

## CRITICAL VIEW OF SAFETY DURING LAPAROSCOPIC CHOLECYSTECTOMY

**Mohammed Shaheed<sup>\*</sup>, Mansour Ameen Mohammed<sup>#</sup> & Zeki A Al-Faddagh<sup>@</sup>**

<sup>\*</sup>MB,ChB, FICMS, General Surgeon, Al-Mawanee General Hospital, <sup>#</sup>MB,ChB, DS, CABS, MRCS, Lecturer, Dept. of Surgery. <sup>@</sup>MB, ChB, CABS, Professor of Surgery, College of Medicine, University of Basrah, IRAQ.

### Abstract

Laparoscopic cholecystectomy has become the preferred choice of management for gallstone disease. In spite of various theories explored trying to assess different aspects of management and outcome to reach the acceptable safest technique in laparoscopic operation and to compare it with its counterpart. Many surgical methods were attempted to clarify their value in counteracting a serious complication of laparoscopic cholecystectomy, mainly is the bile duct injury.

This study aimed to evaluate the significance of critical view of safety as a technique of laparoscopic cholecystectomy concerning the issue of preventing bile duct injury in regard to the infundibular technique of dissection.

This is an observational study of two hundred fifty patients who were scheduled for laparoscopic cholecystectomy using critical view of safety technique compared with probably matched previously performed two hundred fifty of laparoscopic cholecystectomy using infundibular technique. The incidence of bile duct injury was analyzed in both groups.

The results shows that age, sex, body mass index and gall bladder status were comparable in both groups. The Incidence of bile duct injury in infundibular technique was (1.6%), while in critical view of safety technique the incidence was 0% which is statistically significant ( $P < 0.05$ ).

In conclusion, critical view of safety technique in laparoscopic cholecystectomy has a significant effect in preventing bile duct injury as compared to infundibular technique with comparable time of surgery and it is best to be the preferred technique in laparoscopic cholecystectomy.

### Introduction

In 1985, the first laparoscopic cholecystectomy (LC) was performed by Mühe of Böblingen, Germany, which adopted rapidly around the world and subsequently recognized as the "gold standard" for the treatment of gallstone disease<sup>1,2</sup>.

The introduction of LC was associated with a sharp rise in the incidence of bile duct injury (BDI). Despite the advancement of LC techniques, biliary injury continues to be an important problem<sup>3</sup>, with an incidence range between 0.4-0.7%<sup>4-6</sup>.

Bile duct injury following LC is usually iatrogenic concerned with significant

perioperative morbidity and mortality<sup>7,8</sup>. The etiology of laparoscopic BDI is multifactorial and 70-80% of injury are due to anatomical misidentification of biliary system and its variations. Also the other factor that affect BDI were gallbladder (GB) inflammation, obesity, excessive fat in dissection area, inadequate exposure, poor or excessive clip placement, injudicious use of electrocautery and bleeding in the operative field<sup>9,10</sup>.

The principal of infundibular technique(IT) was consist of clearance of Calot's triangle from the fat and fibrous tissue and passing through a fatty free

triangle after identification of the two structure "cystic duct and artery" so the cystic plate is not dissected<sup>11</sup>.

Bile duct injury should be regarded as a preventable complication and one of the important method which is considered essential to prevent BDI during LC is the adoption of critical view of safety (CVS), which is identified by Strasberg in 1995 and introduced as way of identification of the cystic structures<sup>12</sup>.

The principal of CVS is summarized in three steps. First; clearance of Calot's triangle from the fat and fibrous tissue. Second; separation of the lowest part of the GB from the cystic plate. Third; identification of the two structures that should be seen entering the GB. Therefore, once these three criteria have been fulfilled, CVS has been achieved<sup>12</sup>.

Critical view of safety technique can be used in mild and moderate inflammation, it is usually not difficult to clear the fat of Calot's triangle and fibrous tissue and take the GB off the bottom of the cystic plate. Once this is done so only 2 structures attached to the GB and they can be visualized circumferentially. At this point, the CVS has been achieved and the cystic structures can be divided<sup>13</sup>.

Using of CVS In the severe inflammation, The common bile duct(CBD) can be similarly dissected in error when using the CVS, but it will be not divided at this point because the other conditions for the CVS have not been met which include misidentification of The cystic artery, incomplete clearance of Calot triangle and failure of displaying of the cystic plate and this made the CVS is superior to the IT under conditions of severe inflammation<sup>14,15</sup>.

Since the time of invention of LC, different strategies have been studied thoroughly to highlight appropriate preventive measures of this catastrophic complication of BDI following LC. The updating issue in the world of laparoscopy has made opinions and methods developing or changing in order to obtain

a safe approach which has a lowest morbidity and mortality.

