seen in about 8 cases (14.8%) in these patients we were obliged to proceed to surgery and abandon the conservative measure for acute cholecystitis, since the intensity of the pain was increasing, WBC counts were shouting and the general condition of the patients was not satisfactory.

Out of 54 patients included in this study 24 patients had a thickened gall bladder wall measuring ≥ 3.5 mm in diameter with

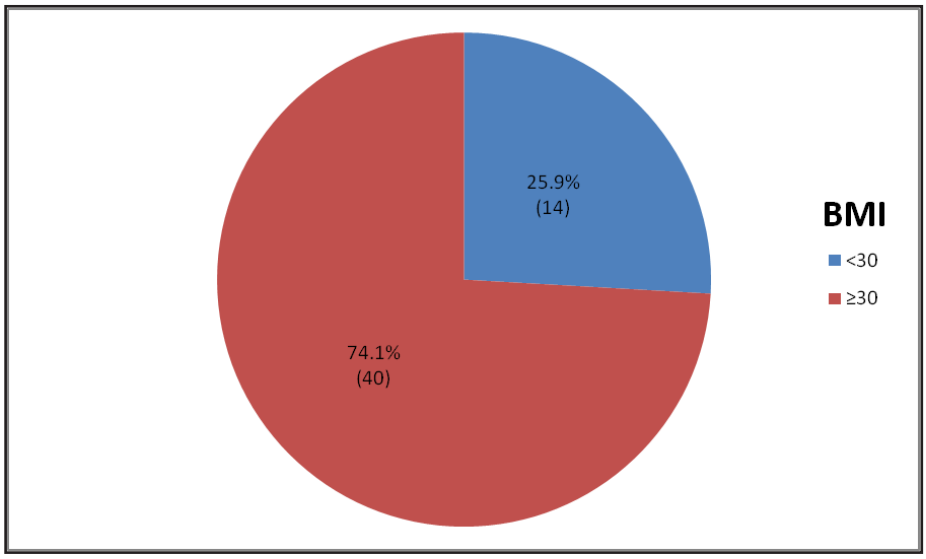

Figure 3 Body Mass Index Distribution of Patients

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significantly high rates of difficulties and conversion to O.C., As shown in Table 2, we concluded that there was a strong association between a thickened gall bladder and male gender particularly in those patients with BMI ≥ 30 with an age group of < 50 years.

Table 1 Frequency and percentages of the probable factors to open conversion

Risk factors	Frequency	Percentage
Bile duct injury	2	3.7
Thickened gall bladder	21	38.9
Gangrenous gall bladder	1	1.9
Emphysematous gall bladder	1	1.9
Fibrosis of calot's triangle	7	13
Acute cholecystitis	8	14.8
Intra-operative bleeding	1	1.9
Aberrant anatomy	6	11.1
Visceral (Duodenal) injury	2	3.7
Visceral (Colon) injury	1	1.9
Impacted stone in the gall bladder neck	4	7.4
Upper abdomen incision	3	5.6
Comorbidity*	16	29.6

Comorbidity*: Diabetes mel1itus 13, cardiovascular 2, and respiratory 1

Table 2 Association of thickened gall bladder with age, gender, BMI and co-morbidities

Risk factors	Total	Thickened Gall Bladder				*P*-value
		Yes		NO		
		No.	(%)	No.	(%)	
Gender						
Male	33	20	(60.6)	13	(39.4)	< 0.001
Female	21	1	(4.8)	20	(95.2)	
Age in years						
< 50	6	6	(100.0)	0	(0.0)	
50-59	21	10	(47.6)	11	(52.4)	0.001
≥ 60	27	5	(18.5)	22	(81.5)	
BMI						
< 30	40	7	(17.5)	33	(82.5)	< 0.001
≥ 30	14	14	(100.0)	0	(0.0)	
Comorbidity						
Yes	16	6	(37.5)	10	(62.5)	0.892
No	38	15	(39.5)	23	(60.5)	
Total	54	21	(38.9)	33	(61.1)	

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Discussion

After performing the first successful endoscopic cholecystectomy in Germany by Erich Muhe of Boblingen in 1985, now aday LC is regarded as a gold standard technique for the management of the symptomatic gall stone disease worldwide, the benefits of L.C. includes rapid return of bowel function, reduced post-operative pain, good cosmetic result, and significantly a shorter hospital stay with early return to normal daily activity.[2,10] However for many reasons there is occasionally a need to abandon the laparoscopic procedure and to perform classic open cholecystectomy.[11] Thus, identification of risk factors for conversion is crucial for sound surgical planning and to avoid complications. There are many significant risk factors that has been shown to predict a difficult laparoscopic cholecystectomy because it could limit the extent of anatomical identification and could make dissection very difficult at the gallbladder bed and calot's triangle.

