

ORIGINAL ARTICLE

Critical View of Safety in Laparoscopic Cholecystectomy: A Prospective, Observational Study

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Background: The critical view of safety (CVS) has been increasingly recognized as the standard method for identification of different cystic structure and to prevent any vascular or biliary injuries during laparoscopic cholecystectomy operation. **Objective:** To observe the percentage of patients in whom CVS was attained during laparoscopic cholecystectomy, percentage of patients where bail out procedures were needed and the type of bail out procedure adopted. **Methods:** This prospective, observational study was conducted in the Department of Minimal Access and General Surgery, Govt. Medical College Srinagar at Kashmir in India, over a period of 6 months. A total of 55 patients of symptomatic cholelithiasis, aged >20 years were enrolled in this study. The said patients were followed up for a period of 6 weeks in the post operative time. **Results:** 29(52.73%) of the patients were in the age group of 40-59 years, followed by 16(29.09%) in 20-39 years age group. Female predominance was observed as male-female ratio was 1:5. Critical view of safety (CVS) was attained in 50 patients (90.9%), while 5 patients had difficulties: difficulty in dissection of calot's triangle in 5 cases, dense adhesions were found in 3 cases and 1 had perforated gallbladder. Significant differences were observed between two groups (CVS attained and not attained) in terms of operative time, gallbladder wall thickness and total hospital stay ($p<0.001$). However, no complications like bile duct injuries or mortality were observed in our study. Bail out procedures were opted – conversion to open cholecystectomy in 3 cases (60%) and laparoscopic fundus first cholecystectomy in 2 cases (40%). **Conclusion:** Even after adopting all these strategies of critical view of safety (CVS), the surgeons often fail to secure safety in some cases in laparoscopic cholecystectomy due to difficulty in handling gall bladder in situ.

Keywords: Laparoscopic cholecystectomy, critical view of safety, symptomatic cholelithiasis, gall bladder, bile duct injury

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INTRODUCTION

Laparoscopic cholecystectomy (LCC) is the most common abdominal surgical procedures and is considered the gold standard for the management of symptomatic cholelithiasis.^{1,2} As LCC is associated with relatively higher risk of bile

duct injury compared to open cholecystectomy, the critical view of safety (CVS) has been increasingly recognized as the standard method for identification of different cystic structure and to prevent any vascular or biliary injuries during the procedure.³⁻⁵ The most common and severe bile duct injury usually occurs when common

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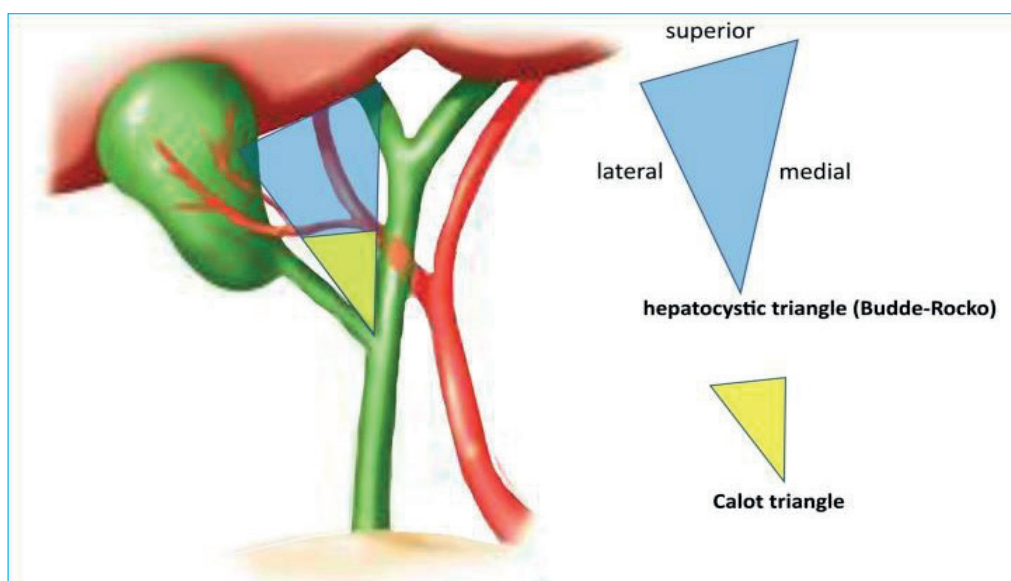


Figure 1. Hepatocystic triangle and triangle of Calot. Hepatocystic triangle (blue): upper boundary of hepatocystic triangle is the inferior border of liver. Lateral, the cystic duct and the neck of the gall bladder. Medial, the common hepatic duct. Triangle of Calot (yellow): Upper boundary is the cystic artery. Lateral the cystic duct. Medial the common hepatic duct, common bile duct (CBD).

