

Endoscopic retrograde cholangiopancreatography in the management of Traumatic bile duct injury following blunt abdominal trauma: A case series and literature review

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Abstract

Bile duct injuries from blunt abdominal trauma are rare. Bile leak after liver injury is not uncommon, especially in complex liver injury. Conventionally, bile duct injury was treated by surgical intervention. In recent decades, however, there had been an increase in radiologic or endoscopic intervention to treat traumatic bile duct injury. Endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy and biliary stent insertion is an effective treatment of bile leak after liver injury. We report three cases with persistent bile leak after complex liver injury who had had a ERCP for internal biliary stent placement. The procedure was well tolerated and the patient was discharged with biliary stent. A follow-up imaging was performed 6 weeks later, a MR cholangiopancreatography (MRCP) showed a normal biliary tree, without any leakage, and the internal biliary stent was subsequently removed. All patients had a complete recovery. Based on our study results, ERCP should be considered as first-line therapy in the management of traumatic bile leaks.

Keywords : Traumatic bile duct injury, Blunt abdominal trauma, Hepatic injury

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การส่องกล้องรักษาภาวะบาดเจ็บของท่อทางเดินน้ำดี

ภายหลังอุบัติเหตุตับฉีกขาดระดับรุนแรง: รายงานผู้ป่วย

บทคัดย่อ

ภาวะท่อทางเดินน้ำดีบาดเจ็บจากอุบัติเหตุแบบกระแทกกระแทกบริเวณช่องท้อง เป็นภาวะที่พบได้น้อยและผลการรักษามีหลายรูปแบบ รายงานผู้ป่วย 3 ราย ได้รับอุบัติเหตุกระแทกที่ศีรษะและบริเวณหน้าท้อง ตรวจเอกซเรย์คอมพิวเตอร์พบว่ามีภาวะตับฉีกขาด ได้รับการรักษาแบบประคับประคอง ร่วมกับ หลังจากนอนโรงพยาบาล 6 วัน คนไข้มีอาการไข้ ตัวตาเหลืองขึ้น ส่งตรวจวินิจฉัยเพิ่มเติมสงสัยภาวะน้ำดีรั่วจากตับหลังการบาดเจ็บ ผู้นิพนธ์พยายามรักษาภาวะน้ำดีรั่วโดยการส่องกล้องทางเดินอาหารเพื่อใส่ท่อระบายในท่อน้ำดี แต่ยังมีเลือดและน้ำดีค้างอยู่ในช่องท้อง จึงตัดสินใจใส่ท่อระบายเลือดและน้ำดีผ่านผนังหน้าท้องเป็นผลสำเร็จ ทำให้น้ำดีหยุดรั่ว รวมถึงระบายเลือดและน้ำดีในที่สุด และสามารถหลีกเลี่ยงการผ่าตัดในผู้ป่วยรายนี้ได้

คำสำคัญ : ท่อน้ำดีบาดเจ็บจากอุบัติเหตุ, อุบัติเหตุช่องท้องแบบกระแทกกระแทก, ภาวะบาดเจ็บของตับ

การส่องกล้องรักษาภาวะบาดเจ็บของท่อน้ำดีภายหลังอุบัติเหตุระดับฉีกขาดระดับรุนแรง: รายงานผู้ป่วย 3 ราย และการทบทวนวรรณกรรม

Treatment of traumatic liver injuries is based on patient physiology, mechanism and degree of injury, associated abdominal and extra-abdominal injuries and local expertise. Non-operative management has evolved into the treatment of choice for most patients with blunt liver injuries who are hemodynamically stable and success rates for non-operative management commonly are greater than 95%. The rate of liver-related complications is low, and generally ranges from 0% to 7%¹. However, the majority of patients in these studies suffered from low-grade liver injuries. Liver-related complication rates in high-grade liver injury patients are 11-13% and can be predicted by the grade of liver injury and the volume of packed red blood cells transfused at 24 hours post-injury².

