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Traumatic bile leaks from blunt liver injury in children: A multidisciplinary and minimally invasive approach to management☆,☆☆

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ABSTRACT

Background: Selective non-operative management (NOM) of hemodynamically stable pediatric patients with blunt hepatic trauma is the standard of care. Traumatic bile leaks (TBL) are a potential complication following liver injury. The use of endoscopic retrograde cholangiopancreatography (ERCP) in the diagnosis and treatment of TBL is described in adults, but limited in the pediatric literature. We report our experience with a multidisciplinary and minimally invasive approach to the management of TBL.

Methods: This was an IRB-approved 13-year retrospective review (January 1999-December 2012) of an institutional pediatric trauma registry; 294 patients (≤17 years old) sustained blunt hepatic injury. Those with TBL were identified. Patient demographics, mechanism of injury, management strategy and outcomes were reviewed.

Results: Eleven patients were identified with TBL. Hepatobiliary iminodiacetic scan (HIDA) was diagnostic. Combinations of peri-hepatic drain placement, ERCP with biliary stenting and/or sphincterotomy were performed with successful resolution of TBL in all cases. No child required surgical repair or reconstruction of the leak. Cholangitis developed in one child. There were no long-term complications.

Conclusions: A multidisciplinary and minimally invasive approach employing peri-hepatic external drainage catheters and ERCP with sphincterotomy and stenting of the ampulla is a safe and effective management strategy for TBL in children.

Selective nonoperative management (NOM) of blunt hepatic injury in hemodynamically stable pediatric patients has become the established standard of care over the last several decades [1–5]. As many as 10% of patients who undergo successful selective NOM of blunt hepatic injury are still at risk for developing complications, such as hemobilia, hepatic artery pseudoaneurysm, gallbladder necrosis, abdominal compartment syndrome, abscesses, intra- and extra-hepatic bilomas, and biliary fistulas [2,6,7]. A high index of suspicion for complications must be maintained in patients with selective NOM, even after initial recovery.

Increasing attention has been turned towards minimally invasive approaches to managing traumatic bile leaks (TBL) [2,3,8,9]. Techniques such as image-guided drainage, laparoscopic washouts of bile, and endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy or stenting are used in the management of TBL and are well described in the adult hepatobiliary and trauma literature [3,5,9–11].

In contrast, the pediatric experience is limited to small series or individual case reports [3,9–11]. We previously reported a TBL following NOM of a grade III liver injury in a pediatric trauma patient, which was managed successfully with ERCP and sphincterotomy [7]. Here, we describe our institutional experience with a minimally invasive and multidisciplinary approach to TBL following pediatric blunt liver injury, all of which resolved successfully.

1. Methods

An institutional review board (IRB) approved 13-year retrospective review (IRB#31993EM) (January 1999 to December 2012) was performed using the institution's pediatric trauma registry and patient medical records. A total of 294 pediatric patients (≤17 years old) were found to have liver injuries from blunt trauma. Eight patients received operations secondary to hemodynamic instability. Four patients expired from liver or other injuries. Of the remaining four patients, only one developed a post-traumatic bile leak. Of the non-operatively managed patients, ten developed a bile leak as a result of their injury. Medical records of these eleven total patients

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were reviewed to evaluate the patient demographics, mechanism of injury, management strategy, outcomes, and complications. Grades of injuries were determined by CT scan and in accordance with the Association for the Surgery of Trauma (AAST) guidelines [12]. Successful non-operative management of TBL was defined as no required hepatobiliary surgery during the index stay [3]. TBL was diagnosed by the appearance of bile in peri-hepatic drains or by hepatobiliary iminodiacetic (HIDA) scan. Combinations of image-guided or operatively (laparoscopic or open) placed peri-hepatic drains, and ERCP with biliary stenting and/or sphincterotomy, were used in the management of all patients with TBL.

The choice of sphincterotomy and/or stent placement was the decision of the pediatric endoscopist, although sphincterotomy with stent placement has become our preferred approach as our experience with these techniques has grown. Those with symptomatic or tense biliary ascites received peri-hepatic drain placement to relieve pain or discomfort. The choice of laparoscopic versus image-guided placed peri-hepatic drains was based on the attending pediatric surgeon's clinical judgment. Laparoscopically placed drains provided additional opportunity for evaluation of other potential injuries, peritoneal lavage, and direct visual placement. Resolution of bile leak was determined when external catheter drainage diminished and became non-bilious or when repeat ERCP demonstrated no further evidence of bile leak.

2. Results

Eleven patients with TBLs (3.7%) were identified following pediatric blunt liver injury. Of these eleven, seven were male (64%). The median age at presentation was 11 years (range, 3-16 years). The mechanism of injury varied among patients, but all sustained either crush or direct impact injuries to the upper abdomen. There was one patient with a grade II liver injury, five with grade III liver injuries, and five with grade IV liver injuries. The median injury severity score (ISS) was 17.5 (range, 9–38). In 82% of the patients, liver injury was the only abdominal solid organ injury present. At initial presentation, ten patients were hemodynamically stable and subsequently managed successfully non-operatively.

