EVALUATING THE EFFECTIVENESS OF THE CRITICAL VIEW OF SAFETY IN LAPAROSCOPIC CHOLECYSTECTOMY AT BINH DAN HOSPITAL

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ABSTRACT

Background: The aim of this study was to assess the safety of laparoscopic cholecystectomy using "The Critical View of Safety" (CVS) technique for the management of gallbladder stone disease. ***Subjects and methods:*** Prospective study, describing a series of cases of patients undergoing laparoscopic cholecystectomy with CVS applied to treat gallbladder stones at Binh Dan Hospital from January 2022 to October 2022. ***Results:*** We enrolled 89 patients and recorded the following outcomes: the success rate was high, at 97.8%. The failure cases were due to large stones blocking the gallbladder neck and severe adhesions in the hepatocystic triangle in necrotizing cholecystitis. There is a statistically significant difference in the success rate of achieving CVS between groups: gallbladder condition (p=0.02), degree of adhesion inflammation of the hepatocystic triangle (p=0.039). The overall bleeding complication rate was 10.3% (9 cases) and during CVS was 6.7% (6 cases). The overall gallbladder perforation complication rate was 8% (7 cases) and during CVS was 4.4% (4 cases), with no biliary tract injuries. The postoperative complications included fluid collection in the gallbladder bed in 10.3% of cases and surgical wound infection in 2.3% of cases. All were successfully treated with conservative measures. ***Conclusion:*** We concluded that CVS is a necessary, safe, and effective diagnostic method in laparoscopic cholecystectomy for gallbladder stone disease.

Keywords: *The critical view of safety, Gallbladder stones, Laparoscopic cholecystectomy.*

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I. INTRODUCTION

Nowadays, laparoscopic cholecystectomy (LC) has gradually replaced the classic open cholecystectomy. Although it has many advantages over open surgery to cut gallbladder, laparoscopic surgery has a higher rate of complications of biliary tract injury than open surgery multiple times. The results of some studies have shown that misidentification of anatomical structures is the main cause of cases of coronary artery disease in laparoscopic surgery.first. Since then, there have been studies that have proposed a safe approach to help prevent coronary artery disease in laparoscopic surgery, including "The Critical View of Safety" (CVS) 2. The application of CVS since its first introduction by Steven M Strasberg and colleagues in 1995 has been considered a reliable and safe method to identify the cystic duct and gallbladder artery. In Vietnam, there has been a study by author Tran Ho on CVS in LC. However, the study population did not include cases of acute thrombophlebitis, so the feasibility and effectiveness of applying CVS in these cases in our country has not yet been studied. Therefore, we conducted the study "Evaluating the effectiveness of the critical view of safety in laparoscopic

cholecystectomy at Binh Dan hospital" to evaluate the safety of LC with the application of "CVS" and evaluate the rate of intraoperative complications and postoperative complications when performing this method.

II. RESEARCH METHODOLOGY SUBJECTS

2.1. Research subjects

All patients had LC due to gallbladder stones at Binh Dan Hospital

2.1.1. Criteria for selecting patients

The patient was diagnosed with gallbladder stones based on ultrasound. The patient was diagnosed with acute cholecystitis (AC) due to stones according to Tokyo Guideline 2018.

The patient was operated on using the laparoscopic surgery method, with CVS performed which was recorded in the sample medical record.

2.1.2. Exclusion criteria

Patients with acute cholecystitis have common bile duct stones, liver stones, biliary tract tumors, pancreatic head tumors, common bile duct cysts, stomach tumors... accompanied.

2.2. Research Methods

2.2.1. Study design and sample size

Study design: prospective, describing a series of cases.

Maximum number of samples taken from possible patients.

2.2.2. Time and place

Research period: From January 2022 to the end of October 2022.

III. RESEARCH RESULTS

There were 89 cases of LC surgery applying the essential safety perspective that met the selection criteria for research subjects. Of these, there were 87 successful cases.

3.1. General features

3.1.1. Year old

Our study recorded 89 cases with an average age of 53.2 ± 13.1 years. The youngest case in our study was 17 years old and the oldest case was 83 years old. The most common age group is 40-60 years old, accounting for 50.6%, two age groups from 17-39 years old have a rate of 21.3%, and 60-83 years old have a rate of 28.1%.

3.1.2. Sex

In the study sample there were 60 females (67.4%) and 29 males (32.6%). Thus, there are more women than men, the female:male ratio is approximately 2:1

3.1.3. Group of surgeons

In our study, there were 69 surgical cases (accounting for 77.5%) performed by surgical teams with experience of 30 or more surgical procedures.

