



## Review Article

# Bile Duct Injury - A Health and Financial Disaster

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### ABSTRACT

**Bile Duct Injury (BDI) is an unfortunate complication of cholecystectomy, if not treated properly may result in the death of the patient due to biliary peritonitis and sepsis or may convert an otherwise healthy young person with a biliary cripple with benign biliary stricture (BBS), cholangitis, secondary biliary cirrhosis, portal hypertension & liver failure. A BDI, even after repair, adversely affects the quality of life and can be a financial disaster for the patient and a legal one for the surgeon. As BDI is associated with health & financial disaster, more attention needs to be paid both to prevent and to recognize early such injury. After recognition the patient should be referred to a surgeon experienced in the management of such injuries to avoid further complications.**

Gall stone disease is common all over the world. Laparoscopic cholecystectomy (LC), which has become the gold standard of management of gall stone disease, is associated with 2 to 4 times higher (0.5%) risk of bile duct injury (BDI) than open cholecystectomy<sup>1</sup>. Moreover BDI is an unfortunate complication of cholecystectomy, if not treated properly may result in the death of the patient due to biliary peritonitis and sepsis or may convert an otherwise healthy young person with a biliary cripple with benign biliary stricture (BBS), cholangitis, secondary biliary cirrhosis, portal hypertension & liver failure. A BDI, even after repair, adversely affects the quality of life<sup>2,3</sup> and can be a financial disaster for the patient<sup>4</sup> and a legal one for the surgeon<sup>5</sup>. Even after

proper management, patient with BDI needs long time follow up.

Most of the BDI are recognized in the early post-operative period & less than half of these are during operation<sup>6</sup>. There are several established iatrogenic injury patterns identified in laparoscopic cholecystectomy. The prevalent type of injury involves mistaking the common bile duct for the hepatic duct. This occurs just distal to the common hepatic duct. The common bile duct is clipped & divided, then gall bladder retracted up, taking with it the common hepatic duct until it is divided again closer to the base of the liver, at the end there is distal common bile duct clipped, upper hepatic duct transected. The second most common type of injury occurs when the distal clips are placed on the common bile duct & the proximal clips are placed on the cystic duct. The end result is a cystic duct stump leak with distal CBD obstruction.

The third & least prevalent type is due to tenting of the CBD from excessive retraction. The cystic duct is identified & clipped, then the tented CBD is clipped and divided. The result is excision of a short segment of CBD with the cystic duct & gall bladder. In this

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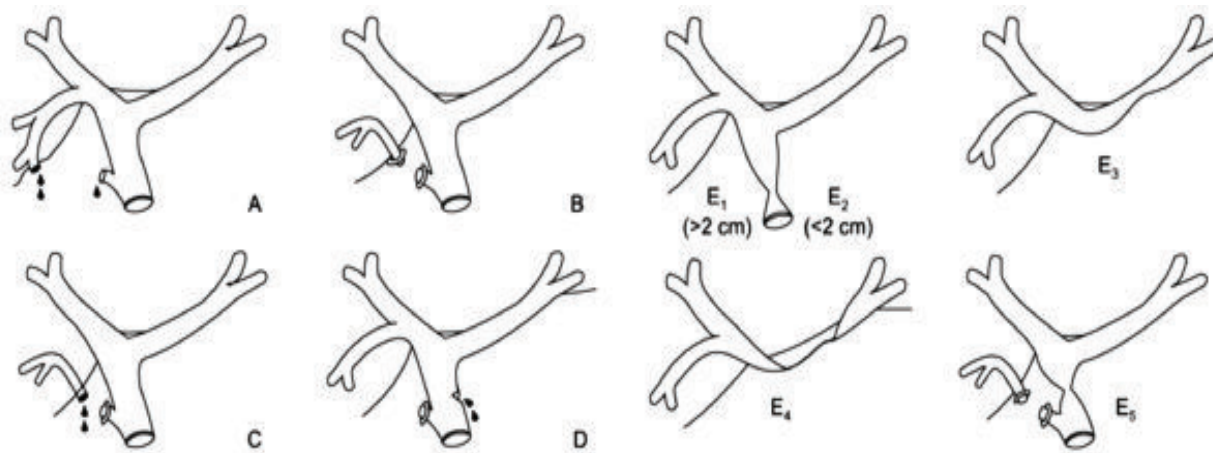
case the patient presents with either biliary leak or obstruction, depending on clip placement<sup>7</sup>. Right hepatic duct injury occurs with & without anatomic variation. In case of normal anatomy, overzealous superior retraction leads to misinterpretation of the right hepatic duct for the cystic duct. In case of cystic from the right, both clipped & divided, then gall bladder removal leads to excision of portion of right ductal system<sup>8</sup>.

Recently Strasberg et al<sup>9</sup> classified bile duct injury & stricture as Class-A, that is injury to small ducts in continuity with the biliary system, with a leak in the duct of Luschka or the cystic duct. Class-B is injury to a sectoral duct with resultant obstruction of part of biliary system. Class-C is injury to a sectoral duct with bile leak, bile leakage occurs from a duct not continuous with biliary system. Class-D is injury to the extra hepatic duct. Class-E1 is stricture more than 2cm. Class-E2 is stricture less than 2 cm from the confluence of right & left duct. Class-E3 is stricture at the bifurcation & Class-E4 is stricture involving the right & left bile ducts, the left & right are not continuous. Class-E5 is complete occlusion of all bile ducts including sectoral ducts. (Figure 1)

Bile duct injury should be regarded as preventable, though over 70 percent of surgeons regard it as unavoidable<sup>11</sup>. Hunter & Troidl have proposed several techniques of preventing injury<sup>12,13</sup>. 30° telescope, avoidance of diathermy close to the common hepatic duct, dissection close to the gall bladder-cystic duct junction, avoidance of unnecessary dissection close to the cystic duct-common hepatic duct junction, conversion to an open approach when uncertain.

