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REVIEW

Management of bile duct leaks

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Endoscopic management;
Stent

Summary The cause of bile duct leaks can be either iatrogenic or more rarely, traumatic. The most common cause is related to laparoscopic cholecystectomy. While surgical repair has been the standard for many years, management in these often morbid and complex situations must currently be multidisciplinary incorporating the talents of interventional radiologists and endoscopists. Based on the literature and in particular the recent recommendations of the European Society of Gastrointestinal Endoscopy (ESGE), this review aims to update the management strategy. The incidence of these complications decreases with surgeon experience attesting to the value of training to prevent these injuries. Bile duct injuries must be categorized and their mapping detailed by magnetic resonance cholangiography MRCP or endoscopic cholangiography (ERCP) when endoscopic therapy is considered. Endoscopic management should be preferred in the absence of complete circumferential interruption of the common bile duct. The ESGE recommends insertion of a plastic stent for 4 to 8 weeks without routine sphincterotomy. For complete circumferential injuries, hepaticojejunostomy is usually necessary. In conclusion, adequate training of surgeons is essential for prevention since the incidence of bile duct injury decreases with experience. Faced with a bile duct injury, a multidisciplinary team approach, involving radiologists, endoscopists and surgeons improves patient outcome.

ESSENTIAL POINTS

- Laparoscopic cholecystectomy is the most frequent cause of bile duct injury (0.3 to 0.86%).
- The incidence of this complication decreases with laparoscopic experience, and knowledge of anatomical variations such as subvesicular bile ducts (Luschka's duct).
- Diagnostic and therapeutic management of these injuries depends on whether the injury is discovered intra- or post-operatively.
- Careful definition of the injury is important and calls for accurate imaging either by intra-operative cholangiogram or post-operative MRCP.

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- The most widely used classification today is that of Strasberg because it includes laparoscopic injury. However, these classifications are of limited value in current practice.
- Endoscopic management should be the first line treatment in the absence of complete circumferential transsection of the main bile duct.
- Placement of a plastic stent for 4 to 8 weeks without routine sphincterotomy is recommended by the European Society of Gastrointestinal Endoscopy.
- In case of complete circumferential bile duct injury, hepatico-jejunostomy is essential for optimal healing.

Introduction: pathophysiology and diagnosis

Bile duct injury (BDI) occurs in two situations, hepatobiliary surgery and trauma; each determining a specific diagnostic and therapeutic management.

Hepatobiliary surgery

Cholecystectomy

Epidemiology

Today, laparoscopic cholecystectomy is the most frequently performed operation worldwide via laparoscopy. Because of this, and although these complications are fairly rare, laparoscopic cholecystectomy is the operation most often responsible for BDI, the prevalence being three times higher (0.3 to 0.86%) than in cholecystectomy via laparotomy (0.1 to 0.2%) [1—5]. A recent study showed that single trocar laparoscopic cholecystectomy might increase this rate considerably to 0.72% [6]. The incidence of BDI decreases with experience in laparoscopic surgery, falling from 2.2% to 0.1% after 13 procedures [7], essentially because of increased knowledge of the details of local anatomy [8].

Intense inflammation is also an independent risk factor for BDI and some authors recommend conversion to open surgery when this condition is encountered [9,10]. The most frequent type of injury is intra- or post-operative loss of substance of the cystic duct or the common bile duct (CBD). Intra-operatively, these injuries are due to misidentification of the CBD (classical Davidoff injury) [11] while delayed leaks are usually due to thermal or vascular injury during dissection [12].

More rarely, retained choledocholithiasis can result in suture breakdown by obstructing bile flow; this emphasizes the value of identifying CBD stones before or during surgery by echo-endoscopy, MRCP or intra-operative cholangiogram.

The presence of Luschka's ducts (direct communications from the gallbladder to the right hepatic ductal system through the gallbladder bed) [13,14] represents the second most frequent cause of post-operative leaks, if they are unrecognized during the operation. All surgeons must be aware of this anatomic variation, which has a prevalence of approximately 0.5%, in order to prevent biliary leaks [15].

Characterization of the injury

Type of injury

According to the 1999 French Surgical Association report (ref?), simple leaks account for 27%, partial injury of the main bile duct, 28.5% and complete circumferential transsection, 11.4% of biliary leaks. Injury may occur immediately, by direct injury if the main bile duct is mistaken for the cystic duct or in case of an accessory bile duct, or secondarily, in case of injury by a laterally placed clip, or due to ischemic or thermal injury.

Classifications of bile duct injuries

There are several classifications of BDI. The first, described by Bismuth (Table 1), before laparoscopic surgery, was meant to be a guide to surgical repair and has been fairly well correlated with outcome after treatment [16].

Since then, several classifications have been proposed, notably that of McMahon et al. that distinguishes minor injuries, requiring a simple repair or insertion of a T-tube and major injuries, possibly requiring surgical repair such as hepatico-jejunostomy [17]. One of the most widely used classifications today is that of Strasberg et al. (Table 2), which aimed to simplify the Bismuth classification while including injury induced by laparoscopic cholecystectomy [18]. These classifications have a limited value in practice, however, because the most important factor intervening in therapy is the existence of a complete circumferential transsection (surgical alternative) or incomplete transsection (endoscopic alternative) of the main bile duct.

Table 1 Bismuth classification of bile duct injury.

Type I: injury or stricture more than 2 cm from the biliary confluence amenable to repair without opening the left duct and without lowering the hilar plate
Type II: injury or stricture, less than 2 cm from the biliary confluence, requiring opening the left duct. Lowering the hilar plate is not always necessary but may improve the exposure
Type III: injury of the injury confluence but leaving the top of the biliary confluence intact, requiring lowering the hilar plate and anastomosis on the left ductal system. There is no need to open the right duct if the communication between the ducts is wide
Type IV: injury of the biliary confluence including the top requiring either reconstruction or two or more anastomoses
Type V injury: injury of the either the right or left hepatic duct associated or not with an injury of the main bile duct. The segmental branch must be included in the repair

Table 2 Strasberg et al.'s classification of bile duct injury.

Type A: bile leak from a minor duct still in continuity with the common bile duct
Type B: occlusion of part of biliary tree
Type C: bile leak from duct not in communication with common bile duct
Type D: lateral injury to extrahepatic bile ducts