Bile duct injuries from blunt abdominal trauma are rare. In fact, extrahepatic biliary tract injuries occur in 3% to 5% of all abdominal trauma victims. The incidence increases to 14-22% in complex liver injury (American Association for the Surgery of Trauma Organ Injury Scale: AAST-OIS more than grade 3)³. Advances in interventional radiology and critical care medicine have shifted the standard of care towards non-operative management, allowing for fewer unnecessary laparotomies and improved outcomes in patients with hepatic lacerations. Hemodynamically stable patients with active arterial hemorrhage can undergo diagnostic angiography and therapeutic angioembolization to manage their injuries. Following successful angioembolization, patients with minimal biloma and hemoperitoneum can often recover without further intervention. Patients with high-grade lacerations complicated by significant hemoperitoneum can undergo angioembolization when hemodynamically stable, but up to two-thirds ultimately require laparotomy to control recurrent hemorrhage or biliary leaks⁴. The management of surgical bile leaks with therapeutic endoscopic retrograde cholangiopancreatography (ERCP) is well-established. However, the diagnosis of traumatic bile leaks can often be delayed and difficult. It has been suggested that posttraumatic bile leaks require more therapeutic procedures, patients have longer hospital courses, and higher hospital charges.

ERCP with sphincterotomy and biliary stent insertion has been accepted as an effective treatment of bile leak after liver trauma with a high success rate (90-100%), thereby operative treatment can be avoided⁵. Nevertheless, ERCP can sometimes be inadequate biliary drainage, resulting in the need for subsequent alternative interventions. Percutaneous interventional procedures aid in the characterization of a bile leak and in its initial management via drainage of fluid collections. These methods share the common goal of decreasing or eliminating the pressure gradient between the bile duct and duodenum, allowing preferential flow of bile from the duct into the duodenum instead of bile exiting the leak site. The absence of ongoing bile flow through the leak site allows the defect to heal.

In this article, the authors report a complex liver injury patient with persistent bile leak who underwent initial successful ERCP and simultaneously percutaneous drainage procedure for intraperitoneal bile leakage. Our current attention should be to reduce liver-related morbidity in order to optimize outcome. The goals of this study were to analyze the complication rate following high-grade liver injuries and assess the safety and efficacy of nonoperative strategy in management of patients with different types of liver-related complications following liver trauma.

Case presentation

Patient 1

A 19 years old male suffered blunt abdominal trauma by a road traffic accident. He was admitted to local hospital emergency room. On arrival, he had a Glasgow Coma Score of 15, and he was hemodynamically stable after adequate fluid resuscitation. An abdominal CT scan with intravenous contrast disclosed a doubtful image of traumatic liver injury predominate at right lobe (AAST-OIS grade 4) was found (Figure 1). This patients were admitted to the trauma service and were initially managed conservative treatment. On hospital day 7, because of an abdomen become tense with low grade fever. A repeat CT of the abdomen on hospital day 7 (Figure 2) showed a large biloma in the subhepatic region and was eventually transferred to our hospital.



Figure 1 : An axial view shows liver parenchymal disruption



Figure 2 : A coronal view shows biloma

The initial Magnetic resonance cholangiopancreatography (MRCP) at our institution revealed nearly transect of common hepatic duct at below confluence level with fluid collection at subhepatic to right paracolic gutter region and left paracolic gutter region.

ERCP was performed with standard therapeutic duodenoscopes by one attending endoscopist within 48 hr of referral (Figure 3-4). Once a bile leak was demonstrated on cholangiogram, a 10-F transpapillary biliary stent was placed. A biliary sphincterotomy was performed routinely. After the ERCP, a subhepatic and paracolic gutter collection were then aspirated and the biloma was drained percutaneously via a pigtail catheter placed by surgeon. Nasogastric tube was also inserted endoscopically to provide enteral nutrition.

