

PREOPERATIVE EVALUATION OF THE COMMON BILE DUCT IN GALLSTONE PATIENTS USING ULTRASOUND ALONE VERSUS ADDED LAPAROSCOPIC CHOLANGIOGRAPHY DURING CHOLECYSTECTOMY

By

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ABSTRACT

Background: Intraoperative cholangiography (IOC) is one of the surgical advances that aim to evaluate the biliary system and reduce the risk of laparoscopic cholecystectomy (LC) complications.

Objective: To evaluate the Common bile duct (CBD) preoperatively in gallstone patients using ultrasound alone versus added laparoscopic cholangiography during cholecystectomy.

Patients and Methods: This prospective randomized study at the Department of Surgery, Faculty of Medicine, Al-Azhar University from November 2019 till September 2020, were 40 patients randomized divided into two equal groups: Group I received laparoscopic cholecystectomy and Group II received laparoscopic cholecystectomy with intra operative trans-cystic cholangiography. Adult patients with good general condition were enrolled if they were diagnosed with symptomatic gall stones. Our protocol was approved by the institutional review board at Faculty of Medicine, Al-Azhar University and all participants signed an informed written consent before the procedure.

Results: IOC scored the highest visualization rate, sensitivity and specificity rate (100%). Success rate was also high reaching 95%.

Conclusion: IOC during LC was associated with a low morbidity rate and no mortalities. This confirmed the effectiveness of IOC in reducing the postoperative complications of LC.

Keywords: Laparoscopic Cholangiography; Cholecystectomy; Gallstone.

INTRODUCTION

Gallstones are the most common biliary pathology. It has been estimated to affect 10–15 percent of the population. They are asymptomatic in the majority of cases (>80 per cent). In the UK, the prevalence of gallstones at the time of death is estimated to be 17 percent and may be increasing. Approximately, 1–2

percent of asymptomatic patients will develop symptoms requiring surgery per year, making cholecystectomy one of the most common operations performed by general surgeons (*Lammert et al., 2016* and *Shabanzadeh et al., 2018*).

Symptomatic gallstone patients may be presented by different complains such as:

biliary colic, nausea, vomiting, dyspepsia or acute cholecystitis (*Arora et al., 2018*).

Asymptomatic (missed) CBD stones constitute about 10%, and up to 2% show no sign of disease (*Hakuta et al., 2020*).

Complications of gallstone patients may include obstructive jaundice, acute cholangitis, acute pancreatitis, gallstone ileus, mucocele of gallbladder, empyema of gallbladder, biliary peritonitis and gallbladder cancer (*Portincasa et al., 2016*).

The management of gallstone patients may be in form of cholecystectomy, cholecystostomy and ERCP in patients with obstructive jaundice (*Alemi et al., 2019*).

Several strategies have been employed to minimize the incidence of LC complications including use of intraoperative cholangiography (IOC), laparoscopic ultrasound (LUS), cholecysto-cholangiography and the critical view of safety (*Patel and Bhatt 2011*).

Intraoperative cholangiography (IOC) in the course of LC is not only valuable in detecting common bile duct (CBD) stones, but also in delineating the anatomy of the biliary ducts, in facilitating dissection, avoiding injuries to the biliary tract and in identifying other abnormalities, such as fistulas, cysts and tumors of the biliary system (*Schlumpf et al., 2014*).

The routine use of IOC in all cases of LC is still controversial. Some authors supporting routine IOC, others favouring selective IOC, while other reported no advantage of IOC in preventing biliary injuries and missed CBD stones (*Champault et al., 2012*).

The present study aimed to evaluate of the common bile duct in gallstone patients using ultrasound alone versus added laparoscopic cholangiography during cholecystectomy.

PATIENTS AND METHODS

The current study was performed as a prospective randomized study at the Department of Surgery, Faculty of Medicine, Al-Azhar University from November 2019 till September 2020. Adult patients with good general condition were enrolled if they were diagnosed with symptomatic gall stones. Patients were divided into two equal groups: **Group I:** Received laparoscopic cholecystectomy, and **Group II:** Received laparoscopic cholecystectomy with intra operative trans-cystic cholangiography.

The exclusion criteria were having dilated CBD on ultrasound, current jaundice or cholangitis and unfit patient. Our protocol was approved by the institutional review board at Faculty of Medicine, Al-Azhar University and all participants signed informed written consents before the procedure.

