Original Article

Patient Outcomes in Laparoscopic Cholecystectomy and Its Relationship with Achieving Critical View of Safety

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Abstract

Background: Laparoscopic cholecystectomy (LC) is the preferred method for treating gallbladder disease, particularly gallstones. However, bile duct injury (BDI) is still a serious complication that often happens due to misidentifying anatomy. To minimize these complications, Strasberg introduced the Critical View of Safety (CVS). This dissection technique helps ensure that the cystic duct and artery are correctly identified before cutting. The aim is to study the role of CVS in safe laparoscopic cholecystectomy and evaluate patient outcomes when CVS is achieved versus when it is not. **Material and Methods:** This observational study followed 147 patients with symptomatic gallstones who underwent laparoscopic cholecystectomy at TMMC&RC in Moradabad. The patients were divided into two groups: those who achieved CVS (Group A) and those who did not (Group B). The study compared the outcomes before, during, and after the operation. **Results:** CVS was achieved in 61.2% (n=90) and not achieved in 38.8% (n=57). Group B had a higher incidence of adhesions (43.9% vs 11.1%, p=0.002) and abnormal anatomy (12.3% vs 1.1%, p=0.034). Mean operative time was slightly longer in Group B (86.9 vs 82.4 min). One bile leak occurred in Group B. Post-op pain was marginally higher in Group B (6.07 vs 5.94). No major complications occurred in Group A. **Conclusion:** Achieving CVS greatly lowers intraoperative challenges and postoperative complications. It provides clear anatomy, which helps prevent bile duct injury. Making CVS a regular part of surgical training and procedures can improve patient safety and surgical results.

Keywords: Laparoscopic cholecystectomy, Critical view of Safety (CVS), Hepatocystic triangle, Bile Duct Injury, Fundus First approach, Subtotal cholecystectomy.

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Introduction

Laparoscopic cholecystectomy (LC) has become the standard treatment for gallstone disease. It is minimally invasive, leads to shorter hospital stays, and causes less postoperative discomfort than open surgery.[1] However, LC can have complications, with bile duct injury (BDI) being the most significant. The incidence of BDI ranges from 0.1% to 0.5% in large studies.[2,3] These injuries can lead to increased health problems, higher costs, and legal issues.

The main reason for BDI during LC is misidentifying anatomical structures, especially the cystic duct and common bile duct (CBD). This misinterpretation can happen because of inflammation, adhesions, anatomical variations, or lack of experience.[4,5]

To combat this issue, Strasberg introduced the Critical View of Safety (CVS) concept in 1995. The CVS involves dissecting the hepatocystic triangle, clearing fibrofatty tissue, exposing the cystic plate, and identifying only two structures leading into the gallbladder: the cystic duct and artery.[6] Achieving CVS lowers the chances of misidentifying structures, thereby minimizing BDI.[7]

Despite recommendations from professional groups like SAGES (Society of American Gastrointestinal and Endoscopic Surgeons),[8] CVS is not consistently used in practice. Factors like surgeon training, the difficulty of cases, and anatomical differences can affect the successful application of CVS.

This study aimed to compare outcomes in patients undergoing LC where CVS was achieved versus when it was not. We sought to find out if achieving CVS leads to safer surgeries, fewer complications, and better patient outcomes.

Materials and Methods

Study Design and Setting: This was a hospital-based, observational longitudinal study conducted in the Department of General Surgery, TMMC&RC, Moradabad over 18 months.

Sample Size: A total of 147 patients presenting with symptomatic gallstones and undergoing LC were enrolled. Sample size was calculated using the formula:

$n = Z^2 \times P(100 - P) / E^2$.

Inclusion Criteria

- Age >18 years

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- All sexes
- Symptomatic cholelithiasis (chronic calculus cholecystitis, recurrent biliary colic, acute cholecystitis, or mucocele)
- Patients providing informed written consent

Exclusion Criteria

- Coagulopathy
- Pregnancy
- Carcinoma gallbladder
- Choledocholithiasis or Mirizzi syndrome
- Planned open cholecystectomy
- Contraindications to laparoscopy or general anesthesia

Grouping

Patients were divided into:

- Group A – CVS Achieved during LC
- Group B – CVS Not Achieved

Surgical Procedure

LC was performed using standard 4-port technique under general anesthesia. Experienced surgeons with >100 prior LC cases independently performed the surgeries. CVS was attempted in all cases. If it could not be achieved due to anatomical distortion or inflammation, alternative safe dissection methods were employed.

