Traumatic pediatric bile duct injury: nonoperative intervention as an alternative to surgical intervention

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Abstract

Background: Nonoperative management of blunt pediatric liver injuries has become the standard of care in the absence of hemodynamic instability. However, associated bile duct injuries remain as difficult challenges. Few case reports have demonstrated the benefits of conservative approaches, but others have found better outcomes with surgical intervention. In this study, we report on our experience with interventional endoscopic and radiologic management of 5 pediatric patients with bile duct injuries who underwent unsuccessful surgical interventions.

Methods: We conducted a retrospective review of medical records of all pediatric patients who were admitted with major blunt liver trauma and bile duct injuries over a period of 5 years.

Results: There were 5 patients (4 boys and 1 girl) whose ages range from 3 to 11 years in this study. All patients had major liver laceration and bilomas. Two had intrahepatic and 3 had extra hepatic bile duct injuries (2 right hepatic ducts and 1 junction of cystic duct with common bile duct). All of them underwent previous laparotomies, once in 2 patients, twice in 2 patients, and thrice in 1 patient. All 5 patients were eventually treated successfully with interventional endoscopic and radiologic techniques. Three underwent endoscopic retrograde cholangiopancreatography stenting with percutaneous drainage. Two patients were managed with percutaneous drainage alone. The follow-up is up to 2.5 years with normal liver function test and bile duct ultrasound.

Conclusion: With the current advancement in endoscopic retrograde cholangiopancreatography and intervention radiology techniques, we believe that interventional endoscopic and radiologic management of bile duct injuries caused by blunt trauma in children is successful and efficacious even after multiple laparotomies.

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We present our experience with 5 pediatric patients with traumatic bile duct injury missed during the initial laparotomy. All were successfully managed nonoperatively.

1. Patients and methods

Between June 1999 and February 2005, 5 patients were admitted to our hospital with the diagnosis of major blunt liver trauma and bile duct injuries.

These patients’ medical records were reviewed retrospectively for demographic data, mechanism and type of injury, associated injury, time delay to definitive diagnosis, diagnostic and therapeutic modalities, length of hospital stay, and outcomes.

2. Results

There were 5 patients (4 boys and 1 girl) with an average age of 6.8 years (range: 3-11 years) in this study. The primary cause of blunt abdominal trauma was a fall from a motorbike in 1 patient and an automobile accident in 4 patients. All patients were transferred from other hospitals after local initial management allowing hemodynamic stabilization. All of them underwent previous laparotomies before their transfer: once in 2 patients, twice in 2 patients, and thrice in 1 patient (Table 1). The indication of the initial laparotomy in all patients was hemodynamic instability. The repeated laparotomies were for bile leaks that were not controlled. In all cases, there were major liver laceration and bilomas. Two had intrahepatic and 3 had extrahepatic bile duct injuries (2 right hepatic ducts and 1 junction of cystic duct and common bile duct).

One of the patients had fractures of both the tibia and fibula and another one had a fractured right humerus and colonic tear. The average delay before diagnosis was 24.8 days (range: 3-60 days). All patients were eventually treated successfully with interventional endoscopic and radiologic techniques. Three patients underwent endoscopic retrograde cholangiopancreatography (ERCP) stenting with percutaneous drainage and 2 were managed by percutaneous drainage alone (Table 2). One patient required total parenteral nutrition for 3 weeks, 2 patients required peripheral parenteral nutrition for a short period before starting oral intake, and 1 patient did not require nutritional support. The average follow-up was 19 months (range: 5-30 months). All were clinically free of symptoms with normal liver function and bile duct ultrasound.

3. Discussion

Bile duct injuries caused by blunt abdominal trauma are rare. They are usually associated with liver parenchymal injury and seldom an isolated one.

The exact incidence of such injuries is unknown. Bourque et al [1], in their review of the literature in 1989, RTA indicates road traffic accident; CBD, common bile duct.

