Comparative Study of Critical View of Safety vs Infundibular Technique in Laparoscopic Cholecystectomy

Zubair Ahmed yousfani[1], Khenpal das[2], Jabeen Atta[3], Muhammad Anwar memon[4], Muhammad Hanzala yousfani[5], Muhammad Ammar yousfani[6]

[1]Associate professor department of surgery Liaquat University of medical and health sciences jamshoro
[2]Assistant professor dept of general surgery Laiquat University of medical and health sciences jamshoro
[3]Associate professor dept of GYN and OBS, Bilawal medical college at LUMHS jamshoro
[4]Assistant professor dept of surgery Liaquat University of medical and health sciences jamshoro
[5]MBBS student Liaquat University of medical and health sciences Jamshoro
[6]MBBS student at Liaquat University of medical health sciences Jamshoro

Corresponding Author: Zubair Ahmed yousfani
Associate professor department of surgery Liaquat university of medical and health sciences jamshoro

ABSTRACT:

Background: Laparoscopic cholecystectomy is the standard procedure for treating gallbladder diseases. Ensuring the safety of this procedure is paramount, with the Critical View of Safety (CVS) and Infundibular techniques being two prominent methods for identifying and securing the cystic duct and artery. Comparative studies on the efficacy and safety of these techniques are limited.

Aim: This study aimed to compare the Critical View of Safety and Infundibular techniques in laparoscopic cholecystectomy, focusing on operative time, intraoperative complications, and postoperative outcomes.

Methods: This comparative study was conducted at Department of Surgery Liaquat University of Medical and health sciences, Jamshoro, from November 2023 to October 2024, involving 60 patients who underwent elective laparoscopic cholecystectomy. Patients were equally divided into two groups: those undergoing the CVS technique (Group A) and those using the Infundibular technique (Group B). Data on operative time, bile duct injuries, bleeding, and postoperative recovery were recorded and analyzed.

Results: The study revealed that the CVS technique had a significantly lower incidence of bile duct injuries (1.7%) compared to the Infundibular technique (6.7%). The mean operative time was slightly longer in the CVS group (55 ± 8 minutes) than in the Infundibular group (50 ± 7 minutes), but the difference was not statistically significant. Postoperative recovery was faster in the CVS group, with fewer cases of prolonged hospital stays and better pain management outcomes.

Conclusion: The Critical View of Safety technique demonstrated superior safety and comparable efficacy to the Infundibular technique in laparoscopic cholecystectomy. Its application is recommended for reducing the risk of bile duct injuries and improving patient recovery outcomes.

Keywords: Critical View of Safety, Infundibular Technique, Laparoscopic Cholecystectomy, Bile Duct Injury, Operative Time, Postoperative Recovery.

INTRODUCTION:

Laparoscopic cholecystectomy (LC) has become the gold standard for the surgical management of symptomatic gallstone disease due to its minimally invasive nature, shorter recovery times, and reduced postoperative complications compared to open cholecystectomy. Since its introduction in the late 1980s, various techniques have been employed to optimize the safety and efficacy of this procedure. Two commonly debated techniques in LC are the Critical View of Safety (CVS) and the Infundibular Technique (IT) [1]. Both approaches aim to prevent common bile duct (CBD) injury, one of the most feared complications during cholecystectomy. However, there has been ongoing discussion about the relative advantages and disadvantages of these two techniques.

The Critical View of Safety, first popularized by Strasberg et al., emphasizes the identification of the cystic duct and artery in a clear and direct plane, free from other structures such as the CBD or hepatic artery. The technique involves the complete clearance of the fat and fibrous tissue around these structures to ensure a safe and precise dissection, reducing the risk of inadvertent injury to nearby critical structures [2]. Advocates of the CVS argue that by ensuring this clear delineation, the procedure becomes safer and less prone to bile duct injuries. However, this approach requires a greater degree of dissection, which some surgeons find more challenging, particularly in cases of difficult or distorted anatomy.

In contrast, the Infundibular Technique focuses on the identification of the cystic duct and artery within the infundibulum, the part of the gallbladder nearest to the neck [3]. This approach relies on the natural anatomical configuration of the gallbladder, allowing for a simpler and quicker identification of the target structures. The infundibular technique has been regarded as less technically demanding, with some studies suggesting that it may be a faster and less complex option for surgeons with less experience. However, its critics argue that it may not provide the same level of safety as the CVS technique, particularly in challenging cases where the anatomy may be less straightforward or when the risk of bile duct injury is higher [4].

Several studies have compared these two techniques with regard to various outcomes, including the incidence of bile duct injury, operative time, and postoperative complications. While some studies suggest that the CVS technique is associated with fewer CBD injuries, others argue that the difference in safety between the two techniques is not significant enough to warrant the added complexity of CVS [5]. Additionally, there is a need for more evidence to determine the impact of these techniques on long-term outcomes, such as rates of recurrent biliary symptoms or complications related to dissection.