Data Collection

- Demographics (age, gender)
- Intraoperative findings (adhesions, abnormal anatomy)
- Operative time (from 1st port to last port exit)
- Postoperative complications (bile leak, pain score)

Statistical Analysis: Data were analyzed using SPSS. Chi-square and t-tests were used. A p-value <0.05 was considered statistically significant.

Results

A total of 147 patients undergoing laparoscopic cholecystectomy (LC) were included in the study. The mean age was 38.01 ± 12.26 years, with the majority being female (87.8%), which aligns with the known higher prevalence of gallstone disease in females [21]. Symptomatic cholelithiasis was the diagnosis in all patients. [Table 1].

The critical view of safety (CVS) was achieved in 61.2% (n=90) of cases (Group A) and not achieved in 38.8% (n=57) (Group B). Adhesions were significantly more common in Group B (43.9%) compared to Group A (11.1%) (p=0.002). Additionally, abnormal anatomy was observed in 12.3% of Group B versus 1.1% in Group A (p=0.034), indicating a statistically significant difference. [Table 2]

Posterior and anterior dissection was performed in all patients across both groups. The mean time from first port insertion to exit of the last port was slightly longer in the CVS not-achieved group (86.91 ± 19.98 minutes) than in the CVS-achieved group (82.41 ± 20.75 minutes), although the difference was not statistically significant (p=0.059). [Table 4]

Bile leakage occurred in one patient (1.8%) in Group B and in none of the patients in Group A (p=0.067), suggesting a trend toward safer outcomes with CVS achievement. Postoperative pain scores were comparable between the groups, though marginally higher in Group B (6.07 ± 0.79) compared to Group A (5.94 ± 0.81) (p=0.198). [Table 5].

Table 1: Demographic Data

Parameter	Group A (n=90)	Group B (n=57)
Mean Age (yrs)	38.01 ± 12.3	38.01 ± 12.3
Female (%)	88%	88%
Male (%)	12%	12%

Table 2: Adhesions

Adhesions Present	Group A	Group B	p-value
Yes	11.1%	43.9%	0.002*
No	88.9%	56.1%	

Table 3: Anatomical Variations

Anatomy	Group A	Group B	p-value
Abnormal	1.1%	12.3%	0.034*
Normal	98.9%	87.7%	

Table 4: Operative Time

Metric	Group A	Group B	p-value
Mean time (min)	82.4	86.9	0.059

Table 5: Bile Leak

Bile Leak	Group A	Group B	p-value
Yes	0	1.8%	0.067
No	100%	98.2%	

Table 6: Postoperative Pain Score

Score (0–10)	Group A	Group B	p-value
Mean Pain	5.94	6.07	0.198

Discussion

Laparoscopic cholecystectomy has changed how we treat gallstones. However, bile duct injuries remain a significant concern. The main cause of these injuries is misidentifying anatomical structures during surgery, particularly when there is inflammation, adhesions, or congenital issues.

Strasberg introduced the Critical View of Safety (CVS), which has greatly improved surgical safety. CVS requires complete clearing of the hepatocystic triangle and identifying only two structures entering the gallbladder: the cystic duct and the artery, before making any cuts. Our study found that CVS was achieved in 61.2% of cases. This aligns with existing research showing variable success rates between 40% and 90%, depending on training and case complexity.

We noticed significant differences in surgical conditions and outcomes between cases with and without CVS. Adhesions were more common in the non-CVS group (43.9% vs. 11.1%, p=0.002), as were abnormal anatomical findings (12.3% vs. 1.1%, p=0.034). These factors are well-known challenges to reaching CVS, as supported by similar studies.

Although not statistically significant, the non-CVS group had slightly longer operative times, more bile leakage, and higher pain scores. Importantly, there were no bile duct injuries in any cases, suggesting that when CVS could not be achieved, other safe methods like the fundus-first approach or subtotal cholecystectomy were effectively used.

Education and training are essential. Despite the safety benefits, the low global adoption rate of CVS is often due to inadequate training, as shown in studies using video analysis. Programs focusing on CVS, including those based on simulation, have demonstrated improvements in surgical decision-making and practice.

Achieving CVS should be a key part of safe laparoscopic cholecystectomy. When it is not possible, recognizing this and applying timely conversion or alternative strategies is crucial.

Conclusion

This study confirms that achieving the Critical View of Safety during laparoscopic cholecystectomy significantly improves intraoperative clarity, reduces complications, and enhances patient outcomes. Incorporating CVS routinely and emphasizing it in surgical education are vital for reducing bile duct injuries and standardizing safe surgical practice.

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Conflicts of interest

There are no conflicts of interest.

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