



Case report: Management of pediatric blunt abdominal trauma following an ATV accident leading to liver hilum injury

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ABSTRACT

Blunt abdominal trauma from the ever-popular all-terrain vehicle is becoming an increasing concern in pediatrics. Non-operative management has become the standard of care for isolated blunt hepatic injuries. However, operative intervention is still warranted in hemodynamically unstable patients and for any serious delayed complications such as liver devascularization and liver failure. This case report presents a pediatric patient with an isolated Grade V blunt hepatic trauma following a quad rollover. After the initial damage control laparotomies, due to ongoing bilious drainage, clinical deterioration and extensive free fluid on imaging, the patient went for a repeat exploratory laparotomy. This showed significant injuries to the vascular and biliary systems, involving both hepatic lobes. The patient was followed closely with imaging, as the fear of liver devascularization was high, with a follow-up computed tomography (CT) scan showing subtle signs of atrophy. The patient was admitted three months later for an uncomplicated delayed hepaticojejunostomy. Delay in diagnosis of biliary system damage following trauma is not uncommon but concomitant vascular injuries to both lobes of the liver is rare. Possible liver ischemia should be followed at a major trauma center, monitoring for any secondary complications and to assess the need for surgical resection or transplantation.

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According to the Canadian Institute of Health Information, Canadian children are at a 6 times higher risk of significant injury when riding an All-terrain vehicle (ATV) as compared to a conventional automobile, with off-road motor vehicles being the fourth most common cause of injury-related death in children [1]. The liver is commonly injured after such a traumatic event, with a reported incidence between 1% and 8% [2]. The Hepatic Organ Injury Scale is a useful tool for classifying patients following blunt abdominal trauma, with a grading system from I (subcapsular injury, <1 cm deep) to VI (hepatic avulsion) [3,4]. Mortality rates from severe liver injuries, grades IV and V, are significant, ranging from 35% to 80% [5].

Over the past two decades, there has been a shift in the management of isolated hepatic blunt trauma in pediatrics toward non-operative management, likely due to advancements in imaging techniques [6,7]. The American Pediatric Surgical Association (APSA) Trauma Committee established consensus guidelines for

standardized management of pediatric patients in isolated hepatic and splenic trauma [8]. While non-operative techniques have shown to be quite successful, it is still important to recognize which patients warrant a surgical solution.

1. Case report

A previously healthy 14-year old male, passenger in an ATV traveling at high speed, was admitted following ejection and a crush injury when the vehicle landed on the patient. Emergency services were mobilized to the scene of the injury and the patient was transported by helicopter to a Level 1 pediatric trauma center.

Upon arrival in the emergency department, the patient was rapidly triaged and resuscitated by the pediatric surgical service utilizing advanced trauma life support (ATLS) procedures. His presenting hemodynamic profile revealed a heart rate of 120 beats/min, respiratory rate of 22 breaths/min, and a blood pressure of 72/32 mm of mercury. His initial Hemoglobin was 101 g/L on a blood gas. Following initial resuscitation, a multiphasic contrast enhanced computed tomography (CT) of the chest, abdomen, and pelvis was performed. This revealed an extensive comminuted hepatic

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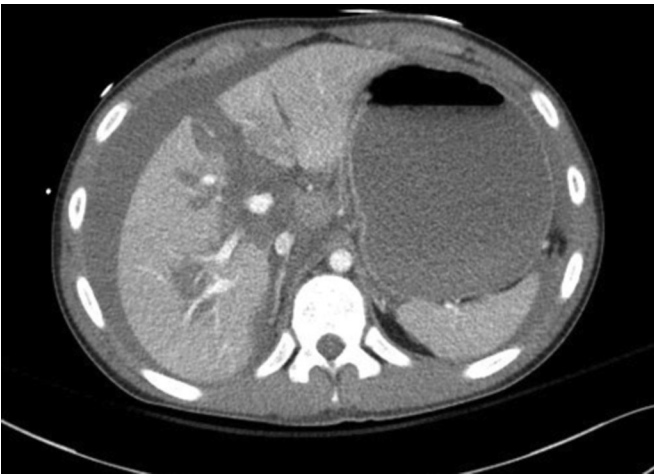


Fig. 1. Abdominal computed tomography scan obtained at initial resuscitation demonstrating Grade V liver injury.

laceration involving segments 5, 6, 7, and 8, extending into the hilum along the gallbladder fossa (Fig. 1). There was extension of the laceration to a lesser extent into segments 4a and b. There was a significant arterial perfusion defect to the right lobe of the liver, with marked attenuation of the right hepatic arterial flow. Neither active extravasation nor pneumoperitoneum was noted.

