Extrahepatic Duct Injury in Blunt Trauma: Two Case Reports and a Literature Review

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Abstract Traumatic injuries of the extrahepatic biliary tract are rare. Associated injuries are usually responsible for immediate indication for surgical treatment, the time when an injury to the extrahepatic biliary ducts may be diagnosed. However, missed injuries are often common. The primary aim of this paper is to describe the clinical features, diagnosis, treatment, and outcome of two patients with left hepatic duct injury after blunt abdominal trauma. As a secondary objective, a literature review is presented. The two cases presented in this study are as follows: (1) A young male, involved in a motor vehicle crash, was admitted with blunt hepatic trauma in a general hospital. Endoscopic retrograde cholangiography was conducted 3 weeks later and revealed a large leakage at the left hepatic duct. Exploratory laparotomy was performed 26 days after the initial traumatic event and identified a complete section of the left hepatic duct, treated with anastomosis. (2) A male fell from a height. On exploratory laparotomy, a 30 % partial injury of the left hepatic duct was found in addition to hemoperitoneum, liver injury, gallbladder detachment together with cystic duct rupture, retroperitoneal hematoma to the right, and cecum hematoma. A high level of suspicion is necessary to identify injuries to the hepatic ducts. Early diagnosis that occurs during laparotomy due to associated injuries is important to reduce complications.

Keywords Abdominal injuries · Wounds and injuries · Bile ducts · Extrahepatic · Biliary tract surgical procedures · Delayed diagnosis

Introduction

Extrahepatic bile duct traumatic injuries are rare events. Few cases after blunt abdominal trauma are described [1–9]. This type of injury may be partial or complete (total transection), and associated injuries usually lead to immediate surgical treatment indication [3, 10–12]. Isolated injuries have an insidious presentation, which frequently ends up as a delayed or missed diagnosis [3, 11–13]. Treatment should be individualized according to the anatomical location and extension of the injury and may include primary repair, use of stents, or anastomosis [2, 3, 6, 13]. The primary aim of this manuscript is to describe the clinical features, diagnosis, treatment, and outcome of two patients with left hepatic duct injury after blunt abdominal trauma as well as the outcome differences between early and delayed diagnosis. As a secondary objective, a literature review is presented.

Case Reports

Case 1

A 34-year-old male was involved in a motor vehicle crash. This young patient was rescued by local EMS and removed to a general hospital. Upon admission into the emergency hospital, the patient presented with normal vital signs, conscious, with pains in the right upper quadrant, and an obvious excoriation over this same topography. Revised Trauma

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Score (RTS) on admission was 7.84. A plain chest X-ray revealed fractures from the seventh to the ninth right ribs associated with pulmonary contusion. Abdominal ultrasonography demonstrated presence of a small amount of free intraperitoneal fluid in the hepatorenal and peri-splenic spaces, with no solid viscus injury. The assistant general surgeon decided to follow up this young patient at the ward, without CT scan, and after 5 days, despite the improvement of abdominal pain, jaundice appeared along with abnormalities of the following lab tests: direct bilirubin of 1.54 mg/dl, indirect bilirubin of 2.06 mg/dl, transaminase glutamic oxaloacetic of 38 IU/ml, glutamate pyruvate transaminase of 90 IU/ml, alkaline phosphatase of 145 U/l, and amylase of 139 U/l. Abdominal ultrasonography (US) was then repeated and revealed no alterations when compared to the first US exam. Nine days after trauma, the patient was anicteric, accepting oral diet, and was discharged from this first admission hospital. After 1 week, he returned to the same hospital complaining of abdominal distension. Ascites was detected by clinical exam. Abdominal paracentesis was performed, with drainage of 6 l of sero-bilious liquid. Endoscopic retrograde cholangiography with sphincterotomy was indicated and performed, which revealed a large leakage at the left hepatic duct (Fig. 1) through a complete duct injury, so the patient was transferred to our trauma center for further specialized care. On the 26th day after the trauma event, the trauma and gastrointestinal surgery teams decided on an exploratory laparotomy, when a coeloperitonium with multiple adhesions in the upper abdomen

Fig. 1 Endoscopic retrograde cholangiography with sphincterotomy revealing a large leakage at the left hepatic duct

was found. A cholecystectomy and an intraoperative cholangiography were performed with the introduction of a cross-cystic stent, which facilitated the identification of a complete section of the left hepatic duct, 1 cm above the bifurcation. End-to-end anastomosis was performed over an endobiliary indwelling stent. As a precaution, drainage of the biliary tree with a Kehr's drain was also done. A Jackson–Pratt tube was inserted to drain eventual leakage to the abdominal cavity. The Injury Severity Score (ISS) was 20 and the probability of survival Trauma and Injury Severity Score (TRISS) was 99 %. The patient was discharged on the 15th postoperative day. The indwelling biliary stent was removed on the 90th postoperative day. Cholangiography was performed through Kehr's drain, 60 days later, with no contrast leak through the left hepatic duct. Two years after surgery, the patient is on clinical follow-up, asymptomatic, with a slight increase of alkaline phosphatase (406 U/l—referenced value of 80 to 306). A control abdominal ultrasound, after this same period, revealed mild intrahepatic biliary dilatation on the left hepatic duct.