After the procedure, bile leak gradually stopped and the pigtail catheter was removed on hospital day 142. The patient was discharged on hospital day 147 and was scheduled for a repeated ERCP and stent removal in the next 3 months.



Figure 3 : Cholangiogram shows a pool of contrast media leaking from the right hepatic duct



Figure 4 : Internal biliary stents placed in the common bile duct

Patient 2

A 21-year-old male patient who was in a motorcycle accident. The motorcyclist was ejected from his vehicle and sustained multiple trauma. Emergency medical service responded and transported the aided motorcyclist to our hospital. After resuscitation, according to the ATLS protocol, the patient underwent further investigation. Computed tomography with intravenous contrast showing hemoperitoneum, liver laceration through central segment with large intracapsular hematoma and intraparenchymal active contrast extravasation. Patient was managed nonoperatively with immediate shift for interventional radiology to attempt angioembolization of the bleeding vessels. Small arterio-portal shunt anomalies in origin including right hepatic artery and right

portal vein were reported. Both vessels were selectively cannulated and bilateral gel foam embolization of the bleeders was achieved with immediate satisfactory results (Figure 5).



Figure 5 : Visceral angiogram shows intraparenchymal arterio-portal shunt

One week into this admission since the onset of injuries, the patient developed abdominal pain and low-grade fever. Computed tomography of the abdomen 7 days after trauma illustrated disruption of proximal common hepatic duct and diffuse intraperitoneal free fluid. MRCP showed an isolated common hepatic duct injury. Ultrasound-guided pig tail for external drainage was inserted and 2,000 cc bile was drained. Bile drainage continued to be constant at 200 cc per day (Figure 6). The ERCP revealed left hepatic duct and duct confluence injury which was stented with 7 French stent. External drain was removed after decrease in output. The patient recovered well. Stent was removed after 8 weeks. He remained free of abdominal symptoms and signs for the 3 months following trauma (Figure 7).



Figure 6 : Percutaneous biliary drainage Figure **Figure 7 :** Follow up 3 months after trauma

Patient 3

The patient was a 22-year-old man was brought with trauma to head, thorax and abdomen due to a road traffic accident. On arrival he had tachypnea, tachycardia and hypotension. Glasgow Coma Scale score was 8/15. Definitive endotracheal intubation was performed. Decreased breath sounds on right side should lead to an immediate chest tube drainage. Abdomen was distended with tenderness and guarding in the right hypochondrium. Focus assessment sonography in trauma (FAST) revealed massive hemoperitoneum. He was resuscitated by administration of crystalloids. Patient's vitals instability after adequate resuscitation and blood transfusion were performed in the emergency room, and the patient was transferred to the operating room within 14 min.

A crash laparotomy was performed with a long midline incision which revealed a large laceration of the right lobe of the liver and intraperitoneal massive hemorrhage (Figure 8). Perihepatic packing (PHP) was conducted using the Pringle's maneuver and the abdomen was left open with vacuum packing closure (VPC). After further resuscitation in the ICU, a second operation was performed 48 h after the first operation. When towel packing was removed, no further bleeding was detected. Partially liver necrosis was found, and liver recontouring was performed by interrupted delayed absorbable suture (Figure 9). After the hemostasis was secured, the Jackson-Pratt drain was placed at right subdiaphragmatic and subhepatic area and abdomen was completely closed.

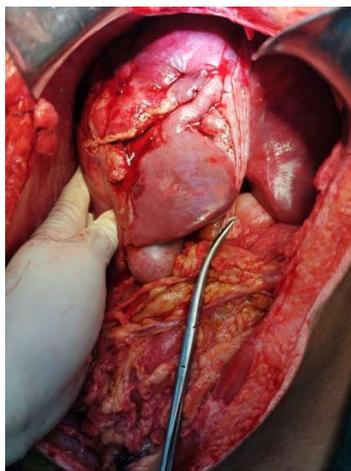


Figure 8 : A large laceration of the right lobe liver



Figure 9 : Liver recontouring during second operation

Billous ascites were detected by Jackson-Pratt drain on day 7 after admission. MRCP revealed a fluid collection communicating with segment VIII/IV intrahepatic duct, likely peripheral duct injury and biloma. The patient underwent ERCP because of continued bilious output from the surgically placed drain (Figure 10). ERCP found a bile leak from the peripheral intrahepatic ductal system on cholangiogram, the biliary stents placed. He was discharged on day 12 after hospital admission and alive and no neurological and abdominal sequelae (Figure 11).



