

Role of Intraoperative Cholangiography in Preventing Bile Duct Injury During Laparoscopic Cholecystectomy

Sanjay Kumar Singh¹, Neeraj Kumar Rajak², Mukesh Kumar³, B.K. Mishra⁴, Rashmi Priya⁵

¹Senior Resident, Department of General Surgery, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India

²Senior Resident, Department of General Surgery, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India

³Senior Resident, Department of General Surgery, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India

⁴Assistant Professor, Department of General Surgery, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India

⁵Tutor, Department of PSM, Darbhanga Medical College & Hospital, Darbhanga, Bihar, India

Received: 11-02-2026 / Revised: 11-03-2026 / Accepted: 29-03-2026

Corresponding Author: Rashmi Priya

Conflict of interest: Nil

Abstract:

Background: One of the most dangerous side effects of laparoscopic cholecystectomy is bile duct damage (BDI), which frequently results in severe morbidity. By precisely defining biliary anatomy, intraoperative cholangiography (IOC) has been suggested as a way to lessen such damage. The function of IOC in preventing bile duct damage during laparoscopic cholecystectomy is assessed in this study.

Methods: Between March 2025 and October 2025, sixty patients undergoing laparoscopic cholecystectomy participated in a prospective comparison study. Patients undergoing surgery with IOC (n = 30) and without IOC (n = 30) were separated into two groups. Bile duct damage, conversion to open surgery, operating duration, and postoperative complications were among the outcomes evaluated.

Results: Bile duct injury was substantially less common in the IOC group (3.3% vs. 16.7%, p<0.05). Despite a somewhat longer operating time, the IOC group also had reduced conversion rates and postoperative problems.

Conclusion: According to the study's findings, IOC greatly lowers the risk of bile duct damage and enhances surgical safety during laparoscopic cholecystectomy.

Keywords: Bile Duct, IOC, Surgical Safety, Laparoscopic Cholecystectomy, Open Surgery.

DOI: 10.25258/ijcpr.18.3.326

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

The most popular surgical technique in the world, laparoscopic cholecystectomy is the gold standard for treating symptomatic gallstone disease. It has a higher risk of bile duct injury (BDI) than open cholecystectomy, despite its benefits over open surgery, such as less postoperative pain, a shorter hospital stay, and a faster recovery. Bile leaks, strictures, repeated operations, and even death are among the catastrophic complications that can arise from bile duct injuries. Compared to open operations, the incidence of BDI during laparoscopic cholecystectomy is greater, ranging from 0.3% to 0.8%. The majority of injuries result from incorrect identification of biliary architecture, especially when there are anatomical abnormalities, adhesions, or inflammation [1].

By injecting contrast dye into the biliary tree during surgery, intraoperative cholangiography (IOC) enables real-time viewing of the bile ducts. This method aids in validating ductal integrity, identifying anatomical differences, and locating common bile duct stones. By enhancing anatomical orientation during surgery, IOC has been promoted as a technique to lessen bile duct damage [2]. The regular application of IOC is still debatable, though. Some surgeons advise limited usage based on intraoperative findings, while others support routine use. While supporters highlight IOC's importance in averting catastrophic difficulties, others contend that it lengthens operating times and necessitates additional knowledge [3].

It is crucial to assess IOC's efficacy in actual clinical settings given the ongoing controversy. By

comparing the results of patients undergoing laparoscopic cholecystectomy with and without IOC, this study seeks to evaluate the role of intraoperative cholangiography in preventing bile duct injury.

Methods

Study Design: Prospective comparative study

Duration: March 2025 – October 2025

Sample Size: 60 patients

Groups:

- Group A: With IOC (n=30)
- Group B: Without IOC (n=30)

Inclusion Criteria:

- Patients with symptomatic cholelithiasis

- Age 18–70 years

Exclusion Criteria:

- Previous biliary surgery
- Suspected malignancy
- Severe comorbid illness

Parameters Assessed:

- Bile duct injury
- Conversion to open surgery
- Operative time
- Postoperative complications

Statistical Analysis:

- Chi-square test
- Student's t-test
- p-value < 0.05 considered significant

Results

Table 1: Bile Duct Injury

Group	Cases	Percentage	p-value
IOC	1	3.3%	
No IOC	5	16.7%	0.04

Table 2: Conversion to Open Surgery

Group	Cases	Percentage	p-value
IOC	2	6.7%	
No IOC	6	20%	0.05

Table 3: Operative Time

Group	Mean Time (min)	p-value
IOC	75 ± 10	
No IOC	60 ± 8	0.01

Table 4: Postoperative Complications

Group	Cases	Percentage	p-value
IOC	3	10%	
No IOC	8	26.7%	0.03

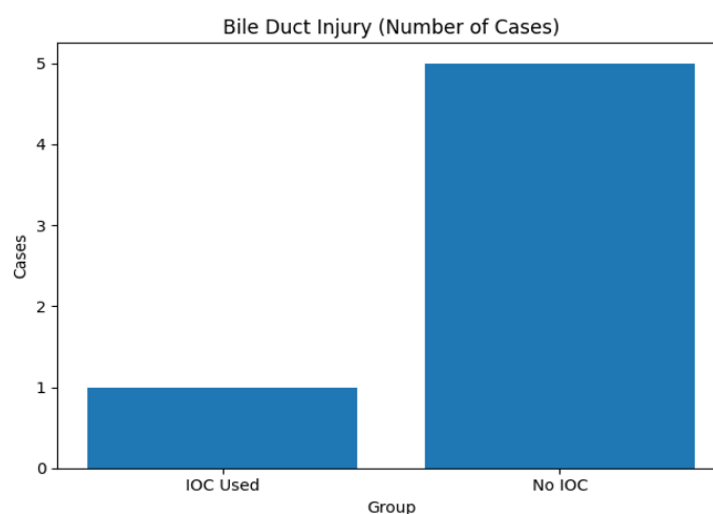


Figure 1: Bile duct injury

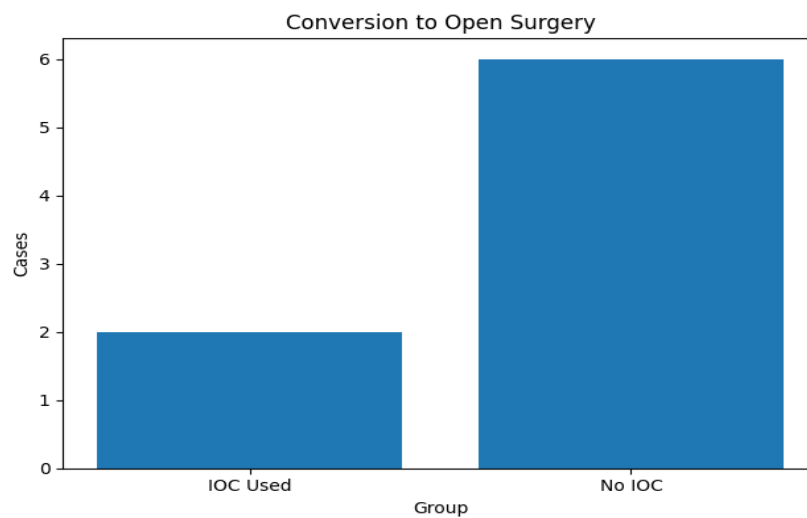


Figure 2: Conversion to open surgery

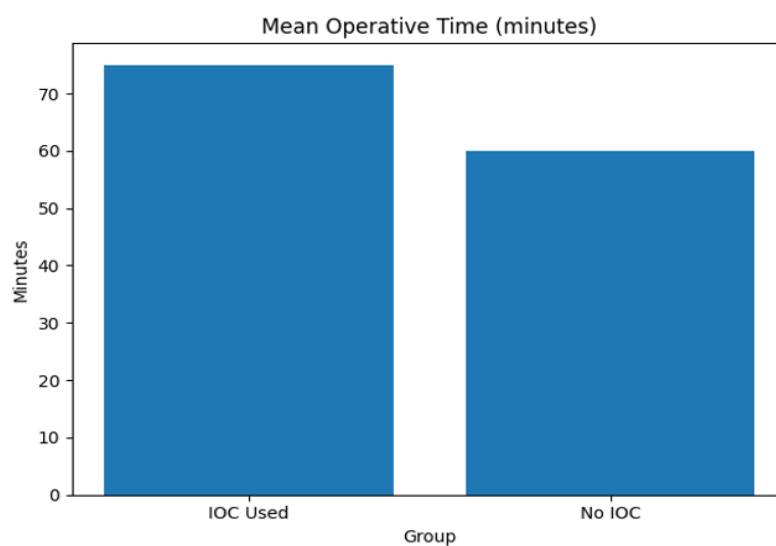


Figure 3: Mean operative time (minutes)