Operative Interventions:

Following general anesthesia, LC with cholangiography was performed using the standard four-cannula technique. We applied traction on the gallbladder fundus in a cephalic direction with a grasper placed through the midclavicular port. Then, we performed intraoperative cholangiography using either a cholangiogram/a ureteric catheter or catheter (5F) or a specialized grasper with the cholangioneedle catheter. Using the first catheter, it was guided into the partially transacted proximal cystic duct

(using a guide wire when necessary) and was secured in place in the cystic duct with a cholangioclamp. The second catheter was used to inject 5 to 15 ml of contrast material to visualize the biliary ductal system. Then, the biliary duct was flushed with saline. The catheter was removed, two clips placed on the common duct end of the cystic duct and it was divided with scissors.

Data collection:

Demographics data were collected, experienced symptoms, comorbid conditions, and history of cholangitis or pancreatitis. Patients presenting with acute cholangitis or pancreatitis were allowed to settle first before the operation. We further performed abdominal examination to assess organomegaly, positive Murphy's sign and any signs of cholangitis. The following preoperative investigations were performed: CBC, INR, liver and renal function tests. Later, all participants underwent abdominal US imaging to detect dilated CBD, intra hepatic biliary radical dilatation.

Discharge and follow-up:

Patient discharge was allowed after clinical improvement, defined as a reduction of abdominal pain and

tenderness, normalization of laboratory values and neutral fluid balance. Following discharge, patients were followed up clinically (abdominal pain, guarding, masses) every 2 weeks for one month, then every month for 6 months and radiologically (abdominal US) if indicated. To detect late postoperative complications, we continued the follow up for six months.

Outcome measures:

Safety was determined based on the rate of IOC-associated complications, morbidity rate, mortality rate, conversion rate, and readmission rate.

Statistical analysis:

Data were coded and entered using the statistical package for the Social Sciences (SPSS) version 26 (IBM Corp., Armonk, NY, USA). Data were summarized using mean and standard deviation for quantitative variables and frequencies (number of cases) and relative frequencies (percentages) for categorical variables. For comparing categorical data, Chi square (χ^2) test was performed. Exact test was used instead when the expected frequency was less than 5. P-values less than 0.05 were considered as statistically significant.

RESULTS

Our sample comprised 40 patients were randomized divide into two groups. The mean age was 39.73 ± 10.69 years, and most of patients were females (82.5%). Most patients were non-smokers (85%) and only 12 patients had comorbid chronic

illnesses. All patients had elective LC, Indications for LC included chronic calcular cholecystitis with history of jundice, but the majority of patients had LC for chronic calcular cholecystitis (**Table 1**).

Table (1): Demographic and Clinical characteristics of all patients

Variables	N	%
Age (years) mean \pm SD	39.73 \pm 10.69	
Age		
<50 years	32	80
\geq 50 years	8	20
Gender		
Male	7	17.5
Female	33	82.5
Smoking		
No	34	85
Yes	6	15
Special habits of medical importance		
No	39	97.5
Yes“addict”	1	2.5
Chronic diseases		
Hypertension	7	17.5
DM	5	12.5
IHD	0	0
Indication of LC		
Acute calcular	0	0
Chronic calcular cholecystitis	40	92.5
Chronic calcular cholecystitis with history of jaundice	3	7.5
Chronic calcular cholecystitis with history of pancreatitis	0	0
Type of surgery		
Elective	40	100
Emergency	0	0

DM: diabetes mellitus, IHD: ischemic heart disease.

The majority of patients had normal LFTs and total leukocytic count. Regarding the results of preoperative

ultrasound, no significant abnormalities were detected in both groups (**Table 2**).

Table (2): Preoperative Biochemical and Radiological data

Variables	N	%
AST		
Normal	37	92.5
High	3	7.5
ALT		
Normal	35	87.5
High	5	12.5
ALP		
Normal	39	97.5
High	1	2.5
dirict Bilirubin		
Normal	29	72.5
High	11	27.5
TLC		
Normal	40	100
High	0	0
Normal biliary tree	40	100
Stones in CBD	0	0
Dilated IHBD	0	0
Dilated CBD	0	0
CBD sludge	0	0
Filling defect	0	0
CBD diameter (mm) mean ± SD	6.93 ± 1.19	

AST: Aspartate Transaminase, ALT: Alanine Transaminase, ALP: Alkaline Phosphatase, TLC: total leucocytic count,CBD: common bile duct, IHBD: intrahepatic biliary duct.

