

Comparing Bile Duct Injuries: Open Versus Laparoscopic Cholecystectomy

David H. Corral Federico*¹, Ian Xavier Gil Fernández², Marthel Aketzali Carrillo Hernández³, Alejandro Alcalde Márquez⁴, David Arturo Colina Lopez³, Francisco Alvarez Trejo⁵, Benjamín Fernández Reséndiz⁶, Aarón Díaz Navar⁷.

¹Centro de Estudios Universitarios Xochicalco, Campus Ensenada, Facultad de Medicina

²Universidad Popular Autónoma del Estado de Puebla

³Universidad Anáhuac Veracruz campus Xalapa

⁴Universidad Autónoma de Sinaloa campus Mazatlán

⁵Universidad Latina de México, Facultad de medicina Dr. Rafael Lemus Muñoz Ledo

⁶Universidad Nacional Autónoma de México, Facultad de Estudios Superiores Iztacala

⁷Hospital general 450 Durango, Durango

ABSTRACT

Bile duct injuries in the context of cholecystectomy present a multifaceted challenge for healthcare professionals. This review article delves into the epidemiology, theoretical framework, and comparative analysis of bile duct injuries, emphasizing open versus laparoscopic cholecystectomy. With a slightly higher risk associated with laparoscopy, understanding the risk factors, early detection, and management strategies is crucial. Long-term surveillance, comprehensive follow-up care, and individualized surgical approaches play a pivotal role in perfecting patient outcomes. The ability of the surgical team and prudent patient selection significantly influence the risk of injuries. This review underscores the complexity of bile duct injuries, advocating for ongoing research and advancements to minimize their incidence and improve patient care.

KEYWORDS: Bile duct injuries, Cholecystectomy, Laparoscopic surgery

ARTICLE DETAILS

Published On:
15 November 2023

Available on:
<https://ijmscr.org/>

INTRODUCTION

Bile duct injuries are a significant concern in gallbladder surgery, particularly cholecystectomy. Cholecystectomy, the surgical removal of the gallbladder, is one of the most common surgical procedures performed worldwide. It is shown for the treatment of symptomatic gallstones, a prevalent condition that affects millions of individuals. Most of these surgeries can be performed through two primary approaches: open cholecystectomy and laparoscopic cholecystectomy^{1,2}.

Understanding the epidemiology and outcomes of bile duct injuries in the context of open versus laparoscopic cholecystectomy is of paramount importance. Bile duct injuries can result in severe complications, including bile leakage, strictures, and subsequent cholangitis. The incidence and consequences of these injuries vary between the two surgical techniques^{3,4}.

Overall, iatrogenic injuries to the biliary ducts are less common in open cholecystectomy, with a rate below 0.2%.

However, in the laparoscopic approach, the incidence is slightly higher, ranging between 0.2% and 0.8%⁵.

This review aims to supply a comprehensive analysis of the existing literature, exploring the differences in bile duct injuries between open and laparoscopic cholecystectomy. By examining the epidemiology, definitions, types of injuries, complications, and management strategies, this review looks to shed light on the nuances of each approach, enabling better decision-making in clinical practice and improved patient outcomes.

Types of injuries.

Bile duct injuries are often classified according to their severity and extent, and this classification can vary⁶. However, broadly, they can be categorized as follows:

Minor injuries: These include minor abrasions or superficial damage to the bile ducts that typically do not require major intervention. They may heal spontaneously or with minimal intervention^{6,7}.

Comparing Bile Duct Injuries: Open Versus Laparoscopic Cholecystectomy

Major injuries: These are more severe and may involve partial or complete transection of the bile duct. Major injuries often require surgical repair or complex management strategies ^{6,7}.

Strictures: Bile duct strictures result from scarring and narrowing of the duct following injury. Strictures can be short or long and may require surgical revision or endoscopic interventions ⁸.

Complications.