One patient with a grade IV injury sustained following a motor vehicle accident (MVA) was hemodynamically unstable at presentation to another hospital. An exploratory laparotomy with hepatic packing was performed, and he was transferred to our institution. Re-exploration 72 hours later demonstrated continued liver bleeding and bile-stained tissues, which were addressed with argon beam coagulation and operative drain placement. Bilious drain output persisted and an ERCP with sphincterotomy was performed on postoperative day (POD) 17, with subsequent resolution of the bile leak within 2 weeks. Another patient suffered a grade IV liver laceration, pancreatic transection, and renal artery dissection following an all-terrain vehicle (ATV) accident. Following a period of stability, she developed progressive abdominal distension and physiologic instability. She underwent diagnostic laparoscopy with drainage of ascites, peritoneal lavage, and placement of peri-hepatic drains that subsequently drained bile.

Bile leaks were diagnosed at a median time of 5 days (range, 3–7 days) after initial trauma. The development of new symptoms, including increasing abdominal pain, distention, nausea, and vomiting, prompted suspicion in the majority of cases. This led to hepatobiliary iminodiacetic acid (HIDA) scanning by nuclear medicine in nine of the eleven patients, which proved to be diagnostic of biliary leak in all nine cases (Fig. 1). In the remaining patients, none had symptoms concerning for TBL and no HIDA scans were performed. In the two patients described above, a bile leak was diagnosed from operatively placed peri-hepatic drains. Intraperitoneal drains were placed laparoscopically or using image-guided techniques in six additional patients to treat symptomatic biliary ascites. ERCP was performed at a median time of 8 days (range, 3-17 days) after initial trauma. This procedure confirmed bile leaks in all patients, of which nine were intrahepatic and two were extrahepatic. During ERCP, sphincterotomy and/or stent placement was performed in all patients.

Following ERCP, all bile leaks resolved with a median time to resolution of 13 days (range, 3-64 days). The drains were subsequently removed at a median of 23 days (range, 6–78 days). Indwelling biliary stents were endoscopically removed at a median of 60 days (range, 12–438 days). TBL resolution was confirmed with radiographic visualization during ERCP stent removal. Two patients developed complications related to their interventions. One patient was lost to follow up and developed cholangitis secondary to retained biliary stent, which was subsequently removed on day 438. Another patient developed a small pneumothorax and pleural effusion after an image-guided drain placement, which required a drainage catheter and resolved. No child suffered from any long-term complications. Median length of stay was 10 days (range, 5–31).

3. Discussion

Selective NOM of hemodynamically stable pediatric patients with blunt hepatic injury has emerged as the accepted standard of care [1–5]. Advances in critical care and patient selection have contributed to success rates exceeding 90%, with success observed even in Grade V liver injuries [2,3,8,13]. TBLs are a potential complication of selective NOM of traumatic blunt hepatic injury, occurring almost

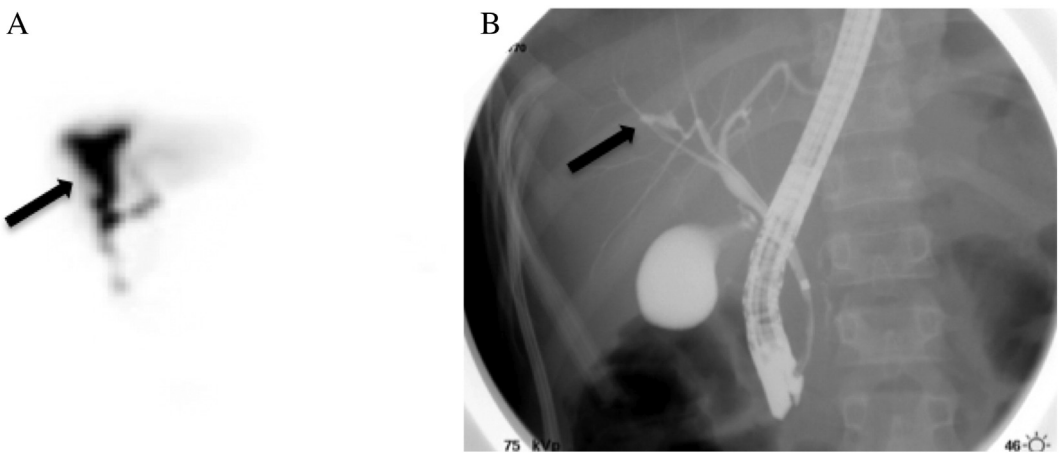

Fig. 1. A, HIDA scan demonstrating bile leak (arrow indicates bile leak). B, ERCP demonstrating bile leak (arrow indicates bile leak).