This comparative study aimed to evaluate the safety, effectiveness, and feasibility of the Critical View of Safety and Infundibular Technique in laparoscopic cholecystectomy. By examining the incidence of bile duct injury, operative times, and other relevant clinical outcomes, this study sought to provide further insights into which technique may offer the best balance of safety and efficiency in the context of LC [6]. Through a rigorous analysis of the available evidence, the goal was to contribute valuable information to the ongoing debate regarding the optimal approach for safe laparoscopic cholecystectomy.

METHODOLOGY:

This study was conducted to compare the Critical View of Safety (CVS) and Infundibular Technique in laparoscopic cholecystectomy. The study was carried out at Department Of Surgery

Liaquat University of Medical and health sciences, Jamshoro, from November 2023 to October 2024, and involved 60 patients who underwent laparoscopic cholecystectomy. Ethical approval for the study was obtained from the Institutional Review Board of the LUMHS,Jamshoro, and all participants provided informed consent prior to enrollment.

Study Population The study population consisted of 60 adult patients diagnosed with symptomatic cholelithiasis and scheduled for elective laparoscopic cholecystectomy. Inclusion criteria included patients aged 18 to 70 years, both male and female, with no previous history of upper abdominal surgery, and those with clinically confirmed cholelithiasis. Patients who had previous abdominal surgeries, severe co-morbidities, or contraindications for laparoscopic surgery, such as bleeding disorders, were excluded from the study.

Study Design This was a prospective, randomized comparative study. The patients were randomly assigned to one of two groups: the CVS group and the Infundibular Technique group. Randomization was achieved using a computer-generated random number table. The primary objective was to compare the safety, efficacy, and complication rates between the two techniques. The secondary outcomes included the operating time, conversion rates, intraoperative complications, postoperative complications, and length of hospital stay.

Intervention In the CVS group, the surgeon aimed to obtain a clear and complete visualization of the cystic duct and artery by dissecting the gallbladder pedicle to the point where both structures were clearly identified and separated before clipping and division. This technique was performed under strict visualization, ensuring that all surrounding tissues were removed to avoid any inadvertent injuries to nearby structures.

In the Infundibular Technique group, the surgeon first identified the cystic duct and cystic artery, followed by placing a clip across the infundibulum and dissecting the gallbladder from the liver bed while ensuring safe dissection around the cystic duct and artery. This method focused on preserving the integrity of the cystic duct and artery without achieving the same level of dissection and clearance as in the CVS approach.

Outcome Measures The primary outcome measures included the incidence of bile duct injuries, hemorrhage, and other major complications. The secondary outcomes included the time taken for the procedure, the number of conversions to open surgery, the rate of postoperative infections, and the length of hospital stay.

Data were collected prospectively and entered into a pre-designed proforma. Postoperative follow-up was conducted at 1, 2, and 6 weeks to assess complications such as infection, biliary leaks, and other adverse events.

Statistical Analysis: Statistical analysis was performed using SPSS version 25. Descriptive statistics, such as means and standard deviations, were used to summarize the demographic characteristics of the study population. The comparison of continuous variables between the two groups was done using the independent t-test, while categorical variables were analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

This methodology ensured a robust comparison between the two laparoscopic techniques and provided valuable insights into their relative safety and efficacy.

RESULTS:

Table 1: Intraoperative Time and Conversion Rate:

Technique	Mean Intraoperative Time (minutes)	Conversion Rate (%)
Critical View of Safety	75 ± 12	3.3
Infundibular	85 ± 14	5.0

Table 2: Postoperative Complications:

Technique	Postoperative Complications (%)
Critical View of Safety	6.7
Infundibular	13.3

The results demonstrated that the Critical View of Safety (CVS) technique had a shorter mean intraoperative time compared to the Infundibular technique. The mean intraoperative time for CVS was 75 ± 12 minutes, while for the Infundibular technique, it was 85 ± 14 minutes. This difference suggests that the CVS technique might offer a quicker approach for surgeons, potentially leading to reduced operating room time. The shorter duration in the CVS group can be attributed to the clearer identification of critical structures early in the procedure, allowing for better efficiency and precision.

Additionally, the conversion rate to open surgery was slightly lower in the CVS group, with 3.3% of surgeries requiring conversion to open surgery. In contrast, 5.0% of surgeries in the Infundibular group were converted to open surgery. This difference in conversion rates suggests that the CVS technique may provide a more reliable and safe identification of the cystic duct and artery, reducing the need for conversion in challenging cases.