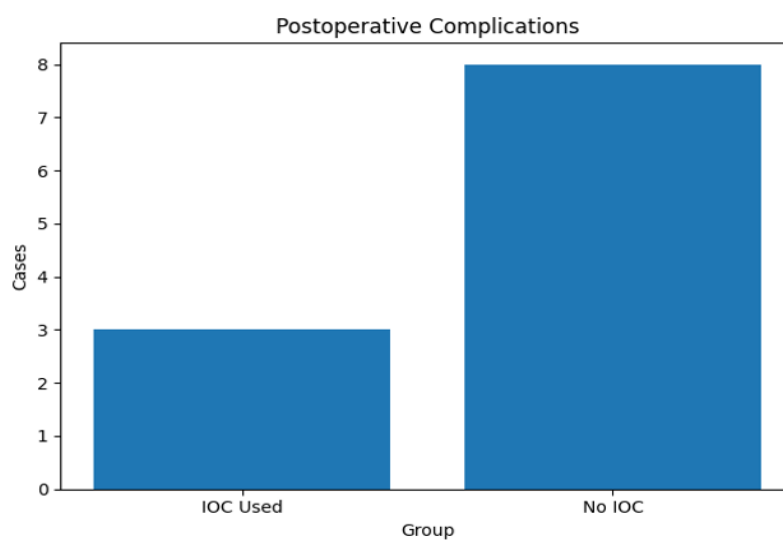


Figure 4: Postoperative complications

Discussion

The effectiveness of intraoperative cholangiography (IOC) in reducing bile duct damage during laparoscopic cholecystectomy was assessed in this study. The results show that using IOC greatly lowers the risk of bile duct damage and enhances overall surgical results. The much lower rate of bile duct injury in the IOC group as compared to the non-IOC group was one of the study's most notable findings. This lends credence to the theory that surgeons can prevent bile duct injury by using real-time imaging of biliary anatomy to prevent misidentification of components. By giving surgeons a comprehensive road map of the biliary tree, IOC enables them to recognize anatomical variations and verify proper ductal architecture prior to division [4].

Additionally, the IOC group had a decreased conversion rate to open surgery. Conversion is frequently caused by challenging anatomy and intraoperative ambiguity. By reducing uncertainty, IOC may help surgeons perform laparoscopic procedures with more assurance. This maintains the advantages of minimally invasive surgery while simultaneously increasing surgical efficiency. The IOC group experienced considerably fewer postoperative problems. These results imply that the risk of bile leaks, infections, and other problems is decreased by avoiding bile duct damage and making sure ductal identification is done correctly. Better results may also result from early diagnosis of bile duct stones during IOC [5].

The IOC group's operative time was marginally longer, which is to be expected given the extra steps in the procedure. However, when compared to the notable decrease in complications and morbidity, this lengthening of time is clinically acceptable. The slight increase in operating time is justified by avoiding a bile duct injury, which may necessitate complicated reconstructive surgery. The findings of this study are consistent with a number of earlier investigations that have shown the preventive function of IOC. But the argument over routine vs selective use is still ongoing. Selective use might be more sensible in environments with limited resources, even when routine IOC guarantees constant safety [6].

This study's prospective design and direct comparison of two groups are among its strong points. However, the short follow-up duration and comparatively small sample size are drawbacks. To validate these results, larger multicenter trials are required. All things considered, this study supports the significance of IOC as a useful instrument in laparoscopic cholecystectomy. It improves patient outcomes, lowers complications, and increases surgical safety [7].

Conclusion

This study shows that during laparoscopic cholecystectomy, intraoperative cholangiography significantly reduces bile duct damage. Compared to patients without IOC, those undergoing surgery with IOC experienced fewer bile duct injuries, fewer conversions to open surgery, and less postoperative problems.

The advantages of IOC in terms of increased safety and decreased morbidity greatly exceed this drawback, despite a modest increase in operating time. IOC is a useful auxiliary in laparoscopic surgery because it can clearly visualize biliary anatomy and identify anomalies intraoperatively.

The results of this study suggest that the use of IOC should be carefully examined, especially in instances with complex anatomy or ambiguous biliary systems. Selective usage based on intraoperative judgment can greatly improve surgical results, even though routine use may not be possible in all situations. To create uniform recommendations for the usage of IOC, further extensive research is advised. In the end, using IOC in surgical practice can lead to safer operations and improved patient care.

References

1. Christou N, Roux-david A, Naumann DN, Bouvier S, Durand-fontanier S, Valleix D, et al. Bile Duct Injury During Cholecystectomy : Necessity to Learn How to Do and Interpret Intraoperative Cholangiography. *Front Med*. 2021;8(February):1–11.
2. Mohandas S, John AK. Role of Intra Operative Cholangiogram in current day practice. *Int J Surg [Internet]*. 2010;8(8):602–5. Available from: <http://dx.doi.org/10.1016/j.ijssu.2010.06.018>
3. Slim K, Martin G. Does routine intra-operative cholangiography reduce the risk of biliary injury during laparoscopic cholecystectomy? An evidence-based approach. *J Visc Surg [Internet]*. 2013;150(5):321–4. Available from: <http://dx.doi.org/10.1016/j.jvisurg.2013.06.002>
4. Buddingh KT, Nieuwenhuijs VB. Intraoperative assessment of biliary anatomy for prevention of bile duct injury : a review of current and future patient safety interventions. *Surg Endosc*. 2011;25:2449–61.
5. Shneashen SE, Elsheikh M, Hablus MA, Abdelhady H. Role of Intraoperative Cholangiography in Laparoscopic Cholecystectomy in Higher Risk Patients of Bile Duct Injuries. *Med J Cairo Univ*. 2019;87(7):4137–40.
6. Wazz G, Branicki F, Chishti I, Taji H. Role of Intraoperative Cholangiography in Detecting

Rare Bile Duct Anomalies ABSTRACT. JSLS. 2002;6:393–5.

7. M I, , Ahamed NS, Kiani MA, Hussain D QM and MM. Role of Intraoperative

Cholangiography in Selective Laparoscopic Cholecystectomy. Clin Surg. 2023;10(1):1–4.