### Table 1 Specification of injuries, time delay before diagnosis, and number of laparotomies

<table>
<thead>
<tr>
<th>No.</th>
<th>Age (y)</th>
<th>Sex</th>
<th>Mechanism of injury</th>
<th>Type of biliary injury</th>
<th>Associated injuries</th>
<th>No. of previous laparotomies</th>
<th>Delay before diagnosis (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>Male</td>
<td>RTA</td>
<td>Junction of cystic duct and CBD</td>
<td>–</td>
<td>2</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Female</td>
<td>RTA</td>
<td>Right hepatic duct</td>
<td>Fractured tibia and fibula</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Male</td>
<td>RTA</td>
<td>Right hepatic duct</td>
<td>Fractured humerus and colonic tear</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>Male</td>
<td>RTA</td>
<td>Intrahepatic</td>
<td>–</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>Male</td>
<td>Fall from motorbike</td>
<td>Intrahepatic</td>
<td>–</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 2 Management, complications, and hospital stay

<table>
<thead>
<tr>
<th>No.</th>
<th>Age (y)</th>
<th>Sex</th>
<th>Type of injury</th>
<th>Method of management</th>
<th>Complications</th>
<th>Hospital stay (d)</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>Male</td>
<td>Junction of cystic duct and CBD</td>
<td>Percutaneous drainage, ERCP + stent</td>
<td>Infection</td>
<td>36</td>
<td>1 y</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>Female</td>
<td>Right hepatic duct</td>
<td>Percutaneous drainage, ERCP + stent</td>
<td>–</td>
<td>25</td>
<td>2 y</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>Male</td>
<td>Right hepatic duct</td>
<td>Percutaneous drainage, ERCP + stent</td>
<td>Infection</td>
<td>20</td>
<td>2 y</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>Male</td>
<td>Intrahepatic</td>
<td>Percutaneous drainage</td>
<td>–</td>
<td>26</td>
<td>2.5 y</td>
</tr>
<tr>
<td>5</td>
<td>11</td>
<td>Male</td>
<td>Intrahepatic</td>
<td>Percutaneous drainage</td>
<td>–</td>
<td>20</td>
<td>5 mo</td>
</tr>
</tbody>
</table>
reported 125 cases of extrahepatic bile duct injury—one third of them were in pediatric patients. Dawson et al [5] reported one case of bile duct injury in 10,500 consecutive trauma patients.

The diagnosis is always difficult and often delayed, especially in those cases where nonoperative management of blunt liver injuries was implicated [6]. However, these injuries can be missed even in those requiring laparotomies [6,7]. Michelassi and Ranson [8] reported a 12% incidence of missed ductal injury on initial laparotomies. The diagnosis of bile duct injuries was missed in all our patients on their initial laparotomies. Repeated laparotomies were unsuccessful in controlling the bile leaks.

The time delay before diagnosis in our patients is similar to that in others [1,2]. Early diagnosis requires a high index of suspicion and timely use of diagnostic modalities such as hepatobiliary scintigraphy, ultrasound, computed tomographic scan, magnetic resonance cholangiopancreatography, ERCP, and intraoperative cholangiogram [2,9-12]. HIDA scan is the preferred screening tool for bile leak. Weissman et al [11] recommended obtaining delayed images if bile leak is suspected even if the study is normal at 1 hour. All our patients had a positive HIDA scan demonstrating bile leak. It was able to differentiate the intrahepatic from the extrahepatic bile duct injuries without specific localization. We did not find magnetic resonance cholangiopancreatography useful in these cases. Endoscopic retrograde cholangiopancreatography may be required to obtain more precise data on the anatomy of the biliary system. Its usefulness and safety have been advocated in many recent publications, with greater than 90% ductal visualization and lower than 10% morbidity [13].

The management of bile duct injuries has evolved over the past few decades from a strategy where laparotomy was required to one where laparotomy is used selectively.

With the current advancement in radiologic and endoscopic techniques, few pediatric case reports describing the benefits and safety of nonoperative management using ERCP stenting and/or percutaneous drainage have been published. In our study, 5 patients were treated successfully using this approach despite multiple laparotomies in some of them. Three patients underwent ERCP stenting with percutaneous drainage and 2 had percutaneous drainage alone. This modality of management is not free from complications. Hartle et al [14] claimed that the use of percutaneous drainage may be beneficial if an active bile leak is not present. They added that the risk of secondary infection restricts this treatment to a relatively short period. Two of our patients developed infection of the bile collection. Both were treated by intravenous antibiotics without significant morbidity.

Stents may migrate or clog. In adults, stent migration is reported to occur in 2% to 5% of patients, whereas clogging is reported to occur in 20% to 30% of patients within 3 months of insertion [15]. In children, the long-term effects of biliary stenting are not known. A stent was used in 3 of our patients and was removed after 3 months with no particular adverse effect demonstrated over a follow-up period ranging from 6 months to 2.5 years.

In conclusion, with current interventional endoscopic and radiologic techniques, we believe that nonoperative management of blunt bile duct injuries in pediatric patients is successful and efficacious even after multiple laparotomies.

References