Figure 10 : Continuous biliary leakage



Figure 11 : Bile leak from the peripheral intrahepatic ductal system on cholangiogram

Discussion

Many patients with complex liver injuries undergo validation for hemorrhage control as definitive Fig. 1. Axial (A) and coronal (B) abdominal CT scans demonstrating AAST grade 5 hepatic laceration with extravasation treatment, whereas high-grade injuries can require modalities to achieve hemostasis. We presented a case of a high-grade liver injury where hemorrhage control was successful (Figure 12).

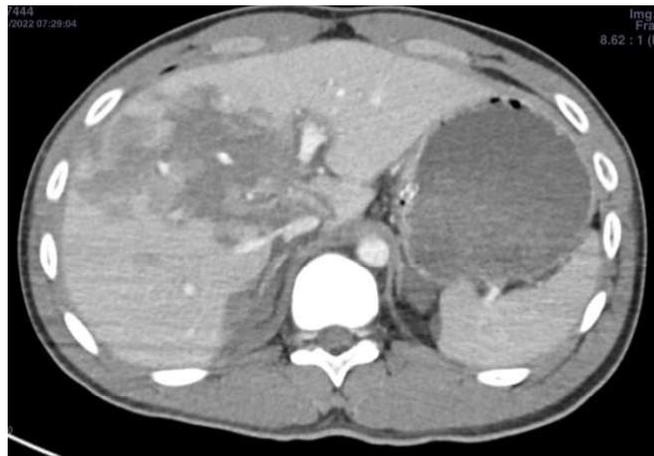


Figure 12 : An axial view shows intraparenchymal laceration with active contrast extravasation

Following blunt hepatic trauma, biliary complications have been reported in 2.8 to 7.4% of patients⁶. We performed repeat CT scans based on the appearance of clinical signs and symptoms of liver-related complications such as right upper quadrant pain, jaundice, fever, or melena. Our data show that the optimal time period from injury to repeat imaging studies for high-grade liver injuries seems to be 7 to 10 days, the mean time for the appearance of complications.

We report on complications and the required interventions for the management of complex liver injuries. Complications are mostly seen in high-grade liver injuries. Such complications can be bile leak, liver abscess, and ischemic necrosis of the liver and gallbladder. Injuries to the biliary tract after blunt abdominal trauma can be classified as intra- or extrahepatic. Extrahepatic bile duct injury may occur in the absence of a liver parenchymal injury, whereas intrahepatic bile duct injury is invariably associated with liver parenchymal laceration. These injuries can be simple bile leaks into the

lacerated liver, peritoneal cavity, or pleural cavity or even biliary-vascular fistulae. The appearance of clinical signs and symptoms like right upper quadrant pain, jaundice, fever, or malena indicates liver-related complications. The CECT suggests biloma as progressive growth of a well-circumscribed, low-attenuation intraparenchymal or perihepatic collection (Figure 13)⁷.

However, though the presence of free fluid is sensitive, it is nonspecific for bile leak. Delayed bile leaks have also been reported to occur following a secondary rupture of a subcapsular collection or due to duct ischemia. Other diagnostic modalities that can help in the differential diagnosis are magnetic resonance cholangiopancreatography (MRCP), and endoscopic retrograde cholangiopancreatography (ERCP). MRCP is useful in diagnosing bile leak in patients with subtle clinical presentations, especially those undergoing a non-operative management (Figure 14).



