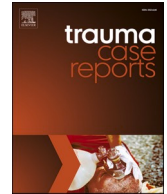




ELSEVIER

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Case Report

Use of glue embolization in management of traumatic bile leak: A case report

Kasiemobi Pulliam^{b,1}, Meera Kotagal^{a,b,*}, Tom K. Lin^{c,d}, Manish N. Patel^{e,f}^a Division of Pediatric General and Thoracic Surgery, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229, United States of America^b Department of Surgery, University of Cincinnati College of Medicine, 3230 Eden Avenue, Cincinnati, OH 45267, United States of America^c Division of Gastroenterology, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229, United States of America^d Department of Pediatrics, University of Cincinnati College of Medicine, 3230 Eden Avenue, Cincinnati, OH 45267, United States of America^e Division of Interventional Radiology, Cincinnati Children's Hospital Medical Center, 3333 Burnet Avenue, Cincinnati, OH 45229, United States of America^f Department of Radiology, University of Cincinnati College of Medicine, 3230 Eden Avenue, Cincinnati, OH 45267, United States of America

ARTICLE INFO

Keywords:

Pediatric injury
Blunt abdominal trauma
Bile leak
Liver injury
Nonoperative management

ABSTRACT

Blunt abdominal trauma is a common cause of solid organ injury in children. Nonoperative management has been established as the standard of care for suspected liver and spleen injuries without peritonitis. Major ductal injury with resultant biloma is a rare complication of nonoperative management of blunt liver injury. Endoscopic retrograde cholangiopancreatography (ERCP) and/or percutaneous drain placement are considered to be safe adjuncts in the management of these bile leaks. However, in the rare cases of persistent bile leak, further nonoperative alternatives have not been reported. In this case report we present a novel multidisciplinary approach to managing persistent bile leaks in blunt liver injury.

Introduction

In the U.S. and worldwide, injury is the leading cause of childhood death and disability [1]. Blunt injury makes up the majority of these patients, and abdominal injuries affect about 10% of injured children [2]. The liver and spleen are the most frequently injured intra-abdominal organs. While initial management for blunt abdominal injury was historically operative, over time non-operative management has become the standard for management in children with blunt abdominal solid organ injury [3]. Potential complications after non-operative management can include delayed bleeding, segmental infarction, and potential bile leak from the liver. The incidence of bile leak or biloma after non-operative management of pediatric liver injury is quite low, around 3–5%, and tends to only occur in patients with grade III injuries or higher [4]. In present day, minimally invasive techniques including percutaneous drain placement and endoscopic retrograde cholangiopancreatography (ERCP) are the mainstays of treatment and are usually sufficient to manage such leaks without further operative intervention [5]. In this case report, we describe an innovative multidisciplinary approach to management of a persistent bile leak after blunt abdominal trauma.

* Corresponding author at: 3333 Burnet Avenue, MLC 2023, Cincinnati, OH 45229, United States of America.

E-mail address: meera.kotagal@cchmc.org (M. Kotagal).

¹ Contributed to this study as co-first authors.

<https://doi.org/10.1016/j.tcr.2021.100468>

Accepted 13 March 2021

Available online 18 March 2021

2352-6440/© 2021 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Case presentation

Patient G. is a 13-year-old male who initially presented to the emergency department at our level I pediatric trauma center after a bicycle crash. He had been traveling downhill, missed a bridge and careened into a creek. Direct, blunt handlebar trauma to the abdomen occurred. Upon presentation, he was hemodynamically normal and remained so throughout his hospitalization. Initial cross-sectional imaging revealed an AAST grade IV liver laceration (Fig. 1).

Patient course and treatment

The patient underwent initial non-operative management per our solid organ guideline and was discharged home on post-injury day 3. Five days post hospital discharge (post-injury day 8), he represented with progressive diarrhea and post-prandial emesis. Repeat abdominal/pelvic CT demonstrated large volume ascites, an evolving liver laceration and an intrahepatic fluid collection concerning for a biloma. Initial intervention consisted of percutaneous drain placement with elevated bilirubin level in the drain fluid that was supportive of a biloma. This was followed two days later by an ERCP demonstrating a narrow, but otherwise normal, extrahepatic bile duct with findings of a deep right lobe intrahepatic laceration and bile leak with contrast extravasation tracking to the dome of the liver. Endotherapy included a biliary sphincterotomy with placement of a plastic biliary stent (5 Fr) within the extrahepatic biliary tree. However, over the next few days, the percutaneous drain continued to demonstrate high volume output. Repeat ERCP failed to attain direct intrahepatic guidewire access to the biliary defect and thus limited the relative proximity a stent could be placed. This repeat procedure did include replacement of the original stent with larger caliber 7 Fr stent extending into a segment of the right central intrahepatic biliary tree with the intraductal stent tip remaining 2–3 cm downstream from the biliary defect. This second endoscopic intervention failed to control the leak. Due to issues with drain clogging, the intra-abdominal percutaneous drains had to be replaced and were able to be positioned directly adjacent to the leak site.

