



Bile duct injuries: incidence, prevention, and management

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Bile duct injuries (BDI) are devastating complication following a common operation in general surgery. In a single center analysis of 10,123 laparoscopic cholecystectomies performed between 1991 and 2010, 19 patients had a BDI (0.19%) (1). This low incidence might be the result of a low rate of complications but can also be indicative of poor reporting and properly capturing these injuries (2).

Nevertheless, the most important aspect of these injuries is appropriate management. Thus, experienced hands undertaken these procedures is paramount. The manuscript in this issue of the journal *Digestive Medicine Research* “*Bile duct injuries management: the experience of a high-volume liver surgery centre*” is both on target and timely (3). The fact that this hospital encountered only twenty-three lesions in twenty patients over a 12-year period is also indicative of a low number of these complication. Importantly, only eleven of these were encountered at their center with the majority being referred from other hospitals.

The manuscript underscores the current rates of BDI following cholecystectomy (0.1% to 0.3%) during open and (0.08% to 0.6%) laparoscopic approach. The manuscript also presents an overall review of the current classifications schemes that is substantially relevant. But, more importantly the manuscript addresses the natural history of injuries treated by surgeons less experienced with hepatobiliary procedures. Thus, when a BDI occurs, if not address properly, the sequelae that follows is even more consequential. The manuscript emphasized the previously held approach of rapid recognition of a BDI (1). If there is no available expert in hepatobiliary surgery, a patient that

sustained a BDI, appropriate drainage should be undertaken followed by transfer to a center with experience managing these injuries (4).

The retrospective review of Sbuelz *et al.* (3) suffers from statistical analysis as a result of its descriptive nature. The small number of cases encountered also prevented it from higher class evidence other than expert opinion on this matter. However, with prior reports in the literature outlining similar findings, the opinion of this group becomes stronger (1,4). While the authors indicate the various ways in which BDI are reported, it would still have been more elucidating if they had presented a stronger review of the literature with tables outlining the incidence of these injuries in various centers, the influence of delay and the management.

However, even with such limitations, the paper provides a timely reminder on an issue that requires regular revisits and updates. In the current state of our understanding of gallbladder disease and cholecystectomies, BDI injuries should become even less common. However, if they do occur, further consequences should be minimized. The most substantial progress in our understanding of BDI has been in the area of prevention. The second is early identification and lastly appropriate transfer to a specialized center. These issues are briefly discussed below as it applies to most centers in the United States.

The exact number of patients with cholelithiasis in the United States is unknown but estimates project over 20 million Americans have stones within the gallbladder. Fortunately, only a small fraction (7%) of this cohort

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develops symptoms in the form of biliary colic (5,6). Of the affected individuals in the US with biliary calculi, even a smaller fraction (1% to 2%) will require surgical intervention for complications of gallstones, including cholecystitis, choledocholithiasis, biliary pancreatitis, and gallstone pancreatitis (5,7). As a result, a cholecystectomy is one of the most common operations performed by general surgeons in the United States, accounting for about 700,000 cases every year (8).

The laparoscopic approach to a cholecystectomy has been the standard of care for gallbladder disease for over three decades in the Western World (9). However, low- and middle- income countries (LMIC) still perform open cholecystectomies in the elective setting routinely (10,11). Given the incidence of gallstone disease, cholecystectomy has become a routine practice for general surgeons. While the complication rate is low, it is not zero.

Laparoscopic cholecystectomy (LC) carries a mortality of 0.1% with a nearly 10% complication rate (12,13), with complications ranging from common BDI to minor cystic stump or duct of Luschka bile leaks (14). One of the most consequential complications following cholecystectomy is a BDI.

Incidence

Open cholecystectomy was the standard of practice for over a century until the introduction of LC in the 1980, which quickly became the most common approach to cholecystectomy in the US (15). Thus, there is strong information regarding the incidence of BDI following open cholecystectomy ranging from 0.1% to 0.25% (2,16). However, for LC this is less clear, but higher than the open technique with a range of 0.3% to 2.6% (2,17). A study examining 800 randomly selected cases including all chart reviews examining for BDI regardless of ICD code found an incidence of BDI of 0.5% (2), suggesting that not all procedures regarding the complication of the first index operation are appropriately captured. Thus, BDI might have a higher rate than reported in the literature. Thus, prevention of this complication is one of the most important aspects in our understanding of BDI.

Prevention

In 1995, the concept of the Critical View of Safety (CVS) was introduced by Strasberg *et al.* (18). In this approach,

the gallbladder must be suspended and held up only by the cystic duct and the cystic artery prior to clipping and transecting any structures. All fibrous tissue has to be dissected at the triangle of Calot such that the liver can be observed through this window (19). Proper identification of the CVS has decreased DBI from 0.79% to 0.58% from 1990 to 2007 (20). In a recent review, the CVS was inappropriately and insufficiently reported in the medical records of patients undergoing a LC (2).

If this view is not identified or difficult to attain an intra-operative cholangiogram should be in order (19,21). A difficult gallbladder where the CVS is not easily attainable, can be managed by a partial cholecystectomy (22).

A percutaneous cholecystectomy tube (C-tube) for patients not initially candidates for a cholecystectomy might be indicated in some settings. However, it is important to recognize that a cholecystectomy following C-tube placement carries a higher risk of BDI compared to elective cholecystectomies (23). Thus, an appropriate widow between C-tube placement and a cholecystectomy should be considered as well as a more senior surgeon with experience laparoscopic skills should be performing these operations. A second alternative is the use of the robotic platform for this approach.

The robotic approach to cholecystectomy reduces the rate of complications in difficult gallbladders (24). Some studies have demonstrated the robotic approach to be more efficient in addressing complicated cases of benign gallbladder disease where an open approach is typically needed (25). In cases, that need a re-operation because of a previous partial cholecystectomy or in cases of Mirizzi syndrome, the robotic approach has been an excellent alternative (25).

Management

The manuscript by Sbuely *et al.* addressed this issue in detail (3). Importantly, early identification is key and ideally this occurs in the operating room (1). If such is the case as the authors indicate, drainage and transfer to a specialized center should be undertaken (4). Most cases of LC are outpatient procedures, in cases that do not follow the typical postoperative course a hepatobiliary iminodiacetic acid (HIDA) scan should be rapidly performed. Magnetic resonance cholangiopancreatography (MRCP) is also an excellent tool to identify BDI. Once identified, early or late, experienced surgeons addressing BDI will avoid further consequential sequelae of this devastating injury.

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