### **Aim of the study**

To evaluate the benefit of critical view of safety technique during laparoscopic cholecystectomy in reducing the incidence of major bile duct injury in comparison to infundibular technique.

### **Patient and method**

This prospective observational clinical study was carried out in Basrah Medical Institution including Al-Mawanee General Hospital and two private hospitals (Ibn-Albeitar and Al-Moswai) between January 2009 till January 2013

Three general surgeons were involved in this study, their experience in LC was more than five years and each of them has done more than one hundred cases of LC before our study.

During the period of the study, two hundred fifty patients scheduled for LC using CVS and compared with two hundred fifty cases who underwent LC using IT in the same period of time.

Patient demographics, age, sex, body mass index (BMI), recent history, past history, drug history and accompanying systemic diseases were evaluated. All cases were symptomatic and the diagnoses was confirmed by ultrasonography.

All patients signed informed consent about the surgery and its possible complications. All patients received appropriate prophylactic antibiotic starting at the induction time and continue for two postoperative doses.

All surgeries performed under general anesthesia and management in recovery room were done, LC was performed using the standard four-port technique advocated by Reddick<sup>6,16</sup>. The pneumoperitoneum was created by the closed method using Veres needle, dissection of Calot's triangle was done by grip and strip blunt method using dissecting forceps "Maryland", or by electrocautery using surgical hook. Dissection of GB was

performed using electrocautery with energized hook "monopolar". The cystic artery and duct were ligated with titanium medium-large sized "9 mm" clips. The GB was removed through the epigastric port.

In the IT, cephalad traction of the fundus is obtained by the surgeon assistant and the lateral traction of the infundibulum by the surgeon left hand. The peritoneum is incised parallel to the cystic duct and artery, just caudally to the infundibular edge, thus dissecting the duct and artery to open Calot's triangle. After the identification of these two structures, passing through a fatty-free triangle, they are divided between clips, and retrograde cholecystectomy is completed.

In the CVS technique, cephalad traction of the fundus is obtained by the surgeon assistant, together with a lateral traction of the infundibulum by the surgeon left hand. A complete incision of the peritoneum is performed both in the medial and lateral aspect of the infundibulum and extended upwards almost to the fundus. The medial incision is performed over the vertical fatty line visible on the GB wall; it usually corresponds to the anterior cystic artery. The medial release of the artery is obtained with electrocautery by dissecting it from the GB wall, The dissection of cystic artery permits access to the critical safety triangle, set between the GB wall on the right, the cystic duct inferiorly, and the cystic artery on the left. The entire fatty dissection of this triangle and the mobilization of the infundibulum, both anteriorly and posteriorly, permits visualization of the liver surface through the triangle. The clipping and the section of the duct, next to the GB, the clipping of the artery, and the retrograde dissection of the GB complete the operation.

The duration of the total operation and the time of calot's triangle dissection were recorded.

The majority of patients resumed oral intake few hours postoperatively, appropriate analgesia was given and the majority of patient discharged home next day unless there is indication for more hospital stay. The patient follows up at the time of stitch removal and 30<sup>th</sup> postoperative day.

The way of recognition of postoperative BDI was recognized by abdominal pain, biliary fistula (bilious drainage from an intra-operatively placed drain or abdominal incision), jaundice and biliary peritonitis while the way of recognition of intra-operative BDI was recognized by presence of bile in operative field after GB removal.

Data were recorded, tabulated and analyzed using statistical package for social science version 18.0 software, with Chi square, Fisher's exact and student t-test were used as appropriate and p value of <0.05 was considered to be statistically significant.

## Results

As Shown in Table I, Out of 250 patients of the CVS group, 45 patients were males and 205 patients were females, while 56 patients were males and 194 patients were females in IT group.

The mean age of patients with CVS group was 44.6 years $\pm$ 11.2 (ranged 15-72 years), while in IT group was 39.9 years $\pm$ 13 (ranged 16-71 years).

The mean of BMI in CVS group was 30 $\pm$ 3.1, while in IT group was 31 $\pm$ 3.3.

Forty patients had acute cholecystitis and 210 had chronic cholecystitis in CVS group, while 37 patients had acute cholecystitis and 213 had chronic cholecystitis in IT group.

The differences in age, sex, BMI and GB status between the two group were statistically insignificant (P value >0.05).