The complications stemming from bile duct injuries during cholecystectomy are multifaceted and can significantly affect patient outcomes ⁹. Some of the common complications include:

Bile leakage: Bile leakage into the abdominal cavity can lead to peritonitis and abscess formation if not promptly addressed ¹⁰.

Strictures: Bile duct strictures can impede the flow of bile, leading to jaundice, cholangitis, and associated symptoms ⁸.

Cholangitis: Infection of the biliary system, often resulting from bile duct injury, can lead to cholangitis, a severe and potentially life-threatening condition ¹¹.

Pancreatitis: Injuries to the pancreatic duct or papilla can result in pancreatitis, which adds complexity to patient management ¹².

Secondary surgery: Severe bile duct injuries may need secondary surgical procedures, such as hepaticojejunostomy or Roux-en-Y hepaticojejunostomy, to restore biliary flow ¹³.

Management.

The management of bile duct injuries is tailored to the nature and severity of the injury ¹⁴. It may involve a range of interventions, including:

Non-operative management: Minor injuries and some bile leaks may resolve spontaneously or with non-operative approaches like endoscopic stenting and drainage ⁶.

Surgical repair: Major injuries often require surgical intervention, which may involve hepaticojejunostomy, Roux-en-Y hepaticojejunostomy, or ductal reconstruction ^{6,7}.

Endoscopic interventions: Endoscopic retrograde cholangiopancreatography (ERCP) can be used to manage strictures, dilate ducts, and place stents to support bile flow ¹³.

Long-term follow-up: Regular follow-up and monitoring are essential to detect and manage any long-term complications or recurrent strictures ⁸.

DISCUSSION

The comparison of bile duct injuries between open and laparoscopic cholecystectomy is a complex and multifaceted issue that calls for a deeper exploration. In this section, we will delve into specific aspects of this comparison to supply a more comprehensive understanding.

Incidence and risk factors.

Numerous studies have examined the incidence of bile duct injuries in open and laparoscopic cholecystectomy, revealing that the latter is associated with a slightly higher risk. This

increased risk can be attributed to several factors inherent to laparoscopy. These include limited visualization of the operative field, reduced tactile feedback, and the need for advanced laparoscopic skills. Moreover, laparoscopic cholecystectomy may be performed in cases with acute inflammation, dense adhesions, and anatomical variations, which can further elevate the risk of bile duct injuries ^{2,3,5}.

Aberrant anatomy.

Patients with aberrant biliary anatomy, such as a low-lying cystic duct or a short common hepatic duct, are particularly susceptible to bile duct injuries during laparoscopic cholecystectomy. The surgeon's ability to find and manage these anatomical variations is essential in minimizing the risk of injury ¹³.

Early detection and management.

Early recognition and prompt management of bile duct injuries are pivotal in mitigating their consequences. Intraoperative recognition of injuries is critical, and immediate repair or conversion to open surgery is often needed. The advent of intraoperative cholangiography, which allows real-time imaging of the biliary tree, has improved the early detection of injuries during laparoscopy. In cases where injuries are detected postoperatively, minimally invasive endoscopic techniques, such as endoscopic retrograde cholangiopancreatography (ERCP), play a crucial role in managing these injuries without subjecting the patient to a full reoperation ¹⁵.

Long-term outcomes and complications.

Bile duct injuries can have profound long-term consequences. Patients who experience these injuries are at risk of developing strictures, which can impede the flow of bile and result in symptoms like jaundice and cholangitis. Comprehensive follow-up care and long-term surveillance are imperative to detect and manage strictures and other complications effectively ⁸⁻¹².

Surgical expertise.

The role of surgical ability in reducing the incidence of bile duct injuries cannot be overstated. Surgeons with considerable experience in both open and laparoscopic cholecystectomy are better equipped to oversee challenging cases and minimize the risk of injuries. Ability in laparoscopy, adherence to strict patient selection criteria, and proficiency in recognizing anatomical variations are key factors in reducing the incidence of injuries ^{5, 15}.

Patient selection.