At this time, a course of non-operative management with close observation was pursued. The patient had persistent high-volume drainage (800–1000 mL per day) from his right upper quadrant drain (immediately adjacent to laceration and leak) for 10 days post drain placement. This quantity of drain output was bilious in nature, consistent with the drainage after initial drain placement.

A multidisciplinary team meeting was held at this point involving gastroenterology (GI), interventional radiology (IR), and surgery to determine next steps in management. A joint plan was developed to reattempt ERCP to gain direct access to the bile leak for intraductal glue embolization – a joint procedure between GI and IR. This time, repeat ERCP achieved direct guidewire access to the level of the biliary defect with deep advancement of the ERCP catheter tip. Through the ERCP catheter lumen, a 1.5 Fr Marathon microcatheter was placed and, using a 0.010 in. microwire, the microcatheter was directed into the bile duct associated with the leak. Cholangiogram via the microcatheter confirmed the microcatheter positioning (Fig. 2) and a mixture of n-butyl-2-cyanoacrylate glue (NBCA) and iodized oil at a 1:3 ratio was injected into the duct. The glue extended along the distal aspect of the duct, filling the laceration and extending onto the dome of the liver (Fig. 3). Repeat contrast injection showed resolution of the bile leak (Fig. 4). A short biliary stent was placed to address possible existing, non-visualized secondary sites of bile leak.

Immediately post-procedure, the patient was noted to have a rapid decrease in drain output from the percutaneous drains to essentially zero. His drains were removed sequentially, and the patient's diet was advanced to a regular diet with no increase in drain

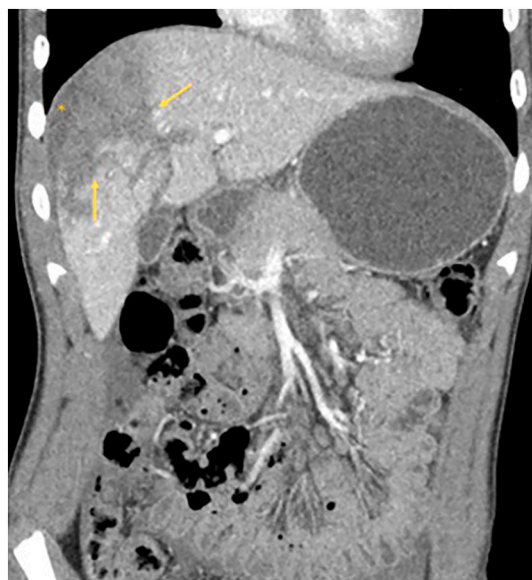


Fig. 1. Coronal reformatted CT with contrast demonstrating a wedge-shaped area of low attenuation (arrows) with capsular fluid collection (*) consistent with a grade IV liver laceration with hemorrhage.

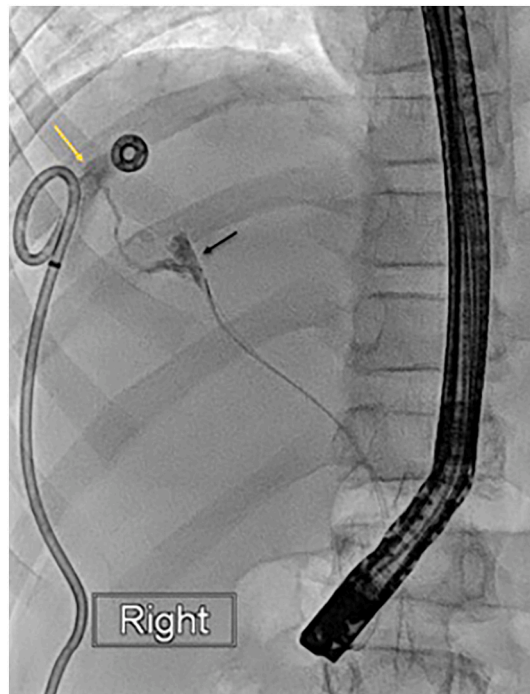


Fig. 2. Contrast injection via a microcatheter placed via ERCP catheter demonstrating intrahepatic biliary injury (black arrow) with contrast extravasation toward the liver dome (yellow arrow) at site of bile leak.

