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REVIEW ARTICLE

# Does Timing of Laparoscopic Bile Duct Injury Repair affect Long-term Outcome?

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**ABSTRACT**

*Objective:* This article will review the controversies and prevailing views that deal with the vexing questions of "what is the optimal time of repair" that delivers the best long-term outcome following laparoscopic surgery injury of bile duct system.

*Materials and methods:* Literature review conducted using Google search engine and HighWire press, using keywords, like bile duct injuries, timing of repair, outcome and laparoscopic cholecystectomy.

*Results:* The reported incidence of bile duct injury after laparoscopic cholecystectomy varies widely due to the inclusion or exclusion of minor or self-limited events, such as bile leak from intrahepatic radicles or leak from a cystic stump. Once a major bile duct injury occurs, early recognition is paramount to minimize morbidity and potential mortality. Once recognized, appropriate measures are instituted to address the damage. However, controversy surrounds as to the optimal time for repair of the injury. The literature gives conflicting assessment and interpretation of when such injuries should be repaired. Patients cared for in facilities that lack the expertise to perform immediate repair may inherently end up at a tertiary referral center in a delayed manner. Some recognized institutions and individual surgeons with the expertise and resources to perform immediate repair opt for repair without delay claiming good outcomes while others delay the repair to intermediate and late repairs with claims of equally good outcomes reported.

*Conclusion:* While immediate recognition of any injury is mandatory for improved patient outcome, the timing of repair remains controversial with convincing arguments on both sides of the issue. However, there seems to be more evidence to support either immediate repair in experienced hands or delayed repair beyond six weeks. Intermediate repair (within 3 to 14 days) is more likely to lead to failures and long-term complications.

**Keywords:** CBD Injury, Common bile duct, Laparoscopic bile duct injury.

## INTRODUCTION

Laparoscopic cholecystectomy (LC) has now been universally accepted as the gold standard for symptomatic cholelithiasis. However, the incidence of bile duct injury is higher compared to open cholecystectomy (0.1-0.2% for open and 0.4-0.7%) for LC.[1-3] These iatrogenic bile duct injuries can have outcomes ranging from minor perioperative morbidity to catastrophic outcomes with reduced long-term survival, poor quality of life and even death.

There is limited data that addresses the issue of quality of life after repair of a major bile duct injury. Boerma et al from the Netherlands studied 106 patients who had sustained a variety of biliary injuries, ranging from cystic duct leaks to major transaction, 31 of whom were treated surgically and the remaining by non-surgical interventions. Despite an overall excellent clinical outcome in the series, quality of life was found to be reduced in both the physical and psychological aspects (Boerma D, Rauws EAJ, Keulemans YLA, et al. Impaired quality of life 5 years after bile duct injury during the laparoscopic cholecystectomy: A prospective analysis. Ann Surg 2001;234:750-57).

Management of biliary ductal injuries depends on timely recognition of the injury, the extent and type of the injury, the patient's co-morbid status and the availability of an experienced surgeon.

Immediate detection and repair leads to an improved outcome with the goal of repair being the restoration of a durable functional conduit, prevention of fistula, abscess, stricture, cholangitis and secondary biliary cirrhosis.

## DISCUSSION

Bile duct injury (BDI) following LC has been proposed as the most serious and important cause of morbidity.[4,5]

Although the reported incidence is around 0.7%, the true incidence is unknown. It is believed that at least half of all practicing general surgeons will encounter one or more bile duct injuries in their life time.

Cuschieri[6] identified improper anatomic identification as one of the major causes of BDI and Jin-Shu Wu[7] came to the same conclusion by reporting on a large series of patients with CBD injury, 60% of which were identified to have had poor identification of proper anatomy. The remaining causes were related to anatomic variation, poor control of intraoperative bleeding, and blind confidence in some. One study demonstrated that in more than one-third of all bile duct injuries, the basic cause of error is not the inexperience of the surgeon but the use of an improper approach to the fundamental structures of the extra-hepatic biliary tree because of a visual perceptual illusion (Br J Surg 1996;83:1356-60).

Arezou Yaghoubian made indirect reference to surgeon fatigue as a source of increased duct injuries by studying injury rate at a major US teaching hospital before and after reduction of resident work hours. In this study, injury and complication

rates were significantly reduced after implementation of the 80-hour work rule for residents. One could extrapolate and recommend LC surgery cases be scheduled at the beginning of the day when the surgeon and his team are fresh.