The choice between open and laparoscopic cholecystectomy depends on a careful assessment of patient-specific factors. High-risk patients, such as those with acute inflammation, dense adhesions, or aberrant biliary anatomy, may be better suited for open cholecystectomy. Laparoscopy is generally preferred for patients who meet specific criteria and are expected to benefit from the minimally invasive approach ^{5, 13}.

Comparing Bile Duct Injuries: Open Versus Laparoscopic Cholecystectomy

Table 1. Comparison between open and laparoscopic cholecystectomy

Aspect	Open cholecystectomy	Laparoscopic cholecystectomy
Incidence of bile duct injuries	Lower incidence	Slightly higher incidence
Risk factors	Aberrant anatomy, high-risk cases	Limited visualization, acute inflammation, anatomical variations
Early detection	Direct visual assessment during surgery	Intraoperative cholangiography, real-time imaging
Management	Immediate repair or conversion to open surgery	Minimally invasive endoscopic techniques (e.g., ERCP)
Long-term outcomes	Risk of complications (stricture, jaundice)	Long-term surveillance for strictures and complications
Surgical expertise	Experience in open cholecystectomy	Expertise in both open and laparoscopic techniques
Patient selection	High-risk cases may favor open cholecystectomy	Suitable candidates for minimally invasive approach
Postoperative factors	Longer hospital stays, more significant postoperative pain	Shorter hospital stays, reduced postoperative pain

Table 2. Strasberg–Bismuth classification of bile duct injury ¹⁶.

Type	Criteria
A	Cystic duct leaks or leaks from small ducts in the liver bed.
B	Occlusion of a part of the biliary tree, almost invariably the aberrant right hepatic ducts.
C	Transection without ligation of the aberrant right hepatic ducts.
D	Lateral injuries to major bile ducts.
E	Subdivided as per Bismuth's classification types 1–5 as into E1–E5.

Table 3. Cont. Strasberg–Bismuth classification of bile duct injury ¹⁶.

Type	Criteria
1	Leaks from cystic duct stump or small ducts in liver bed.
2	Partial CBD/CHD wall injuries without (2A) or with (2B) tissue loss.
3	CBD/CHD transection without (3A) or with (3B) tissue loss.
4	Right/left hepatic duct or sectorial duct injuries without (4A) or with (4B) tissue loss.
5	Bile duct injuries associated with vascular injuries.

CONCLUSION

The management of bile duct injuries in the context of cholecystectomy is a multidimensional challenge that needs a thorough understanding of the nuances associated with both open and laparoscopic approaches. This review has explored the epidemiology, theoretical framework, and comparative analysis of bile duct injuries between open and laparoscopic cholecystectomy.

Key takeaways.

- Bile duct injuries are a concern in gallbladder surgery, with laparoscopic cholecystectomy being associated with a slightly higher risk.
- Understanding the risk factors, early detection, and management strategies are essential in perfecting patient outcomes.
- Long-term surveillance for complications, strictures, and comprehensive follow-up care is critical for individuals who experience bile duct injuries.

- The ability of the surgical team, along with prudent patient selection, significantly influences the risk of injuries.

Individualized approach.

The choice between open and laparoscopic cholecystectomy should be made based on an individualized approach, considering patient-specific factors and the surgeon's experience. While laparoscopy offers certain benefits, open cholecystectomy stays a valuable option for specific cases.

Future directions.

Continued research efforts, as well as advances in surgical techniques and training, are essential to further improve the understanding and management of bile duct injuries in cholecystectomy. By addressing these challenges, healthcare professionals can strive to minimize the incidence of such injuries and enhance patient outcomes.

Bile duct injuries are complex issues that require a comprehensive understanding of both their theoretical underpinnings and the practical aspects of surgical

Comparing Bile Duct Injuries: Open Versus Laparoscopic Cholecystectomy

management. By exploring the epidemiology, theoretical framework, and comparative analysis of these injuries in open versus laparoscopic cholecystectomy, this review contributes to the collective knowledge base in the field.