Table 3.1. ***Number of surgical cases by surgical teams***

Surgical teams	Number of cases
Surgeons with less than 30 cases of experience	20
Surgeons with 30-50 cases of experience	30
Surgeons with over 50 cases of experience	39

3.1.4. Time of surgery (calculated from the first symptom) for cases of AC

Of the 28 cases diagnosed with AC caused by stones, 15 cases (accounting for 53.6% of AC cases) were operated on before 72 hours and 13 cases (accounting for 46.4% of AC cases) were operated on. Surgery after 72 hours.

3.2. Results of LC with the application of CVS

3.2.1. Injury during surgery

We combine ultrasound images, computed tomography, abdominal magnetic resonance imaging, and intraoperative damage to determine the condition of the gallbladder.

Table 3.2. ***Injuries during surgery***

	Number of cases
Gallbladder status	
Gallbladder is not big, Gallbladder wall is not thick	39
Gallbladder has large and thick wall	37
Gallbladder necrosis	8
Stone stuck in Gallbladder neck	5
Degree of adhesive inflammation of the Hepatocystic triangle	
No adhesive inflammation	52
Little inflammation	19
There is a lot of inflammation	18

3.2.2. Rate of achieving CVS

A total of 89 cases of LC applied CVS. The success rate is 97.8% (87 cases).

There were 2 cases of failure during surgery to achieve CVS. These cases include a case of large stones blocking the neck of the gallbladder and a case of necrotizing gallbladder. Both failed cases were performed by 2 surgeons with over 50 cases of experience.

Table 3.3. ***Description of success rates according to lesion groups and time of surgery***

Injury	CVS achieved	Did not achieve CVS	p
Gallbladder status			
Gallbladder is not big, Gallbladder wall is not thick	39	0	p=0.02 (Fisher's test)
Gallbladder has large and thick wall	37	0	
Gallbladder necrosis	7	1	
Stone stuck in Gallbladder neck	4	1	
Degree of adhesive inflammation of the Hepatocystic triangle			
Not adhesive	52	0	p=0.039 (Fisher's test)
Little stickiness	19	0	
Sticky a lot	16	2	
SURGEONS group			
Surgeons with less than 30 cases of experience	20	0	p=0.502 (Fisher's test)
Surgeons with 30-50 cases of experience	30	0	
Surgeons with over 50 cases of experience	37	2	
Time of surgery			
72 hours in advance	14	1	p=1 (Fisher's test)
After 72 hours	12	1	

After surgery in successful cases, we evaluate the CVS scores independently for front and back photos and when combining the two sides. The highest CVS rate (100%) when combining both front and rear views. The rate of achieving CVS in the front view is 93.1%. The rate of achieving CVS in the rear view is the lowest at 81.6%.

Table 3.4. ***Compare the rate of achieving CVS in front view, back view and combined two sides between gallbladder status groups***

Gallbladder status	Front			Backside			Combine	
	Achieved	Not achieved	p	Achieved	Not achieved	p	Achieved	Not achieved
Gallbladder is not big, Gallbladder wall is not thick	39	0	<0.01	39	0	<0.01	39	0
Gallbladder has large and thick wall	35	2		26	11		37	0
Gallbladder necrosis	3	4		3	4		7	0
Stone stuck in Gallbladder neck	4	0		3	1		4	0

Table 3.5. ***Compare the rate of achieving CVS in the anterior, posterior and combined views between the adhesive inflammation groups of the Hepatocystic triangle***

Degree of adhesive inflammation of the Hepatocystic triangle	Front			Backside			Combine	
	Achieved	Not achieved	p	Achieved	Not achieved	p	Achieved	Not achieved
Not adhesive	52	0	<0.01	52	0	<0.01	52	0
Little stickiness	19	0		16	3		19	0
Sticky a lot	10	6		13	3		16	0

3.2.3. Time to achieve "Essential safety perspective"

Table 3.6. ***Describe the time to achieve CVS according to injury groups and time of surgery***

	Time to reach CVS (minutes)	p
Degree of hepatocystic triangle adhesion inflammation		
No inflammation	25.5±11.8	p<0.01 (Kruskal Wallis test)
Little inflammation	39.2±11.0	
There is a lot of inflammation	65.3±15.6	
GALLBLADDER status		
Gallbladder is not big, Gallbladder wall is not thick	24.2±13.4	p=0.001 (Kruskal Wallis test)
Gallbladder has large and thick wall	35.4±14.3	
Gallbladder necrosis	62.7±18.2	
Stone stuck in Gallbladder neck	55.5±17.4	
Group of surgeons		
Surgeons with less than 30 cases of experience	38.3±10.3	p=0.004 (Kruskal Wallis test)
Surgeons with 30-50 cases of experience	43.3±24.2	
Surgeons with over 50 cases of experience	28.4±16.4	

In our study, the average time to reach CVS was 35.8 ± 19.5 minutes. Recorded the shortest time to reach CVS is 10 minutes, the longest time to reach CVS is 90 minutes.