However, to apply these techniques, correct interpretation of anatomy is required. To facilitate orientation before starting dissection, Hugh<sup>14</sup> recommends identifying Rouviere's sulcus as a fixed extra biliary point ventral to the right portal pedicle. Dissection ventral to this allows a triangle of safe dissection when gall bladder has been reflected cephalad. The relative position of the cystic duct, the cystic artery<sup>15</sup> & the common bile duct should be clearly identified. The "Critical View of Safety" (CVS) technique recommends clearing the triangle of calot of fat & fibrous tissue & taking the gall bladder off the lowest part of its attachment to the gall bladder bed. CVS clarifies the relations of the anatomic structures that should be divided.

Recognition of bile duct injury at the time of cholecystectomy allows an opportunity for the hepatobiliary surgeon to assess its severity & presence of a vascular injury. Given that as many as 90 percent of injuries will not be diagnosed during surgery, a high index of suspicion is required in patients who become unwell in the early post-operative period<sup>16</sup>. Initial symptoms may be non-specific; patients are discharged from the hospital frequently only to reappear a few days later with classical symptoms & signs of bile leak or transection of bile duct. These include jaundice, bilomas, sepsis, biliary fistulas & biliary peritonitis<sup>17,18</sup>. The median delay in diagnosis is 1-2 weeks, but for strictures it may be months or years<sup>19</sup>. Any patient remaining unwell 48 hours after surgery should be investigated for possible bile duct injury<sup>20</sup>.



**Figure 1** Strasberg classification of bile duct injury & stricture<sup>10</sup>

Investigations would usually include ultrasonography & liver function tests. Increase in bilirubin & alkaline phosphatase after 24-48 hours require re-evaluation of the patient. Abdominal ultrasound may exclude ductal dilatation but detection of fluid collections mandates aspiration or drainage as undrained bile can be lethal if left untreated<sup>21</sup>. Presence of bile is diagnostic of a bile duct injury & requires investigation by a high quality cholangiogram. Magnetic Resonance Cholangio- Pancreaticography is generally preferred & should determine the need for ERCP if a minor duct leak or distal obstruction due to choledocholithiasis is confirmed<sup>22,23</sup>.

A minor (Strasburg type A or C) injury detected during cholecystectomy needs drainage only, sometimes with ligation of subvesical/segmental duct; & a lateral injury (Strasburg type D) can be repaired over a T-tube or by post-operative endoscopic sphincterotomy & stenting. A major BDI (Strasburg type E) can be repaired with Roux-en-Y hepaticojejunostomy<sup>22,23,24</sup> if expertise & experience are available. Early repair within 6 weeks of cholecystectomy are associated with higher incidence of leak, stricture formation & death<sup>25</sup>. Tension free, mucosa to mucosa hepaticojejunostomy performed in a single layer, using interrupted fine absorbable sutures between unscarred proximal bile ducts & a 60 cm long Roux-en-Y loop of jejunum is the procedure of choice for all cases<sup>26</sup> (Figure 2). Delayed recognition of a major bile duct injury results in sepsis &/or an inflammatory response; early definitive repair should not be done as results are poor. It is preferable to wait for 3 months until the patient is well & in an anabolic state<sup>27</sup>.

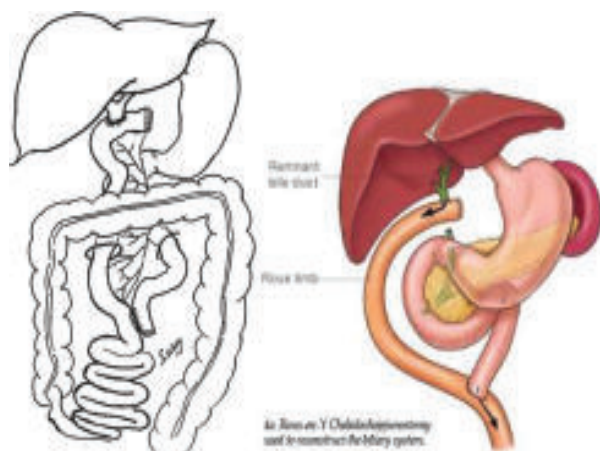


Figure 2. Roux en Y Hepaticojejunostomy<sup>28</sup>

All bilomas need to be treated with percutaneous or open drainage till all the infection is subsided. The location, extent & nature of the injury is to be defined by cholangiogram. Patients with a cystic duct leak or common bile duct stricture of minimal to moderate severity are being treated with Percutaneous Biliary Drainage (PBD) followed by chronic biliary intubation with a large bore silicone catheter. Patients with a common bile duct transection, ligation or severe laceration or stricture are treated with PBD followed by Roux-en-Y hepaticojejunostomy. In an study it is found that cholecystectomy related bile duct injuries are disastrous both healthwise & monetarily. Repair of bile duct injuries can need 4.5 to 26 times the cost of an uncomplicated LC. A well coordinated multi-disciplinary team is required for management. An interventional radiologist can spend a very significant amount of time for care of this group of patients. Ultimately a tremendous expenses are incurred for the management of the patient<sup>29</sup>. Long term follow up is important as delayed & recurrent complications are common<sup>30</sup>.

As BDI is associated with health & financial disaster, more attention needs to be paid both to prevent and to recognize early such injury. After recognition the patient should be referred to a surgeon experienced in the management of such injuries to avoid further complications.

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