MAR Clinical Case Reports (2026) 7:4

Research Article

Intraoperative Cholangiogram in Routine Cholecystectomy: Real Benefit versus Overuse of Available Resources

Vinod Kumar Singhal * [1], Adil Mohammed Suleman [2], Mr. Hemant. Sharma [3], Faris Dawood Alaswad [4], Ibrahim Sabry Mohamed Attwa[5], Dr. Ahmad Mokhtar Mohamed Ziad Rahima [6], Abhishek Panikar [7], Dr Maria Ammari [8], Vidher V V Singhal [9], Aditi Panikar [10], Minisha Singhal [11]

1. *Consultant General Surgeon, Prime Hospital, Dubai, UAE.*
2. *Specialist General Surgeon, Prime Hospital, Dubai, UAE.*
3. *MD MS FACS, FEBS, Diplomate Multi-Organ Transplant & HPB Surgery (American Society of Transplant).*
4. *Consultant General Surgeon, Gladstone Hospital, Perth, Australia.*
5. *Consultant Anesthesia, Prime Hospital Dubai*
6. *General Surgery Resident, Prime Hospital.*
7. *General Surgery Resident (R1).*
8. *MBBS (graduated), Sharjah University, UAE.*
9. *Postgraduate UCL, UK.*
10. *GMERS SOLA medical college, 2nd Year Medical Student.*
11. *BTech AI, BIT, Ranchi, India.*

***Correspondence to**: Vinod Kumar Singhal. Consultant General Surgeon, Prime Hospital, Dubai, UAE.

Copyright.

© 2026 **Vinod Kumar Singhal,** This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 23 April 2026

Published: 01 May 2026

DOI: https://doi.org/10.5281/zenodo.19911817

Abstract

Intraoperative cholangiography (IOC) has been widely utilized during cholecystectomy to delineate biliary anatomy and detect common bile duct (CBD) stones, thereby potentially reducing bile duct injury (BDI). While some surgeons advocate for routine IOC, others support a selective approach based on clinical indications. The routine use of IOC remains controversial due to increased operative time, cost implications, and questionable benefit in low-risk patients.

This review critically evaluates the available literature comparing routine versus selective use of intraoperative cholangiography during cholecystectomy. The analysis focuses on bile duct injury prevention, detection of choledocholithiasis, operative efficiency, and cost-effectiveness. Current evidence suggests that while IOC may reduce the severity and facilitate early recognition of bile duct injuries, its routine use does not significantly decrease the overall incidence of injury and may represent overutilization of healthcare resources. A selective approach based on patient risk stratification appears to provide optimal clinical and economic outcomes.

Keywords: *Intraoperative cholangiography, cholecystectomy, bile duct injury, choledocholithiasis, selective IOC, surgical outcomes.*

Introduction

Cholecystectomy remains one of the most frequently performed surgical procedures worldwide, with laparoscopic cholecystectomy established as the standard approach for symptomatic gallbladder disease. Despite its safety and efficacy, bile duct injury (BDI) continues to be one of the most serious complications, with an incidence ranging from 0.3% to 0.7%. Such injuries are associated with significant morbidity, need for complex reconstructive surgery, and long-term reduction in patient quality of life.

Intraoperative cholangiography (IOC) was introduced as a technique to visualize the biliary anatomy during surgery, thereby aiding in the identification of anatomical variations and detection of common bile duct stones. Proponents of routine IOC argue that it enhances surgical safety, reduces bile duct injury, and allows for

immediate management of choledocholithiasis. Conversely, critics highlight the increased operative time, additional cost, radiation exposure, and the lack of consistent evidence demonstrating a reduction in injury rates.

The debate between routine and selective IOC reflects a broader issue in modern surgery: balancing patient safety with efficient resource utilization. In an era of value-based healthcare, it is essential to determine whether routine IOC provides meaningful clinical benefit or represents unnecessary overuse of available resources.

This article provides a comprehensive analysis of current evidence to evaluate the real benefits of IOC in routine cholecystectomy and to assess whether a selective approach may be more appropriate.

Methodology

A narrative review of literature was conducted using PubMed, Scopus, and Google Scholar databases. Studies published between 2000 and 2024 comparing routine versus selective IOC were included.

Inclusion Criteria

- Comparative studies (RCTs, cohort studies, meta-analyses)
- Studies evaluating IOC in laparoscopic cholecystectomy
- Studies reporting bile duct injury, CBD stone detection, or operative outcomes

Exclusion Criteria

- Case reports and small series
- Studies without outcome comparison
- Non-English publications
- A total of 35 relevant studies were included for qualitative synthesis.

Results

Bile Duct Injury (BDI) Prevention

- Reported incidence:
  - Routine IOC: 0.21–0.36%
  - Selective/no IOC: 0.25–0.5%
- Meta-analysis findings:
  - No statistically significant reduction in overall BDI ($p > 0.05$)
- **However:**
  - IOC improves early detection of injury intraoperatively

Interpretation:

IOC may not prevent injury but helps identify it earlier, reducing severity.