bile duct is mistaken for cystic duct and hence cut. This injury is known as classical laparoscopic injury. LCC carries an overall 0.3-1.8% risk of bile duct injury and 0.1-0.5% risk of severe bile duct injury.³⁻⁷

Critical View of Safety (CVS) has three components:⁸

- 1) Hepatocystic triangle must be cleared off the fibrous tissue and fat;
- 2) Lower part of gall bladder has to be separated from cystic plate (liver bed of gall bladder); and
- 3) Only two structures i.e., cystic duct and cystic artery should be entering the gall bladder. (Figure 1).

Even after adopting all these strategies of critical view of safety (CVS), the surgeons often fail to secure safety in some cases in laparoscopic cholecystectomy. For those cases, there are bail out strategies, as laparoscopic cholecystectomy could be converted into other possible procedures to complete the operation. Most common bail out procedures are laparoscopic subtotal cholecystectomy, laparoscopic fundus first cholecystectomy, laparoscopic tube cholecystostomy, and conversion to open cholecystectomy. In this study, we tried to observe the percentage of patients in whom CVS was

attained during laparoscopic cholecystectomy, percentage of patients where bail out procedures were needed and the type of bail out procedure adopted.

METHODS

This prospective, observational study conducted in the Department of Minimal Access and General Surgery, Govt. Medical College Srinagar at Kashmir in India, over a period of 6 months. A total of 55 patients of symptomatic cholelithiasis, aged >20 years were enrolled. Sample selection was done using a purposive sampling technique. Information regarding age, gender, clinical presentation, and etiological factors was collected through an interview-based questionnaire from the patients or their attendants. We collected the following data of each patients: i) operative time; ii) gall bladder wall thickness; iii) par operative bile duct injury; iv) bail out procedure during surgery, if any; v) any other complications or mortality and finally, vi) the length of stay in hospital. The patients were followed up to a period of 6 weeks after discharge from the hospital.

Data was collected in pre-designed data collection sheet. Data compilation, sorting and analysis were conducted using the MS-Excel. Data were then presented through tables expressed in frequencies with percentage. Chi-square tests were performed

to compare between two groups (CVS attained and not attained). A p-value <0.05 was considered as statistically significant. Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS) software version 22.0 for windows (SPSS Inc, Chicago, Illinois, USA).

RESULTS

A total of 55 patients were enrolled in this study aged ≥ 20 years. 29 (52.73%) of the patients were in the age group of 40-59 years, followed by 16 (29.09%) in 20-39 years age group. Female predominance was observed as male-female ratio was 1:5 (Table 1). Out of 55 patients, critical view of safety (CVS) was attained in 50 patients (90.9%), while 5 patients had difficulties:

difficulty in dissection of calot's triangle in 1 case, dense adhesions were found in 3 cases and 1 had perforated gallbladder. Significant differences were observed between two groups (CVS attained and not attained) in terms of operative time (50.76 ± 6.34 minutes vs. 96 ± 16.24 minutes), gallbladder wall thickness (2.25 ± 0.64 mm vs. 4 ± 0.63 mm) and stay in hospital (2.08 ± 0.22 days vs. 3.2 ± 0.74 days) ($p < 0.001$). However, no complications like bile duct injuries or mortality were observed in our study (Table 2). Bail out procedures were opted: conversion to open cholecystectomy in 3 cases (60%) and laparoscopic fundus first cholecystectomy in 2 cases (40%) (Table 3).

Table 1: Age and gender distribution of the participants (n=55)

Age group (in years)	Male		Female		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
20-39	2	12.5	14	87.5	16	29.09
40-59	5	17.24	24	82.76	29	52.73
≥ 60	2	20	8	80	10	18.18
Total	9	16.36	46	83.64	55	100

Table 2: Outcome of adoption of critical view of safety (CVS) strategies (n=55)

Variables	CVS attained (n=50)	CVS not attained (n=5)	p-value
Mean operative time (in minutes)	50.76 ± 6.34	96 ± 16.24	<0.001
Gall bladder wall thickness (in mm)	2.25 ± 0.64	4 ± 0.63	<0.001
Bile duct injury	-	-	-
Mortality	-	-	-
Stay in hospital (in days)	2.08 ± 0.22	3.2 ± 0.74	<0.001

Table 3: Bail out procedures adopted during laparoscopic cholecystectomy (n=5)

Bail out procedure	Frequency	Percentage
Open cholecystectomy	3	60
Fundus first cholecystectomy	2	40