Success and conversion rates:

The majority of patients had no added intraoperative intervention in both groups (97.5%). The success rate of IOC was 95%.only one patient had failed IOC, One case had flushing and trial of transcystic

stenting which failed and referred to postoperative ERCP. Another two cases were acceded for conservative management, No cases converted to open cholecystectomy. None of the patients had CBD exploration (**Table 3**).

Table (3): Intra operative finding in group II

finding	IOC	IOC	
		Count	%
IOC (CBD)	Normal	17	85.0%
	Dilated	2	10.0%
	Failed (narrow cystic)	1	5.0%
IOC (biliary tree)	Normal	18	90.0%
	Dilated	1	5.0%
	Failed	1	5.0%
filling defect IOC	Yes	1	5.0%
	No	18	90.0%
	Failed	1	5.0%
biliary anatomy	Normal	19	95.0%
	Failed	1	5.0%
Visualization (Intrahepatic bile ducts)	Yes	19	95.0%
	Failed	1	5.0%
Visualization (extrarahepatic bile ducts)	Yes	19	95.0%
	Failed	1	5.0%
Interventions done during LC	Trans-cystic stentting(failed)	1	5.0%
	No	19	95.0%
Failed CBD exploration, post-Operative ERCP	Yes	1	5.0%
	No	19	95.0%
Conversion to Open	No	20	100.0%
Conservative management	Yes	2	10.0%
	No	18	90.0%

Postoperative complications

Most of patients stayed at hospital for one day after the surgery. Only 7.5% had prolonged hospital stay; 2.5% for only two days; 2.5% for three days and 2.5% for four days.

Postoperative complications encompassed intra-abdominal collection, wound infection, pancreatitis, bile leak, and bleeding. Of notice, there were no reported cases of bile duct injury, and mortality rate was 0% (Table 4).

Table (4): Early postoperative complication in both groups

groups	Complications	IOC		LC		P value
		Count	%	Count	%	
	Intra-abdominal collection	0	0.0%	0	0.0%	-----
	Wound infection	0	0.0%	1	5.0%	1
	Pancreatitis	0	0.0%	0	0.0%	-----
	Bile leak	0	0.0%	0	0.0%	-----
	Bleeding	0	0.0%	0	0.0%	-----
	Bile duct injury	0	0.0%	0	0.0%	-----
	Death	0	0.0%	0	0.0%	-----

Follow-up:

Concerning three months follow up, only one patient of group I complained of abdominal pain (5%), cholangitis (5%), abnormal LFTs (5%), and this patient was readmitted to hospital after one month for

DISCUSSION

Over the year, several strategies have been employed to minimize the incidence LC complications, including use of intraoperative cholangiography (IOC), laparoscopic US, cholecystocholangiography and the critical view of safety (*Patel and Bhatt 2011*). However, the success of any of these techniques depends on accurate interpretation of normal biliary anatomy, anatomical variations and abnormal findings (*Wherry et al., 2011*).

Here, we aimed to assess the efficacy of IOC in evaluation of CBD and reducing LC postoperative complications. It is worthy to mention that none of all cases in both groups in our study had bile duct injury, So there was no difference between using IOC or not in decreasing BDI, but we can't depend on that due to small sample of the study.

Khan et al. (2011) found that the incidence of bile duct injury among patients who underwent LC without IOC is 1%, in comparison to 0% among those who had IOC. Similarly, *Tornqvist et al. (2012)* reported a 1.5% incidence rate of BDI in LC without using IOC. IOC decreases this high incidence of BDI up to the half (*Sheffield et al., 2013*).

In spite the 0% bile duct injury, we had few cases reported early and late postoperative complications. In our study, there was one case with wound infection

ERCP. After the third month, none of the patients had abdominal pain, jaundice pancreatitis, cholangitis, abnormal LFTs, only one patient of group II readmitted for ERCP.

as early post-operative complication. Similarly, *Photi et al. (2017)* found that wound infection was the most common postoperative complication but with higher frequency. Second common complication was bleeding followed by sepsis and bile leak, then pancreatitis. The higher frequency in the latter study is explained by their huge sample size in comparison to ours.

Concerning three months follow up, only one patient of group I complained of abdominal pain (5%), cholangitis (5%), abnormal LFTs (5%), and this patient was readmitted to hospital after one month for ERCP. After the third month, none of the patients had abdominal pain, jaundice pancreatitis, cholangitis, abnormal LFTs, only one patient of group II readmitted for ERCP.