Figure 13 : A coronal view shows low-attenuation intraparenchymal or intraperitoneal fluid collection after trauma 7 days

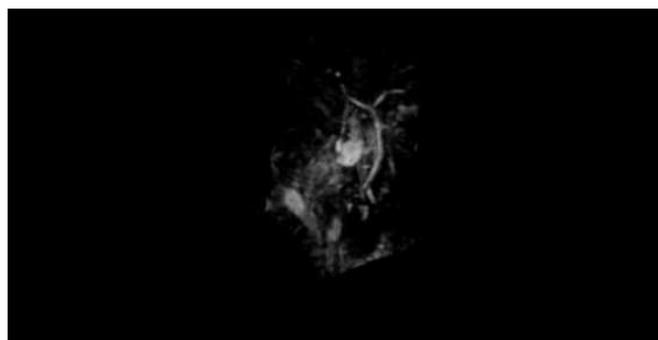


Figure 14 : MRCP demonstrate discontinuity of right intrahepatic duct

Finally, a relatively small proportion of patients presents with late complications, often several months or years after their original trauma. These patients usually develop biliary strictures conditioning dilation of the proximal biliary tree with recurrent episodes of cholangitis or obstructive jaundice. In recent years, because of the growing adoption of nonsurgical approaches to the initial treatment of abdominal traumas, this group of patients has increased significantly.

Traumatic bile duct injuries can be classified in intrahepatic and extrahepatic. This classification not only identifies the anatomical location of the injuries, but also helps directing diagnostic modalities and treatment interventions (Figure 15).

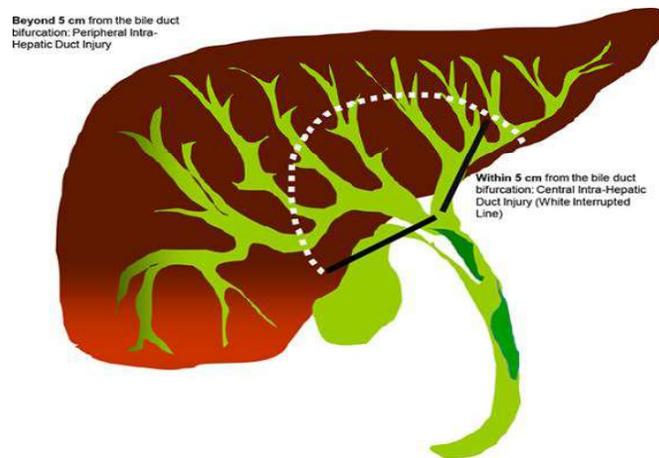


Figure 15 : Schematic representation of the anatomical classification of intrahepatic biliary duct injuries. Central intrahepatic biliary duct injuries occur when the trauma affects biliary ducts within 5 cm from the biliary duct bifurcation. Peripheral intrahepatic bile duct injuries occur when the trauma affects hepatic parenchyma that is more than 5 cm distant from the bile duct bifurcation.

Intrahepatic biliary duct injuries are subcategorized into two groups according to where the injury occurs in the biliary tree. The first group includes central biliary injuries and the second group includes peripheral bile duct injuries. Central intrahepatic biliary injuries are those where the injury falls within 5 cm from the hepatic duct bifurcation. Peripheral biliary injuries are those within the hepatic parenchyma affecting bile ducts that is more than 5 cm distant from the hepatic duct confluence. Extrahepatic bile duct injuries can affect the biliary bifurcation, the hepatic duct, the cystic duct, or the common hepatic duct⁸.

Management is driven by the type and extent of the biliary injury and requires multidisciplinary cooperation between interventional radiologists, endoscopists, and hepatobiliary/transplant surgeons. Nonoperative treatment and angiography with selective embolization are crucial for hemorrhage control, while ERCP with biliary stenting has become an important tool in diagnosing and treating post traumatic bile leak.

The management options for bile leak after liver injury consist of observation, percutaneous drainage, biliary stent placement either via ERCP or percutaneous transhepatic approach, and operative treatment. Selection of the treatment options depends mainly on the patient's condition, the adequacy of drainage, and facility of the institution.