The quest to reduce the incidence of bile duct injuries and improve patient care continues, and it is through ongoing research, training, and the commitment of healthcare professionals that advancements will be made. With a focus on patient safety and perfected surgical techniques, the medical community can strive to minimize the impact of these injuries and enhance the quality of care provided to those undergoing cholecystectomy procedures.

REFERENCES

- I. Lau, W. Y., Lai, E. C., & Lau, S. H. (2010). Management of bile duct injury after laparoscopic cholecystectomy: a review. *ANZ journal of surgery*, 80(1-2), 75-81.
- II. van de Graaf, F. W., Zaïmi, I., Stassen, L. P., & Lange, J. F. (2018). Safe laparoscopic cholecystectomy: a systematic review of bile duct injury prevention. *International journal of surgery*, 60, 164-172.
- III. Gad, E. H., Ayoup, E., Kamel, Y., Zakareya, T., Abbasy, M., Nada, A., ... & Abd-Elsamee, M. A. S. (2018). Surgical management of laparoscopic cholecystectomy (LC) related major bile duct injuries; predictors of short-and long-term outcomes in a tertiary Egyptian center-a retrospective cohort study. *Annals of medicine and surgery*, 36, 219-230.
- IV. Vecchio, R., MacFadyen Jr, B. V., & Ricardo, A. E. (1998, June). Bile duct injury: management options during and after gallbladder surgery. In *Seminars in Laparoscopic Surgery* (Vol. 5, No. 2, pp. 135-144). Sage CA: Thousand Oaks, CA: Sage Publications.
- V. Rituerto, D. C. (2001). Complicaciones de la cirugía biliar. *Cirugia Española*, 69(3), 261-268.
- VI. Lau, W. Y., & Lai, E. C. (2007). Classification of iatrogenic bile duct injury. *Hepatobiliary Pancreat Dis Int*, 6(5), 459-463.
- VII. Moraca, R. J., Lee, F. T., Ryan, J. A., & Traverso, L. W. (2002). Long-term biliary function after reconstruction of major bile duct injuries with hepaticoduodenostomy or hepaticojejunostomy. *Archives of Surgery*, 137(8), 889-894.
- VIII. Kukar, M., & Wilkinson, N. (2015). Surgical management of bile duct strictures. *Indian Journal of Surgery*, 77, 125-132.
- IX. Davidoff, A. M., Pappas, T. N., Murray, E. A., Hilleren, D. J., Johnson, R. D., Baker, M. E., ... & Meyers, W. C. (1992). Mechanisms of major biliary injury during laparoscopic cholecystectomy. *Annals of surgery*, 215(3), 196.
- X. Skipworth, R. J. E., & Fearon, K. C. H. (2008). Acute abdomen: peritonitis. *Surgery (Oxford)*, 26(3), 98-101.
- XI. Ahmed, M. (2018). Acute cholangitis-an update. *World journal of gastrointestinal pathophysiology*, 9(1), 1.
- XII. Krige, J. E. J., Beningfield, S. J., Nicol, A. J., & Navsaria, P. (2005). The management of complex pancreatic injuries. *South African Journal of Surgery*, 43(3), 92-102.
- XIII. da Fonseca Neto, O. C. L., Perez, M. I., & de Paula Lopes, V. G. (2023). Iatrogenic bile duct injuries: diagnosis and management. *Rev Med (São Paulo)*, 102(2), 000-00.
- XIV. De Santibáñes, E., Ardiles, V., & Pekolj, J. (2008). Complex bile duct injuries: management. *Hpb*, 10(1), 4-12.
- XV. Christou, N., Roux-David, A., Naumann, D. N., Bouvier, S., Rivaille, T., Derbal, S., ... & Mathonnet, M. (2021). Bile duct injury during cholecystectomy: necessity to learn how to do and interpret intraoperative cholangiography. *Frontiers in medicine*, 8, 637987.
- XVI. Strasberg S, Hertl M, Soper N. An analysis of the problem of biliary injury during laparoscopic cholecystectomy. *J Am Coll Surg*. 1995;180:101.