3.2.4. Complications during surgery

Table 3.7. ***Complications during surgery***

Symptoms	Number of patients		Ratio (%)
Bleed	9 cases	6 cases when dissected to achieve CVS	10.3
		3 cases after achieving CVS	
Perforated gallbladder	7 cases	4 cases when dissected to achieve CVS	8.0
		3 cases after achieving CVS	
Biliary tract injured	0		0
Other organ damage	0		0

* Bleeding complications

Table 3.8. ***Describe bleeding complications according to injury and time of surgery***

	Bleed	No bleeding	p
Condition of the gallbladder			
Gallbladder is not big, Gallbladder wall is not thick	0	39	p<0.01(Fisher's test)
Gallbladder has large and thick wall	3	34	
Gallbladder necrosis	6	1	
Stone stuck in Gallbladder neck	0	4	
Degree of hepatocystic triangle adhesion inflammation			
No inflammation	1	51	p<0.01(Fisher's test)
Little inflammation	0	19	
There is a lot of inflammation	8	8	

* Gallbladder perforation

Table 3.9. ***Describe complications of gallbladder perforation according to injury and time of surgery***

	Perforated gallbladder	No gallbladder perforation	p
Condition of the gallbladder			
Gallbladder is not big, Gallbladder wall is not thick	2	37	p<0.01 (Fisher's test)
Gallbladder has large and thick wall	0	37	
Gallbladder necrosis	3	4	
Stone stuck in Gallbladder neck	2	2	
Degree of hepatocystic triangle adhesion inflammation			
No inflammation	3	49	p=0.026 (Fisher's test)
Little inflammation	0	19	
There is a lot of inflammation	4	12	

3.2.5. Complications after surgery

All patients were monitored from the first day after surgery until discharge, with follow-up visits 14 days and 30 days after discharge. All patients after surgery receive routine ultrasound. Ultrasound results on the first day after surgery revealed that 9 patients (10.3%) had fluid collection in the gallbladder bed. Assessing the size of the seroma, there were 7 cases with seroma size smaller than 30 mm and 2 cases with seroma larger than 30 mm. 2 cases (2.3%) of surgical wound infection were treated medically

Table 3.10. ***Status of fluid collection on ultrasound according to lesion group and time of surgery***

	Seroma	No seroma	p
Condition of the gallbladder			
Gallbladder is not big, Gallbladder wall is not thick	0	39	p<0.01 (Fisher's test)
Gallbladder has large and thick wall	4	33	
Gallbladder necrosis	4	3	
Stone stuck in Gallbladder neck	1	3	
Degree of hepatocystic triangle adhesion inflammation			
No inflammation	0	52	p<0.01 (Fisher's test)
Little inflammation	0	19	
There is a lot of inflammation	9	7	

IV. DISCUSSION

4.1. General characteristics

4.1.1. Age and gender

Research results showed that the average age of patients was 53.2 ± 13.1 years; The youngest age is 17 years old, the oldest age is 83 years old. The most common age group from 40-60 accounts for 50.6%. As well as Nassar's research3, has an average age of 53.2 years. In our study, cases successfully achieving CVS were distributed in many different age groups, so we believe that age does not affect the success rate of achieving CVS. The study showed that there were 60 cases (67.4%) female and 28 cases (32.6%) male, the female to male ratio was approximately 2:1. Research by Do Trong Hai4 : the female to male ratio is 3:1. This is consistent with the literature. Almost all cases achieved CVS, so we found that gender did not affect the rate of achieving CVS.