DISCUSSION

Laparoscopic cholecystectomy is the current standard of care for symptomatic cholelithiasis. However, it is associated with higher incidence

of complications such as bile duct injury and vasculobiliary injury (VBI) than open cholecystectomy. Anatomical misperception is the most common underlying mechanism of such injuries. Although several strategies have been described to prevent such injuries, critical view of safety (CVS) method of structural identification seems to be the most effective preventive measure. The purpose of present study was to evaluate the CVS achievement in laparoscopic cholecystectomies, bile duct injuries and bail-out procedure options in patients where CVS was not

attained. In our study we had total of 55 patients who underwent cholecystectomy by laparoscopic approach. In our study, out of 55 patients 46 (83.6%) were females and 9 (16.4%) were males. Female to male ratio in our study was 5:1. Most of the patients presented in 4th and 5th decade. The mean age was 47.28 years. Overall, only 7 patients were more than 60 years. Similar findings have been reported by; Hamza et al.⁹ studied on 240 females and 40 males with the mean age of 42.8 years. Taki-Elden & Badawy¹⁰ had 386 females and 106 males in their study with mean age of 49.35 years. Iskandar et al.¹¹ enrolled 77% of females in his study. Gupta et al.¹² studied on 180 females and 90 males affected with cholelithiasis.

In our study, in 5(9.1%) cases, CVS was not attained. The most common cause for non-attainment of CVS was difficult Calot's triangle dissection (frozen Calot's triangle), which was present in all 5(100%) patients. Dense adhesions were also present in 3 (60%) cases that made CVS attainment difficult. In addition, 1 (10%) patient had perforations in the gallbladder. Out of these 5 patients 3 were females and 2 were males. The findings were corresponding to the studies by; Gupta R et al who had 35 patients out of 238 in whom CVS was not attained due to dense adhesions and stone impaction. Taki-Elden & Badawy¹⁰ found difficult dissection through Calot's triangle in 4.9% of patients that lead to non- attainment of CVS in laparoscopic cholecystectomy. Hamza et al.⁹ observed 149 patients, of which 52 gall bladder were found difficult to operate and the reasons were difficult Calot's dissection, thickened gall bladder wall and acute cholecystitis. Rosen et al.¹³ found dense adhesion as the most common cause for conversion in laparoscopic cholecystectomy. Out of the 5 difficult gall bladders where CVS was not attained the bail-out surgery was opted – open cholecystectomy in 3(60%) patients and fundus first in 2(40%) patients. Gupta et al.¹² reported that out of 238 patients, open total cholecystectomy and subtotal cholecystectomy was opted in 9 and 2 cases respectively. Taki-Elden et al.¹⁰ opted for open cholecystectomy in 24 cases as bail-out surgery. In our study, the cases where CVS was not attained had a longer duration of

procedure time (96 ± 16.24 minutes) compared to patients in whom CVS was attained (50.76 ± 6.34 minutes) ($p < 0.001$). Those patients also had a longer duration of hospital stay and delayed drain removal (3.2 ± 0.74 days). Gall bladders with thickened walled (4 ± 0.6 mm) also contributed to the non-attainment of CVS. The differences were found statistically significant ($p < 0.001$) between the groups. Similar to our findings, Hamza et al.⁹ also reported gall bladder wall thickness as a significant predictor of difficult laparoscopic cholecystectomy. No complications were seen in our study, e.g., bile duct injury, vasobiliary injury or mortality. Similar findings were reported by Randhawa & Pujahari¹⁴ and Lal et al.¹⁵.

CONCLUSION

Our data revealed that symptomatic cholelithiasis was more observed in females and the age group most affected were 4th and 5th decades of life. CVS was not attained in 5 patients (out of 55 patients), with most common cause being frozen calot's followed by dense adhesions. Two bail-out procedures were employed in our study, viz., conversion to open cholecystectomy and laparoscopic fundus first approach. Critical view of safety (CVS) plays a critical role in laparoscopic cholecystectomy. Attainment of CVS makes the procedure easy and convenient. Various predictive factors that lead to difficult gall bladder included difficult Calot's triangle dissection, dense adhesion and thickened gall bladder wall. All these factors play predictive role for various bail-out procedures or conversion. Further study with larger sample size and longer study periods are required to emphasize the vast categories of complications and predictive factors.

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Ethical declaration: This study was approved by the Institutional Review Board of the Govt. Medical College Srinagar, Kashmir, India.

Authors' contribution: Concept and design: SNM; data collection, compilation and analysis: SNM, WURD, HB, IAM, BAL; manuscript writing, editing, revision and approval of the final manuscript: SNM, WURD, HB, IAM, BAL.

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