ERCP with sphincterotomy and biliary stent insertion is a safe and effective method of managing bile leak after liver injury (Figure 16-17). The goal of endoscopic treatment is to decrease the pressure gradient within the biliary tract to allow for healing. However, it can be unsuccessful in post-traumatic biloma or bile leakage. Interventional treatments have a vital role in both the diagnosis and management of bile leaks. Percutaneous interventional procedures aid in the characterization of a bile leak and in its initial management via drainage of fluid collections. Regardless of the type of injury, the natural history of traumas to the biliary tree is spontaneous closure within 3 weeks if the biliary drainage is maintained. Conservative management of bile leaks is safe provided that the patients are adequately drained and remain afebrile.



Figure 16 : Standard endoscopic sphincterotomy



Figure 17 : Biliary stent insertion

The success rate for therapeutic endoscopic intervention ranges from 90% to 100%⁹. In our experience, ERCP and percutaneous drainage as a primary therapeutic procedure was effective in 3 out of 3 patients (100%) with a bile leak. We were able to follow up 3 of the 3 patients (100%) who survived and observed that all 3 patients were doing well and had no liver-related complications at a median follow up of 3 months. As far as we can appreciate, non-operative treatment of biliary complications is associated with little or no long-term morbidity.

Similar to data from the literature, our results show that resolution of traumatic bile duct injury and bile leaks occurred after a mean of 21 days (range 3-68 days), following endoscopic intervention¹⁰. The length of time for stenting varied from 4 to 8 weeks in previously published reports¹¹. At 3 weeks after therapeutic intervention, the percutaneous drainage catheter was removed because the output was less than 20 mL per day for 3 days, and follow-up cross-sectional imaging showed complete resolution of the biloma. No recurrent fluid collections were noted. We remove stents after an interval of 12 to 16 weeks as a result of prolonged rehabilitation required following severe multiple trauma. A cholangiogram before stent removal is necessary to confirm healing of bile duct injury. Our experience has shown that all biliary leaks healed, even those involving the main ductal system.

Table 1 : Demographic data of patients and treatment of the study.

	Mechanism	Hemodynamic	FAST	Preoperative CT abdomen	Hemorrhagic control	Symptom of biliary complication	Treatment of biliary leakage	Outcome	Length of stay
Case 1	Blunt	Stable	Positive	Yes	Conservative	Abdominal discomfort, Low-grade fever, Jaundice	ERC with stent + Percutaneous drainage	Discharge	147
Case 2	Blunt	Stable	Positive	Yes	Angioembolization	Abdominal discomfort, Low-grade fever, Jaundice	ERC with stent + Percutaneous drainage	Discharge	21
Case 3	Blunt	Unstable	Positive	No	Explore	Abdominal discomfort, Low-grade fever, Jaundice	ERC with stent + Percutaneous drainage	Discharge	12

To our knowledge, this report on a endoscopic biliary drainage and percutaneous treatment in managing a patient with bile leak after liver injury. This procedure requires cooperation between trauma surgeons, endoscopists and/or interventional radiologists, again, emphasizing the need of a multidisciplinary team.

Conclusion

The traumatic bile duct injury is a rare yet serious consequence of blunt trauma. A minimally invasive, multidisciplinary approach to traumatic bile leaks, as an alternative to open surgery, is practical and safe. It requires flexibility, particularly if the diagnosis has been delayed, and may still involve a prolonged hospital stay. ERCP with biliary stent placement and percutaneous biloma drainage in the management of patients with extensive traumatic hepatic injury with bile leaks. The severity of an injury and the site of a bile leak do not preclude endoscopic as a management option in these patients. The results of our case and those of previously published series suggest that ERCP should be considered as a first line therapy for traumatic bile leaks.

Conflict of interest statement

We hereby certify that there is no conflict of interest in this study.

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