4.1.2. Group of surgeons

In our study, there were 3 groups of surgeons classified based on the number of LC cases they had ever performed, a group of surgeons who had performed less than 30 cases, a group of surgeons who had performed 30-50 cases, and a group of surgeons who had performed surgery on less than 30 cases. performed over 50 cases. both cases of stone stuck in the neck and necrotizing gallbladder failed in performing CVS were performed by doctors with extensive experience with more than 50 gallbladder cutting cases. All young doctors with less than 30 cases of experience and the group of doctors with 30-50 cases of gallbladder cutting experience successfully performed CVS. In this study, we found that the success rate of achieving CVS is not affected by the surgeon's experience

4.1.3. Time of surgery (calculated from the first symptom) for cases of AC caused by stones

Of the 28 cases diagnosed with AC, 15 cases were operated on before 72 hours, and 13 cases were operated on after 72 hours. Vu Bich Hanh5Statistics of 60 cases of emergency laparoscopic surgery to treat AC caused by stones: 27 cases (45%) had surgery < 72 hours and 33 cases (55%) had surgery ≥ 72 hours, difficult to identify the hepatocystic triangle in 26 cases (43.3%): surgery group < 72 hours 8 cases (29.62%), surgery group ≥ 72 hours 18 cases (54.5%). The overall complication rate was 13.3%, converted to open surgery in the surgery group <72 hours in 2 cases (7.4%), in the surgery group ≥72 hours in 5 cases, the

author recommends early surgery within 72 hours to treat AC.

4.2. Intraoperative characteristics

4.2.1. Gallbladder condition and degree of adhesion inflammation in the hepatocystic triangle

In this study, there were 39 cases of gallbladder without signs of inflammation. 37 cases of large gallbladder with thick walls; this is one of the factors that causes many difficulties for pt. in our study, there were 8 cases of necrotizing gallbladder. of these, there were 7 successful cases achieving cvs, accounting for 87.5%. in necrotizing gallbladder, endoscopically removing the gallbladder is a challenge for the surgeon because the gallbladder is highly inflamed, pus-filled, necrotic, difficult to handle, and difficult to identify the anatomical structure. today, laparoscopic surgery is still performed safely and effectively on patients with necrotizing gallbladder3. our study has 5 cases of stones stuck in the gallbladder neck. According to Nassar3, the rate of achieving CVS was only 60% for the gallbladder group with stones stuck in Hartmann's pocket. However, this author's study had 175 cases in the group of stones stuck in the gallbladder neck, much larger than our study. We believe that most cases of stones stuck in the neck of the gallbladder have moderate to severe inflammation and the larger the stone, the more difficult it will be to clearly dissect the biliary triangle and expose the lower 1/3 of the gallbladder bed, so it is possible that failure increases when performing CVS in these cases. In our study, there were 18 cases (20.2%) of a lot of adhesive inflammation, 19 cases (21.3%) of a little adhesive inflammation and 52 cases (58.5%) of no adhesive inflammation.

4.2.2. Success rate of achieving CVS

In our study, the rate of achieving CVS was 97.8%. There were 2 cases of failure during surgery to achieve CVS. The failed cases include 1 case that did not achieve CVS due to large stones stuck in the neck of the gallbladder, narrowing and obscuring the hepatocystic triangle, and 1 case of necrotizing gallbladder, the hepatocystic triangle was so inflamed and adhesive that they had to be treated. I cut the gallbladder from the base, dissecting the gallbladder wall closely to the funnel and canal. Then the forceps cut the gallbladder tube and gallbladder artery. Complete surgery safely. There were no cases requiring conversion to open surgery.

In this study, we found that the success rate of achieving CVS is not affected by the surgeon's experience, the time of surgery in cases of AC as well as some other factors such as age and gender. Besides, the following factors: high level of hepatocystic triangle adhesion inflammation, state of stones stuck in the neck of the gallbladder, and necrosis of the gallbladder reduce the success rate of achieving CVS. When the inflammation of the gallbladder is more severe and the hepatocystic triangle is difficult to dissect, the likelihood of successfully achieving CVS decreases. In those cases, the surgeon can choose other techniques such as: taking pictures of the bile ducts during surgery, cutting gallbladder from the bottom, converting to open surgery. According to P. Sanjay6 , he had 447 cases of LC with 40% of AC cases, 58% of chronic gallbladder inflammation and 2% of symptomatic gallbladder stones. There were 388 (87%) cases achieving CVS, 59 (13%) cases not achieving CVS. due to inflammation in many areas of the

hepatocystic triangle, preventing clear delineation of the anatomy of this area. Among them, 12 cases that did not achieve CVS were converted to partial retrograde gallbladder resection. The remainder were converted to open surgery.