Case 2

This is a 39-year-old male, admitted 40 min after a fall from a 7-m height, conscious with tachypnea, and complaining of right upper quadrant pain. Physical examination demonstrated right hemopneumothorax, which was treated with a chest tube by the trauma team. Admission RTS was 7.55. Sixth and tenth right rib fractures were observed on the chest X-ray, as well as the presence of the chest tube, with good lung expansion. No FAST US exam or CT scan was available at that time so diagnostic peritoneal lavage was performed with a positive result for the presence of blood. On exploratory laparotomy, surgeons found 800 ml of intra-abdominal blood, AAST-OIS grade III liver injury, detachment of the gallbladder, and cystic duct rupture plus a 30 % lesion of the left hepatic duct circumference. A zone II retroperitoneal hematoma to the right and cecum hematoma were also intraoperative findings. Cholecystectomy, liver injury hemostasis, suture of bile duct injury, placement of an endobiliary stent, and drainage of subhepatic topography with a closed drain were also part of the surgical procedure. ISS was 25 and the probability of survival (TRISS) was 0.98. On the seventh postoperative day, the patient developed peritonitis and underwent another exploratory laparotomy, which revealed necrosis of the cecum. A resection of this segment with terminal ileostomy was then performed. On the 18th postoperative day after trauma, the patient presented failure of multiple organs and systems due to severe sepsis and deceased.

Discussion

Traumatic injuries of the extrahepatic biliary tract are uncommon, with incidence ranging from 2 to 5 % in abdominal trauma, mainly affecting the gallbladder [2, 3, 5, 10]. Most lesions of extrahepatic bile ducts are caused by penetrating trauma [2, 3, 13–17].

The exact mechanism of injury to the bile duct after blunt trauma is not well known, but a number of factors are identified as responsible for it: (1) a shear force or stretch or avulsion that intersects the duct at its point of attachment to the pancreas or liver; (2) a short cystic duct, causing rapid emptying of the bladder when force is applied, with a sudden increase in intraductal and subsequent predisposition to injury; (3) a shear force applied to the common duct where it is already strained; (4) a compression of the ductal system against the spinal column [1, 3, 4, 15, 18, 19]. Perhaps a combination of these factors promotes injury of the extrahepatic biliary system. The most frequent sites of injury to the extrahepatic bile ducts in blunt abdominal trauma are at the upper edge of the pancreas, the hepatic duct bifurcation, and in the origin of the left hepatic duct [5, 10, 19]. In this study, one patient had a complete section of the left hepatic duct and the other patient had a partial injury associated with cystic duct avulsion.

The clinical presentation virtually divides patients with injuries in the extrahepatic bile ducts into two groups: one with early diagnosis, where laparotomy is indicated because of the presence of hypovolemic shock and signs of peritoneal irritation or associated injuries, as the patient presented in case 2. The second group is composed of patients with a delayed diagnosis, which are often presented with nausea, vomiting, jaundice, and abdominal pain, as the case 1 patient [3, 11, 14, 18].

Ultrasonography and computed tomography can result in false negative [18]. Although US is an operator-dependent exam, abdominal ultrasonography was performed twice by an experienced radiologist in case 1 and no injury concerning the biliary tract was observed. The computed tomography common findings in bile duct injury are swelling in the hepatoduodenal ligament, free fluid in the peritoneal cavity, and associated injuries to the liver and duodenum [20].

We learned that a high index of suspicion is necessary during surgery. Delayed diagnosis can be catastrophic and the presence of intra-abdominal free fluid with no solid organ injury after trauma may be a strong indication for an exploratory laparotomy. More common associated injuries appear in the liver, great vessels, duodenum, and pancreas [2, 4, 5, 12, 17].

The presence of bile in the hepatoduodenal ligament, retroperitoneum, or abdominal cavity, which in fact can be hidden by hemoperitoneum, is an indicator of bile duct injury [4, 13–15]. The presence of hematoma in the

hepatoduodenal ligament and injury to the liver, duodenum, or gallbladder may also be associated with bile duct injury. This justifies the Kocher maneuver and mobilization of hepatic flexure of the colon, beyond the exploration of the porta hepatis, after obtaining control of any bleeding [11, 16]. In the second case herein, the presence of bile leakage after cholecystectomy and a hematoma in the hepatoduodenal ligament lead to the identification of the injury. If the dissection does not identify the lesion, the diagnosis is not made and an intraoperative cholangiography through the gallbladder or cystic duct should be performed [11–13].