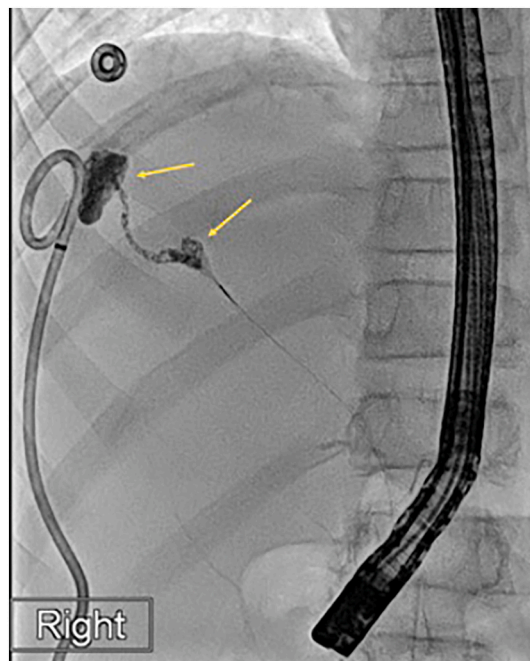


Fig. 3. Static fluoroscopic image following glue injection demonstrating cast of glue (yellow arrows) within site of intrahepatic biliary injury and peripheral biliary duct leading to site of bile leak at the dome of the liver.

output from the drain immediately adjacent to the leak site. This drain was subsequently removed without recurrence of abdominal symptoms. He was discharged from the hospital 6 days post-procedure. His remaining course has been characterized by some intermittent abdominal pain that has subsequently resolved, with return to normal activities and no further hospitalizations. The remaining

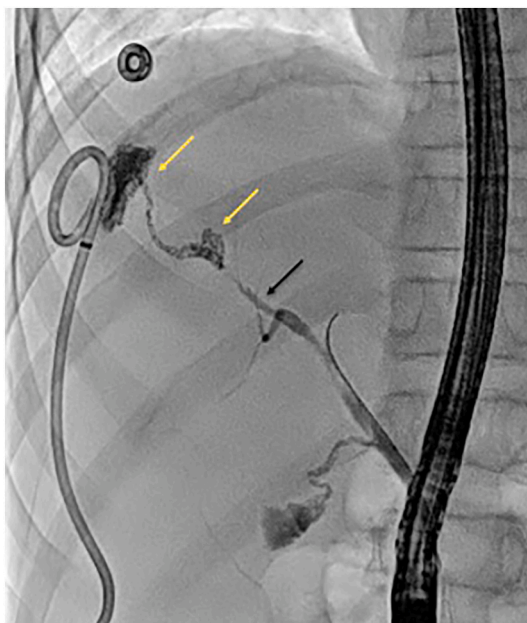


Fig. 4. Contrast injection through ERCP catheter at conclusion of the procedure. Contrast (black arrow) extends up to the site of biliary leak/glue cast (yellow arrow) but not into the intrahepatic biliary injury or to the site of biliary leak.

biliary stent was removed one month after placement.

Conclusion

While bile leaks are a rare complication of blunt liver injury in children, when they do occur they can most often be managed with drain placement or ERCP with sphincterotomy and biliary tree stenting. In this instance, those initial maneuvers failed to control the bile leak, and a unique multidisciplinary approach was taken to allow for treatment of the bile leak without need for surgical exploration and management. Multidisciplinary teams – and team discussions – can be invaluable in the management of complex patients to facilitate optimal outcomes.

References

- [1] Control NCFfPa. Injury prevention & control. <https://www.cdc.gov/injury/wisqars/LeadingCauses.html>. Published 2018. (Accessed).
- [2] E.E. Moore, S.R. Shackford, H.L. Pachter, et al., Organ injury scaling: spleen, liver, and kidney, *J. Trauma* 29 (12) (1989) 1664–1666.
- [3] D.M. Notrica, J.W. Eubanks 3rd, D.W. Tuggle, et al., Nonoperative management of blunt liver and spleen injury in children: evaluation of the ATOMAC guideline using GRADE, *J. Trauma Acute Care Surg.* 79 (4) (2015) 683–693.
- [4] S.R. Giss, N. Dobrilovic, R.L. Brown, V.F. Garcia, Complications of nonoperative management of pediatric blunt hepatic injury: diagnosis, management, and outcomes, *J. Trauma* 61 (2) (2006) 334–339.
- [5] A.N. Kulaylat, A.L. Stokes, B.W. Engbrecht, J.S. McIntyre, S.E. Rzcudlo, R.E. Cilley, Traumatic bile leaks from blunt liver injury in children: a multidisciplinary and minimally invasive approach to management, *J. Pediatr. Surg.* 49 (3) (2014) 424–427.