In our study, only two cases were readmitted one by the first month of follow up for abdominal pain and abnormal liver function tests, and the 2nd one by the 3rd month. *Verma et al. (2016)* there is study of patients who had IOC had no readmissions after the surgery. *Khan et al. (2011)* compared between those who had IOC and those who had not, and found that readmission rate was much higher in the latter group (0% versus 4%) attributing readmission to abdominal pain and symptoms suggestive of CBD obstruction.

Hospital length of stay was not prolonged except in 7.5% of cases for

maximum of four days. The majority of cases stayed at hospital for an average of 24 hours. This agreed with *Mir et al. (2011)* where they found that the mean hospital length of stay ranges between 18 and 72 hours. Similarly, *Pham et al. (2016)* a one to two days ranges for postoperative length of stay with the use of IOC during LC. With the usage of IOC, theirs 0% conversion rate to open cholecystectomy. *Horwood et al. (2010)* found much higher conversion rate. *Hazardous et al. (2014)* also compared the conversion rate in two groups; they revealed a high conversion rate of 7.2% in the group used IOC, and 2.2% without IOC.

The reasons for conversion may be adhesions, poor anatomy delineation. Hence comes the value of the surgeon's experience. *Herrero et al. (2013)* found that conversion rate between junior surgeons was higher than between experts (9% versus 1.5%), However this difference was not statistically significant.

Concerning the IOC associated mortality rate, we observed a 0% mortality rate during the study period in both groups. It is similar to a study was conducted in Kashmir where 0% mortality rate was observed as well (*Mir et al., 2011*).

CONCLUSION

IOC during LC was associated with a low morbidity rate and no mortalities. This confirmed the effectiveness of IOC in reducing the postoperative complications of LC. There was no statistically significant difference.

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تقييم القنوات المرارية بإضافة التصوير عن طريق المنظار الجراحي مقارنة بالموجات فوق الصوتية ما قبل الجراحة في مرضى التحوصل المراري أثناء إستئصال المرارة

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خلفية البحث: يعتبر التصوير المرارى للقنوات المرارية بالمنظار الجراحي أحد خطوات التقدم العلمى و التى تهدف إلى تقييم حالة القنوات المرارية و تقليل مخاطر إستئصال المرارة بالمنظار الجراحي.

الهدف من البحث: تحديد مدى كفاءة تصوير القنوات المرارية اثناء استخدام المنظار الجراحي وسهولة استخدامه وقدرته على اكتشاف التشريح الطبيعى والغير طبيعى للقناة المرارية. وأيضا تحديد نسبة المضاعفات المتعلقة باستخدامه بعد العملية وعدد الوفيات.

المرضى و طرق البحث: تمت هذه الدراسة في قسم الجراحة بمستشفيات جامعة الأزهر، وتضمنت 40 مريضا ممن يشكون من وجود الحصوات المرارية تم تقسيمهم الي مجموعتين; خضعت المجموعة الأولى لإستئصال المراره بالمنظار الجراحي، بينما خضعت المجموعه الثانيه للتصوير القنوات المراريه باستخدام المنظار اثناء إستئصال المراره. قبل إجراء العملية وقد اجري البحث بداية من شهر نوفمبر 2019 الي شهر سبتمبر 2020، تم الحصول على الموافقة المستنيرة للمريض وبعدها تم اخذ تاريخ صحي كامل من المريض واجراء الفحوصات اللازمة.

وقد خضع جميع المرضى بالمجموعه الثانيه لتصوير القنوات المرارية أثناء استخدام المنظار الجراحي. وتم متابعة المرضى لمدة ستة أشهر لتحديد وجود مضاعفات من عدمه.

نتائج البحث: ساعد تصوير القنوات المرارية اثناء استخدام المنظار الجراحي علي رؤية أوضح للقناة المرارية اثناء اجراء الجراحة، بالإضافة إلى أهمية تصوير القنوات المرارية في إكتشاف الحصوات وتمدد القنوات المرارية. وأثبتت النتائج أن إستخدام تصوير القنوات المرارية سهلا وميسرا ونسبة نجاحه تصل الي 95%.

الاستنتاج: تصوير القنوات المرارية اثناء استخدام المنظار الجراحي له أهمية عظيمة في تفادي مضاعفات جراحة الحصوات المرارية. ولكن يجب الأخذ في الاعتبار اجراء تصوير القنوات المرارية اثناء استخدام المنظار الجراحي للحالات التي لديها احتمالية عالية بوجود حصوات مرارية وذلك لتوفير التكلفة المادية.

الكلمات الدالة: تصوير القنوات المرارية، إستئصال المرارة، حصوات المرارة.