Regarding the CVS assessment scale in our study, the rate of failing CVS in front and back images when evaluated independently was higher than in couple images on both sides. In particular, the rate of failing CVS on the back (18.4%) is higher than on the front (6.9%). When comparing the rate of achieving CVS on the front and back between groups of gallbladder status and the level of adhesive inflammation of the hepatocystic triangle, we found a statistically significant difference. Among the groups of gallbladder conditions, the rate of achieving CVS on the front and back surfaces is the highest, reaching 100% in the group of gallbladder that are not large, the wall is not thick, and the lowest in the group of necrotic gallbladder, reaching only 42.8%. In cases with low levels of hepatocystic triangle adhesions, the rate of achieving CVS is 100%. In the group with severe hepatocystic triangle adhesions, the rate of not achieving CVS on the front was 37.5% and on the back was 18.75%. In all cases with double images combining both front and back sides, they achieve CVS. We have the same opinion as most authors, during the dissection process to achieve CVS, combining both the front and rear views will help make the assessment clearer.

4.2.3. Time to achieve CVS

In our study, the average time to reach CVS was 35.8 ± 19.5 minutes. When compared with JK Koong's research7, the time to reach CVS (average 22.8 ± 14.3 minutes) was shorter in our study. This difference we think is due to many different factors between the 2 studies. In the study, we found that the time to reach CVS in different surgeons groups was statistically significant (p=0.004). with our group of experienced surgeons in research, the average time to achieve CVS is 28.4±16.4 minutes, which is longer than Koong's results.

4.2.4. Complications during surgery

4.2.4.1. Bleeding

Bleeding is the leading complication in laparoscopic surgery. This complication often puts pressure on the surgeons and is one of the main reasons for conversion to open surgery. We encountered 9 cases of bleeding (10.3%), including 6 cases during surgery to achieve CVS, the amount of blood loss was from 50-100ml, no case required blood transfusion or open surgery. . In our study with cases of necrotic gallbladder, bleeding during surgery was statistically significantly more than other conditions (p<0.01). Bleeding occurs more frequently in the group with a lot of adhesion to the surrounding structures and a lot of adhesions in the hepatocystic triangle. These differences are statistically significant (p<0.01). However, this complication was not significantly different between the 3 groups of surgeons (p=0.61). Research by Nguyen Van Hai and Nguyen Tuan8 in 66 cases, there were 4 cases of heavy bleeding during surgery but did not require blood transfusion.

4.2.4.2. Gallbladder perforation

Our study had 7 cases of gallbladder perforation, of which 3 cases of gallbladder perforation (3.4%) occurred during surgery to get out of the gallbladder bed, the remaining 4 cases were perforation due to handling (4, 6%). In our study, the rate of

complications of gallbladder perforation had a statistically significant difference between groups of gallbladder conditions (p<0.001), in which the necrotic gallbladder group had the highest perforation rate of 3 out of 4 cases. It is almost rare for studies that apply CVS in LC to mention gallbladder perforation during surgery. Gallbladder perforation rate of Vu Bich Hanh5 is 11.6%.

4.2.4.3 Biliary tract injured

Our study included 87 patients with varying degrees of gallbladder inflamation and hepatobiliary triangle adhesions, operated on by 3 surgical groups. There were no cases of biliary tract injured. This result shows that less experienced doctors who are properly trained in performing CVS can avoid complications of biliary tract injured.

4.2.6. Complications after surgery

In our study, when applying CVS, postoperative complications including gallbladder bed fluid collection were 10.3%, surgical wound infection was 2.3%. Postoperative ultrasound examination results (performed on the first day after surgery) recorded 9 cases (10.3%) with gallbladder bed fluid collection. Of these, 7 cases had seroma size <30mm, 2 cases had seroma size >30mm. The inflamed and necrotic gallbladder group had a higher rate of fluid collection than the non-inflamed gallbladder group and had neck stones stuck in the neck with statistical significance (p<0.01). The rate of seroma according to surgeons group was not significantly different (p=0.147). In cases of post-operative seroma, we closely monitor the clinical situation and the size of the seroma through ultrasounds and then note that the size of the seroma has decreased, so we discharge the hospital like other cases and do not need intervention. any more cards? Our results do not differ much from previous studies. Vu Bich Hanh5 encountered 3 cases (5%), Nguyen Van Hai8 had 2 cases (3.0%) of fluid collection under the liver.

The above complications do not greatly affect the quality of treatment and the rate is not high. This shows that applying CVS in LC is safe, especially for groups of resident doctors and young doctors with little experience. And this technique should be thoroughly applied to the group of less inflamed gallbladder and is very practical for teaching and training general surgeons.

V. CONCLUSION

Applying CVS in LC Surgery at Binh Dan Hospital is completely feasible. High success rate, reaching 97.8%. General complications during surgery and complications after surgery are small and not serious. We find that CVS is a necessary, safe, and effective assessment technique.

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