In our study we observed a significant relation between a thickened gallbladder in elderly male patients and a difficult L.C. with increased rate of conversion to open, this finding is similar to Thesbjerg et al. who reported that the main reason for higher laparoscopic conversion rate in case of thickened gallbladder specially in male was due to recurrent attacks of acute cholecystitis with its sequalae leading to extensive inflammation and adhesion of the gallbladder with the surrounding tissues making dissection at time of surgery much more difficult.[12]

In the current study we found that male gender is associated with an increased rate of difficult L.C. and conversion to open laparotomy, this is consistent with a study done by O'Leary DP, Myers E, Waldron D, Coffey JC.[13]

While in Agarwal et al,[14] and Gupta et al,[15] gender did not affect the procedure of laparoscopic cholecystectomy (P = 0.265) with conversion to open, also in S.T. Bhondave et al,[16] genderhas not been found to be a significant risk factor (P = 0.920) for conversion to open laparotomy, while

In Coelho et al,[17] has shown that conversion rate was similar in both men and women, in addition, the rates of intraoperative and postoperative complications were similar in both genders.

In Lee et al and Hussain,[18,19] old age (>50 years) has been found to be a significant risk factor for difficult laparoscopic cholecystectomy and conversion to open laparotomy this finding is consistent with our study in which old age was a significant risk factor for conversion, this is probably related to a longer history of gallbladder disease, masked symptoms and patient delay.[20,21]

In the early era of laparoscopic surgery, acute cholecystitis was a contraindication for L.C. Nowadays with increasing experience, L.C. has become the preferable access for cholecystectomy in patients with acute inflammation of the gallbladder.[22,23] Similar to our study, Hu et al, And Lowndes et al have shown that acute cholecystitis is the most significant risk factor for laparoscopic conversion and the poor outcome of L.C.[24,25]

While in another study conducted by RAVINDRA et al. they revealed that there was significantly high risk of difficulty and conversion in patients with previous history of more than two attacks of acute cholecystitis (P = 0.03, 95% confidence interval).[26]

In a recent systematic literature review, Hu et al.[24] have reported an association between certain risk factors, like older age, male gender, high body mass index, acute cholecystitis and laparoscopic conversion to open cholecystectomy this finding is consistent with our result in which from a total of 30 studies selected by the authors, 17 have demonstrated that male gender was a risk factor for laparoscopic conversion. In this review, the most common cause of conversion was difficult dissection of Calot's triangle. A possible explanation for the higher conversion rate

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in male gender is that this gender is more likely to delay seeking medical advice and therefore present with more severe inflammation of the gall bladder when they are subjected to surgical treatment.[22]

Surgeons experience and case load is another important factor to reduce laparoscopic conversion rate, according to a study conducted by Jonathan et al.[27] The conversion rate for the fellowship-trained surgeon was significantly lower than for the non-fellowship trained group (1.7% vs 8.5%, p ¼ 0.0004), similarly we found that the conversion rate now a day compared to the start and beginning of the practice of laparoscopic surgery is relatively lower, this difference is possibly due to the surgeons greater experience and improvement in the quality of laparoscopic instruments.

There are many studies in the literature concerning the reasons for the conversion to the open classical procedures.

According to the published studies in recent years, the conversion rates is variable (range: 1.6% to 5.7%).

Table 3 compares favorably the rates reported in the literature. The reported conversion rate in our study was in the range of 3.86%.

Conclusion

Conversion from L.C. to O.C. should be based on the sound clinical judgment of the operating surgeon to minimize the risk of intraoperative catastrophe, the conversion from LC to OC should not be considered a failure or a complication, rather it should be regarded a prudent maneuver for achieving the desired objective namely, safe removal of the gall bladder. Accordingly every patient consent obtained for L.C. must include the possibility of conversion to an open procedure.

Funding

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Table 3 Literature review of reported series of patients requiring conversion to open cholecystectomy.

First author	Year	No. of patients with attempted LC	NO. of O.C.	Conversion rate	Main reason for conversion
Ghnman et al[27]	2010	340	15	1.6 %	Obscure anatomy
Ercan et al[28]	2010	2015	101	4.3%	Intra-abdominal & perihepatic adhesion
Volkan et al[6]	2011	5164	163	3.16%	Adhesion due to severe inflammation
Abelson et al[9]	2015	592	34	5.7%	Failure to progress

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