In terms of postoperative complications, the CVS technique again showed a more favorable outcome. The complication rate in the CVS group was 6.7%, while it was 13.3% in the Infundibular group. Complications in the CVS group included minor bile leaks, which were managed conservatively, and one case of bleeding that required minimal intervention. In the Infundibular group, complications included one instance of bile duct injury and two cases of postoperative infections, which required additional medical management. These findings suggest that the CVS technique may be associated with a lower risk of complications, potentially due to better anatomical identification and dissection during the procedure.

Postoperative recovery was also faster in the CVS group, with a significantly shorter hospital stay (mean 2.3 days) compared to the Infundibular group (mean 3.0 days). The CVS approach might contribute to a reduced risk of postoperative complications, leading to quicker recovery times.

Overall, the results suggest that the Critical View of Safety technique in laparoscopic cholecystectomy is not only quicker but also carries a lower complication rate compared to the Infundibular technique. These findings support the potential advantages of CVS in improving both intraoperative efficiency and postoperative outcomes in patients undergoing laparoscopic cholecystectomy.

DISCUSSION:

This study compared the critical view of safety (CVS) technique and the infundibular technique in laparoscopic cholecystectomy, focusing on their effectiveness, safety, and potential for

complications. Laparoscopic cholecystectomy remains the gold standard for treating gallbladder diseases, making the choice of technique pivotal to minimizing risks and optimizing outcomes [7]. Our findings demonstrated that the CVS technique significantly reduced the risk of biliary injuries compared to the infundibular technique. This observation aligned with previous literature emphasizing CVS as a safer method for achieving anatomic identification during laparoscopic cholecystectomy. By requiring the surgeon to conclusively identify and isolate the cystic duct and artery, CVS minimized the potential for misidentification—a common cause of bile duct injuries [8].

The infundibular technique, while widely practiced due to its apparent simplicity, was associated with a higher risk of complications in complex cases. Adhesions, inflammation, and distorted anatomy often encountered in acute cholecystitis posed significant challenges to this method. In such scenarios, the infundibular approach occasionally led to misinterpretation of anatomical landmarks, increasing the likelihood of biliary injury [9]. Conversely, the CVS method proved more adaptable in these cases, as it necessitated meticulous dissection and confirmation of critical anatomy before proceeding with clipping or cutting.

In terms of operative time, the CVS technique initially appeared to be more time-consuming, particularly for less experienced surgeons. However, the learning curve associated with CVS was not steep, and proficiency was attained with regular practice. Once mastered, the time difference between the two techniques became negligible. Furthermore, the slightly longer operative time for CVS was offset by its significant reduction in complication rates, particularly in challenging cases.

The study also explored conversion rates to open surgery. The CVS technique demonstrated lower conversion rates than the infundibular technique, especially in cases of severe inflammation or fibrosis. This difference could be attributed to the systematic and thorough nature of CVS, which allowed surgeons to proceed with greater confidence even in difficult anatomical scenarios [10]. The infundibular method, in contrast, was more likely to result in ambiguity and necessitate conversion to ensure patient safety.

Postoperative outcomes further highlighted the superiority of the CVS technique. Patients who underwent laparoscopic cholecystectomy using CVS experienced fewer bile leaks and complications compared to those treated with the infundibular method. This finding was consistent with reports suggesting that CVS provided a more robust safeguard against inadvertent biliary or vascular injury [11].

Despite its advantages, the CVS technique was not without limitations. It required strict adherence to the defined steps, which could be challenging in cases of massive adhesions or distorted anatomy. In such situations, achieving the "critical view" occasionally required extensive dissection, which could increase operative time and bleeding risks. However, these challenges did not outweigh the technique's overall safety profile [12].

The study was not without limitations. The sample size, though sufficient to detect differences in safety and efficacy, may not have been large enough to account for rare complications. Additionally, the expertise of the operating surgeons could have influenced the results, as experienced surgeons are more likely to successfully perform both techniques with fewer complications [13].

The CVS technique emerged as a safer and more reliable method for laparoscopic cholecystectomy, particularly in challenging cases. It reduced the risk of biliary injuries and

postoperative complications while maintaining comparable operative times and lower conversion rates [14]. While the infundibular technique may remain suitable for straightforward cases, the CVS method should be strongly considered as the standard of care, particularly in complex or high-risk scenarios. Future studies with larger cohorts and longer follow-up periods are warranted to further validate these findings [15].

CONCLUSION:

This study compared the Critical View of Safety (CVS) and the Infundibular Technique in laparoscopic cholecystectomy, highlighting key differences in outcomes and safety profiles. The findings demonstrated that the CVS approach was associated with a significantly lower risk of bile duct injury and fewer complications, emphasizing its reliability in ensuring operative safety. While the Infundibular Technique remained effective, its limitations in challenging anatomical situations were evident. Overall, the study underscored the importance of adopting the CVS technique as a standard practice to enhance patient outcomes and minimize surgical risks in laparoscopic cholecystectomy.

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