Despite his initial response to resuscitation, he began showing signs of ongoing bleeding, associated with an abrupt drop in his hemoglobin. He was taken for a damage control laparotomy, and control of his liver laceration. Following initial packing of the liver, the hemoperitoneum was evacuated and it was confirmed that he had no additional hollow viscus injury. The patient was closed and he was transported to the intensive care unit for ongoing resuscitation and rewarming. A second-look laparotomy was performed 48-h later. The abdomen was washed out, and the packing carefully removed from the right upper quadrant. Although a large amount of bile was noted upon re-laparotomy, following removal of the packs there was no evidence of ongoing bleeding or bile leakage. Two Jackson-Pratt (JP) fully perforated drains were placed in the sub-hepatic space near the hilum. On the fifth day following his re-look laparotomy, the JP drain output acutely increased from 300 mL/day, to 1400 mL of bilious fluid in the preceding 24 h. An ultrasound demonstrated an edematous gallbladder, no intrahepatic collection, and a heterogeneous echotexture of the liver corresponding to the laceration site.

A repeat CT showed occlusion of the right hepatic artery and left portal vein, with patency of the main portal vein (PV), right portal vein, and left hepatic artery (Fig. 2). Extensive free fluid in the abdomen and pelvis was noted. Based upon his clinical condition and imaging, a re-laparotomy was planned.

At the third laparotomy, post-operative day (POD) #10, the liver hilum was re-explored. Just beyond the hepatic proper artery bifurcation, the right hepatic artery was completely avulsed and thrombosed. This was ligated. Similarly, just beyond the bifurcation of the common portal vein, the left portal vein was completely avulsed. The left PV was controlled and ligated. The gallbladder was dissected in a retrograde fashion and removed to allow clear demonstration of the cystic duct and confluence with the common hepatic duct. Following this proximally, we identified complete avulsion of the left hepatic duct, with a linear tear extending into the common hepatic duct bifurcation. The laceration of the bifurcation was repaired. The proximal bile duct, draining segments 2 and 4 was identified just outside the portal plate. A 5-French

umbilical catheter was placed into the duct and secured, then exteriorized through a separate stab incision to allow preservation of the left lobe. The abdomen was thoroughly irrigated and new JPs placed around the liver hilum, and the abdomen was closed. On POD#2, he was extubated and transferred to the ward the following day (Post-admission day #13).

Although there was a marked decrease of bile from the JPs, an endoscopic retrograde cholangiopancreatography (ERCP) was arranged on POD#10 (post-admission day #20) from his third laparotomy, at which time an 11.5-French, 7 cm stent was placed across the common hepatic duct repair, up into the right hepatic duct. This resulted in complete cessation of bile from the JPs. The patient was subsequently discharged from hospital 32 days after admission on a full diet, with normalization of his liver enzymes and function.

At 11 weeks following the injury, a repeat ERCP revealed no leak or stricture in the remaining biliary tract, and the stent was removed. A percutaneous transhepatic cholangiogram (PTC) showed preservation of the intrahepatic left biliary system. A follow-up CT scan showed subtle signs of atrophy of the right lobe of the liver, with hypertrophy on the left side. A hepatobiliary iminodiacetic acid (HIDA) scan demonstrated good flow through both sides of the liver, with the left side draining extracorporeally via the umbilical catheter. The patient was admitted on October 23, 2012, for an elective exploration and possible left lobe hepaticojejunostomy.

We accessed the segment 2/3 duct by dissecting out the falciform ligament. The segment 2/3 duct was opened longitudinally and a Roux-en-Y jejunal limb anastomosed in a side-to-side fashion (Fig. 3). The distal Roux limb was completed in standard fashion, a JP was placed behind the biliary reconstruction and the abdomen closed. The patient was discharged home on POD#6.

The patient was followed-up in clinic at 1 month and 3 months post-reconstruction. To date he has made a full recovery, with no abnormalities of his liver chemistries. Planned ultrasound imaging at 6 months has been arranged.

2. Discussion

There are several delayed complications following hepatic trauma that are highlighted in this case report, the formation of a biloma and the risk of hepatic revascularization and subsequent compromise following hepatic vascular injury.

Traumatic bile duct injuries are extremely uncommon, occurring in only 0.1% of traumas, with a significant bile leak in 0.5%–21% of

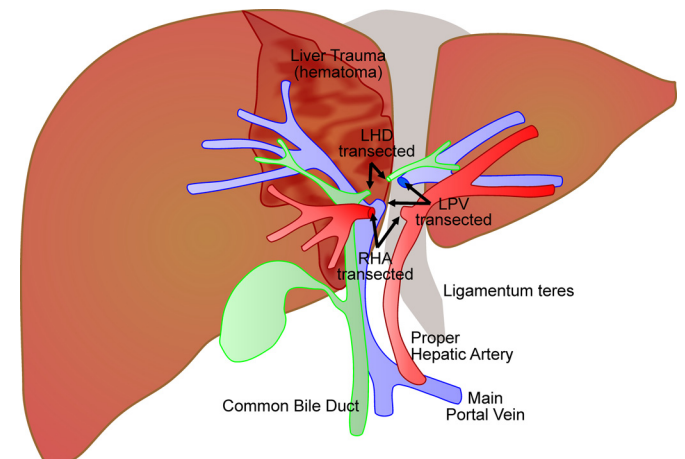


Fig. 2. Image of initial injuries suffered: left hepatic duct (LHD), right hepatic artery (RHA) and left portal vein (LPV) transections.

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