**Table I: General criteria of groups**

	CVS group	IT group	P value
Sex M/F	45/205	56/194	> 0.05
Age (years)	15-72	16-71	
Mean+/-	44.6	39.9	> 0.05
S.D	11.2	13	
BMI (Mean) +/-	30	31	> 0.05
S.D	3.1	3.3	
GB status acute/chronic	40/210	37/213	> 0.05

S.D = Standard Deviation, BMI = Body Mass Index, CVS = Critical View Of Safety  
IT = Infundibular Technique, GB = Gall Bladder

Table II shows the incidence of bile duct injury in both groups of cholecystectomy. Four patients (1.6%) were found to have BDI in IT group while in CVS group no patient (0%) had developed BDI. The difference is statistically significant (P value < 0.05).

**Table II: The incidence of bile duct injury and cholecystectomy approach**

	CVS group (n=250)	IT group (n=250)	P value
BDI	0 (0 %)	4(1.6%)	< 0.05

CVS= Critical View Of Safety, IT= Infundibular Technique, BDI = Bile Duct Injury

One case was discovered intra operatively by observation bile oozing in the region of CBD which recognized after conversion to open surgery to be a partial injury and treated at the time of operation by suturing the defect on T tube. The Other three patients were identified postoperatively through persistence of unwell clinical state such as bile leak from drain supported by biochemical and radiological evaluation.

Two cases presented as persistence bile leak through the drain, a planned ERCP was performed for one of them while a planned ERCP and sphincterotomy was performed for the other case which showed a partial injury to the CBD. With drains, both fistulas were closed spontaneously.

The fourth case presented with jaundice. On doing MRCP, a complete CBD injury were found which was treated by Roux-en-Y (choledocho-jejunostomy) and did well after surgery. All these four cases resolved completely without any mortality.

Table III shows the difference in operative time between the two groups of cholecystectomy. Concerning the time of surgery in relation to surgical technique, the mean duration of surgery in CVS group was 50.3 minute+/-17.7, while in IT group 49.8 minute+/-18.5.

The mean duration of calot's triangle dissection to GB removal in CVS group was 16 minute+/-3.5, while in IT group 15 minute+/-3.2. The differences were not significant (p value more than 0.05).

**Table III: Relationship between surgical technique and duration of surgery.**

	CVS group	IT group	P value
Less than One hour	177 (70.8 %)	186 (74.4% )	>0.05
Duration of surgery (minuets) Mean /-+ S.D	50.3 17.7	49.8 18.5	>0.05
Duration of calot triangle dissection Mean +/- SD	16 3.5	15 3.2	>0.05

S.D = Standard Deviation, CVS = Critical View of Safety, IT = Infundibular Technique

## Discussion

Since the LC was introduced in our hospital the IT was adopted by most of the surgeons as the preferred technique. In this study we try to evaluate the new technique which is CVS for our patient prospectively and compare that with previously performed LC using IT.

Gallstone disease affect the female three time more than male and it affect patient in the 40s of age who are obese<sup>17-19</sup>.

We try to select a probably matched two hundred fifty patient to compare between the two technique(CVS and IT) and this clearly shown in table 1 that demonstrate the two groups were probably matched regarding the sex, age, BMI and GB status which shows no statistically significant difference (P value >0.05).

In this study, No patient in the CVS group got BDI compared with 4 patients (1.6%) in the IT group had gotten BDI. The differences was statistically significant (p value <0.05). This could be explained by the adoption of CVS technique which was significantly prevent the possibility of BDI during performing LC, while dissecting clot's triangle in comparison with IT which might misrepresent vascular or biliary anatomical variants especially in severe inflammation in which the common hepatic duct might be mistaken for the GB wall and also the CBD might be dissected and believe it the cystic duct in presence of sever acute and chronic inflammation, so the CBD will often be clipped and divided<sup>20</sup>. Therefore, the CVS should be achieved every time, by dissecting the entire infundibulum off the liver bed and

by freeing it of all fatty tissue, both in its dorsal and ventral aspects and this way of dissecting the GB pedicle would bear a highly protective role against BDI<sup>21,22</sup>.

By assessing the differences in total time of surgery and the time of calot's triangle dissection in both groups as shown in table, we found that there was no statistically significant difference (p value >0.05) between the total duration of surgery (50.3 +/-17.7 vs. 49.8+/-18.5) and the duration of calot's triangle dissection ( 16+/-3.5 vs. 15+/-3.2). this could explained by that the cystic plate has been already dissected during identification of view of safety which form about 25-30% of all dissection time while it is not done in IT group.

We believe that CVS technique is responsible for the prevention of major BDI, so it is best to be the preferred way of dissection of GB element.

## Conclusion

Critical view of safety technique in laparoscopic cholecystectomy has a significant effect in preventing bile duct injury as compared to infundibular technique with comparable time of surgery and it is best to be the preferred technique in laparoscopic cholecystectomy.

## Recommendation

This study recommends all surgeons to use critical view of safety technique during laparoscopic cholecystectomy because of its value in reduction the incidence of major bile duct injury.

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