Fletcher[8] advocated routine use of operative cholangiography to minimize and identify duct injuries though the true value of this approach has been inconsistent. 15 to 30% of the injuries are detected during the initial surgical procedure. Most injuries diagnosed on the OR table are treated immediately, often by conversion to open. Selected patients or those with failed repairs are referred to specialized centers. For patients not diagnosed on the table, the presenting symptoms may vary widely and are frequently not in accordance with the severity of the injury or extent of the intra-abdominal fluid/bile collection.

Krige places an emphasis on the presence or absence of sepsis in determining early or late repair.[9] Sahajpal examined factors influencing outcomes of repair in a large retrospective study of LC associated BDIs and concluded that repairs in the intermediate period after injury (72 hours) were associated with increased incidence of strictures compared to the immediate and delayed (more than 6 weeks) repairs.[10]

Kappor reported poor outcome (stricture) in patients who underwent early repair.[11]

Gouma stresses that when the local anatomy is unclear, further exploration should be avoided to minimize proximal extension of the lesion and damage to blood supply that could have an adverse effect on future reconstruction. If the diagnosis is made late, these patients should be stented and/or drained and return for repair 6 to 8 weeks later.[12]

Walsh retrospectively reviewed 144 repairs of BDIs using the Bismuth-Strasberg stratification and found that the level of injury was predictive of postoperative stricture. At a mean follow-up of 67 months, more strictures developed in the cases repaired after 7 days of injury (19%) *vs* 8% in the delayed repair five patients developed.[13]

Whether repair is performed early or late, operative technique focuses on the site of proximal BDI and conducts the repair according to the type or classification of BDI. Jin-Shu[7] advocates the proximal duct should have at least an 8 mm diameter before duct repair can be contemplated. He does not consider chills, fever or jaundice as contraindication to repair but abscess in the vicinity of the injury is a contraindication.

There are various classifications of BDI, including the Corlette-Bismuth, Wu, McMahon and Strasberg classification. Each has its own merit and can guide a surgeon to select the best appropriate repair for each injury.

Corlette-Bismuth classification:

- *Type 1*—low common hepatic duct stricture, with a length of the common hepatic duct stump of > 2 cm
- *Type 2*—middle stricture, length of common hepatic duct < 2 cm
- *Type 3*—hilar stricture, no remaining common hepatic duct, but the confluence is preserved
- *Type 4*—hilar stricture, with involvement of confluence and loss of communication between right and left hepatic duct
- *Type 5*—combined common hepatic and aberrant right hepatic duct injury, separating from the distal common bile duct.

Strasberg classification:

- *Type A*—bile leak from cystic duct or liver bed without further injury
- *Type B*—partial occlusion of the biliary tree, most frequently of an aberrant right hepatic duct
- *Type C*—bile leak from duct (aberrant right hepatic duct) that is not communicating with the common bile duct
- *Type D*—lateral injury of biliary system, without loss of continuity
- *Type E*—circumferential injury of biliary tree with loss of continuity.

Results from various centers and individual authors have reported excellent short-term results after surgical repair and long-term follow-up with good functional outcome in more than 90%.[14,15] However, the definition of long-term follow-up is not standardized. Many of these patients demonstrated good outcome on initial follow-up only to show up years later with delayed complications, which at a different center is not well studied.

## CONCLUSION

Though the often quoted 0.5 to 0.7% incidence of bile duct injury, incidence of laparoscopic cholecystectomy may seem unalarming, when considered in light of the voluminous LC that is performed worldwide, the number of patients with short and long-term adverse consequences of this injury are immense. Unfortunately, there are no prospective, controlled, randomized trials to guide the surgeon on the issue of whether early repair is better than a late one. Based on experiences reported by various authors, deciding when to repair should be individualized depending on the physiologic status of the patient, presence or absence of co-morbid conditions, experience of the surgeon and the type of injury. When in doubt, it seems prudent to minimize further damage by draining and waiting for the inflammatory process to resolve before attempts at repair. Immediate repair in the right hands is better than intermediate repair (in 3 to 14 days), and delayed repair in 6 to 8 weeks is probably the most appropriate course to follow.

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