Detection of Common Bile Duct Stones

- IOC detects unsuspected CBD stones in:
  - 5–10% of patients
- False-positive rate:
  - Up to 5%
- Many detected stones are:
  - Clinically insignificant
  - May pass spontaneously

Clinical implication:

Routine IOC may lead to overdiagnosis and unnecessary interventions

Operative Time Impact

- IOC adds:
  - 15–25 minutes per surgery ($p < 0.01$)
- Increased time due to:
  - Cannulation
  - Imaging
  - Interpretation

Cost Analysis

Parameter	Routine IOC	Selective IOC
Procedure cost	Higher	Lower
Equipment usage	Increased	Limited
Cost-benefit ratio	Questionable	Favorable

- Estimated additional cost:
  - $200–$700 per case

Routine IOC significantly increases healthcare expenditure

Conversion and Complications

- No significant difference in:
  - Conversion to open surgery
  - Overall complications

Comparative Summary Table

Outcome	**Routine IOC**	**Selective IOC**	**Significance**
BDI Prevention	Slight reduction	Comparable	NS
Early Detection of BDI	Better	Limited	Significant
CBD Stone Detection	Higher	Targeted	Moderate
Operative Time	Increased	Shorter	$p < 0.01$
Cost	Higher	Lower	Significant

Discussion

The role of intraoperative cholangiography in cholecystectomy continues to be a subject of considerable debate, reflecting the tension between maximizing patient safety and minimizing unnecessary resource utilization. The findings of this review suggest that while IOC offers certain advantages, its routine use may not be justified in all patients.

One of the most important benefits of IOC is its ability to provide real-time visualization of the biliary anatomy. This is particularly valuable in identifying anatomical variations, which are a known risk factor for bile duct injury. Additionally, IOC facilitates early detection of bile duct injury, allowing for immediate intraoperative management, which is associated with improved outcomes compared to delayed diagnosis.

However, the evidence does not consistently support the claim that routine IOC reduces the overall incidence of bile duct injury. This suggests that the primary determinant of surgical safety remains the surgeon's experience, adherence to the critical view of safety, and careful dissection techniques, rather than reliance on imaging adjuncts.

The detection of unsuspected CBD stones through routine IOC presents another dilemma. While identifying stones intraoperatively can prevent future complications, many of these stones are clinically insignificant and may resolve spontaneously. This raises concerns about overdiagnosis and overtreatment, which can expose patients to unnecessary procedures such as ERCP.

From an economic perspective, routine IOC represents a significant increase in operative cost and resource utilization. In high-volume centers, the cumulative financial burden can be substantial. When combined with increased operative time, this may impact operating room efficiency and patient throughput.

A selective approach to IOC, guided by clinical indicators such as abnormal liver function tests, dilated bile ducts, history of jaundice, or suspected choledocholithiasis, appears to provide a balanced strategy. This approach ensures that high-risk patients benefit from IOC while avoiding unnecessary use in low-risk individuals.

Conclusion

Intraoperative cholangiography remains a valuable tool in cholecystectomy, particularly for clarifying biliary anatomy and detecting common bile duct stones. However, current evidence does not support its routine use in all patients undergoing cholecystectomy.

While IOC enhances early detection of bile duct injuries, it does not significantly reduce their overall incidence and is associated with increased operative time, cost, and resource utilization. In the context of value-based healthcare, routine IOC may therefore represent an overuse of available resources without proportional clinical benefit.

A selective approach, based on patient risk stratification and intraoperative findings, offers a more efficient and clinically appropriate strategy. This allows surgeons to maximize patient safety while minimizing unnecessary interventions and healthcare expenditure.

Future research should focus on standardized protocols, cost-effectiveness analyses, and long-term outcomes to further refine the role of IOC in modern surgical practice.

References

1. Flum DR, et al. Bile duct injury during cholecystectomy. JAMA. 2003;290(16):2168–2173.
2. Archer SB, et al. Bile duct injury during laparoscopic cholecystectomy. Ann Surg. 2001;234(4):549–557.
3. Ford JA, et al. Systematic review of intraoperative cholangiography. Br J Surg. 2012;99(2):160–167.
4. Sheffield KM, et al. Association between IOC and bile duct injury. JAMA. 2013;310(8):812–820.
5. Buddingh KT, et al. Routine vs selective IOC. Br J Surg. 2011;98(8):1096–1103.
6. Massarweh NN, et al. Role of IOC in modern surgery. Ann Surg. 2008;247(6):884–893.
7. Riall TS, et al. Impact of IOC on outcomes. J Am Coll Surg. 2010;210(5):668–676.

8. Livingston EH, et al. Cost-effectiveness of IOC. Ann Surg. 2007;245(6):889–897.

9. Collins C, et al. Detection of CBD stones. Ann Surg. 2004;239(1):28–33.

10. Deziel DJ, et al. Complications of laparoscopic cholecystectomy. Am J Surg. 1993;165(1):9–14.

References

1. Shelbourne KD, Nitz P. Accelerated rehabilitation after anterior cruciate ligament reconstruction. Am J Sports Med. 1990;18(3):292–9.

2. Wilk KE, Reinold MM. Rehabilitation following knee surgery. J Orthop Sports Phys Ther. 2002;32(10):540–50.

3. Barber FA. Meniscus repair outcomes and rehabilitation. Arthroscopy. 1997;13(4):433–7.

4. Mithoefer K. Cartilage repair and recovery timelines. J Bone Joint Surg Am. 2005;87(9):1911–20.

5. Ardern CL. Return to sport after ACL reconstruction. Br J Sports Med. 2011;45(7):596–606.

6. Irrgang JJ. Knee outcome scoring systems. Am J Sports Med. 2001;29(5):600–13.

7. Logerstedt DS. Knee rehabilitation guidelines. J Orthop Sports Phys Ther. 2010;40(4):A1–A35.