If there is no indication for early surgical treatment, the diagnosis of injuries to the extrahepatic bile duct may be delayed, as what had happened in the first case presented in this manuscript [3–5]. Patients not operated on, early in time, and with a biliary fistula may remain asymptomatic for days, because the bile is a sterile component and can be well tolerated. Patients may present few symptoms including abdominal discomfort, nausea, vomiting, jaundice, ascites, and fever [10, 18]. The presence of jaundice after blunt abdominal trauma is suggestive of a missed bile duct injury, but other common diagnoses should be also considered such as massive blood transfusion, liver disease, hepatic trauma, hematoma absorption, or cholecystitis [14]. After 5 days of nonoperative management, the case 1 patient presented abdominal pain and jaundice.

The most specific diagnostic methods are colangiogram, parietohepatography (CTPH), cintilography, and endoscopic retrograde cholangiography. The CTPH can diagnose and locate the injury but it can be difficult to perform when the intrahepatic duct is thin and should not be done in patients with complex associated liver injury. Endoscopic retrograde cholangiopancreatography (ERCP) can diagnose and eventually treat bile duct injury with stent even if surgical procedures have been conducted before [7, 21, 22]. In the first case presented herein, the ERCP was performed and revealed a complete section of the left hepatic duct.

The surgical treatment of injuries to the bile ducts should be individualized, based upon hemodynamic stability, associated injuries, and upon the location and extent of the injury [1, 6, 17, 18]. To our knowledge, there is no management algorithm available in literature.

In hemodynamically unstable patients, or when the injury is extensive, exteriorization of the bile through a terminal drain or through a “T” tube, when possible, creates a controlled external fistula and permits rapid identification of the lesion in an eventual reoperation [13, 16, 17]. Another option is a simple external drainage, which indeed is not recommended in literature, due to high morbidity and mortality [2]. Bile drainage using a T tube has also been described as a unique and definitive treatment of partial injuries to the left hepatic duct, with good outcome in these cases [1]. There is a controversy regarding the ligation of the

left hepatic duct or right hepatic duct when injured, and the proponents of this practice say that this is well tolerated, as long as 30 to 50 % of bile flow is preserved, and that the evolution to hepatocellular degeneration is more frequent than to cholangitis [11]. Other authors do not advocate the ligation of the hepatic ducts due to a possible atrophy of the liver lobe, limited experience, and difficulty in following up these cases [1].

In hemodynamically stable patients, the surgeon should try a definitive surgical treatment, and management will depend basically on the extent of the injury, requiring a meticulous surgical technique. Lesions with less than 50 % of the circumference of the bile duct and a well-vitalized bile duct should be primarily sutured, associated or not to the placement of an indwelling stent or T tube, which generally will be used for weeks or even months. Lesions of more than 50 % of duct circumference are controversial from the treatment standpoint [23]. If the transection of the duct is simple, with irregular edges, an end-to-end anastomosis may be indicated [13]. However, it is often necessary to carefully dissect around the duct and a no tension anastomosis may be performed; otherwise, it may result in stenosis or fistulae. In a review of 20 cases of injury to the extrahepatic bile duct treated with end-to-end anastomosis, Ivatury et al. found 11 cases (55 %) of stenosis with reoperation indication ending up in a bileo-digestive derivation [2].

Still in stable patients but with greater injuries, many authors recommend entero-duct anastomosis, using an intestinal Roux-en-Y anastomosis, with an incidence of stenosis of nearly 4 % [2–4, 12, 13, 15, 16]. Associated procedures may become necessary in the treatment of complex injuries, and eventually liver resection may be necessary [2–4, 10, 11, 13, 16, 18].

Complications such as biliary fistulae, abscess, and stenosis may be reduced with early diagnosis and appropriate management during surgery. The high morbidity and mortality of these patients are related to associated injuries and their complications, as described in case 2 [5, 10, 12, 17].

Conclusions

Isolated injuries of extrahepatic bile duct after blunt abdominal trauma are rare and the diagnosis is usually delayed. The presence of free intraperitoneal fluid, with no solid organs injury, is a formal indication for exploratory laparotomy. Early diagnosis that more often occurs during laparotomy because of associated injuries is important to reduce complications. A higher level of suspicion is necessary to identify injuries in the hepatic ducts. Delayed diagnosis is generally related with bad prognosis.

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Conflict of Interest None

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