Super-Selective Hepatic Angioembolization for Traumatic Hepatic Artery Laceration in a Child

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The liver is commonly injured through blunt abdominal trauma in children. Transaction of the hepatic artery and subsequent angioembolization is well reported in the adult population; however, the evidence of its effectiveness is lacking in pediatrics.

We report a case of a child who sustained a grade 3/4 liver injury with contrast blush as evidenced on CT scan. The case was treated by super-selective angioembolization with no major or minor complications. To our knowledge, this is the first case report of pediatric hepatic angioembolization in the Middle East.

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Blunt abdominal trauma is a major cause of abdominal injury in children. The liver is the second most commonly injured organ followed by the spleen[1]. Nonoperative management (NOM) became the main choice for hemodynamically stable patients with solid organ injury (SOI)[2-4]. The reported success rate of NOM in pediatrics reached up to 90%[3]. Adjunct arterial embolization, if indicated, increases the success of NOM. Data about the role of arterial angioembolization (AE) in treating traumatic hepatic arterial bleed in adults is abundant. However, the use of (AE) is not frequently reported for treatment of blunt solid organ injury in children, especially primary traumatic liver bleeding. Our case is a successful super-selective angioembolization of primary traumatic hepatic artery bleed in a child.

The aim of this presentation is to report a case of successful transarterial embolization in a child as one of the available safe options for the management of patients with hepatic tears.

THE CASE

A five-year-old male motorcycle passenger presented to the Emergency Department following a road traffic accident with abdominal pain and vomiting. Blood pressure on arrival was 107/78 mmHg and pulse rate was 114/min. Trauma survey revealed Glasgow Coma Scale of 12/15. Bruises to the right lower chest and abdominal distention was found. Focused Assessment with Sonography for Trauma (FAST) scan was positive for hemoperitoneum. Initial non-contrast abdominal CT showed grade 3/4 (American Association for the Surgery of Trauma Scale) liver laceration involving segment 7/8 with moderate hemoperitoneum. The patient was admitted to the Intensive Care Unit (ICU) for conservative management. Initial hemoglobin result was 5.4 gm/dl; therefore, he received two units of packed red blood cells and fresh frozen plasma. One week later, the hemoglobin dropped to 6.4mg/dl and an additional unit of blood was transfused. Repeat CT with contrast revealed significant pooling of contrast adjacent to a branch of the right hepatic artery. Treatment using angiographic embolization was performed on day 10 of admission. There was minimal elevation of liver function tests postoperatively, which returned to baseline within three days. He was transferred to pediatric ward two days postoperatively. The patient developed no minor or major complications. Total hospital stay was 39 days. A follow-up ultrasound ten weeks postoperatively showed no residual scar or other abnormalities.

The procedure was performed in angiography suit using (Innova, GE, 2100 IQ) in the radiology department. Under aseptic technique and general anesthesia, a right common femoral artery access was secured by 4F sheath through which 4F pigtail catheter was manipulated over the guide wire and placed at the proximal part of the abdominal aorta. An abdominal angiogram was performed, which delineated coeliac trunk as well as superior mesenteric artery. A pigtail catheter was exchanged with Rebar micro-catheter 0.027, which was manipulated over hydrophilic microwire and cannulation of celiac trunk followed by selective celiac angiogram. Super-selective cannulation of the right hepatic artery was performed followed by repeated angiograms, which revealed evident contrast extravasation through segment six feeding artery as well as area of devascularization indicating liver laceration, see figures 1 and 2. Super-selective cannulation of the bleeding artery was performed followed by embolization using Bead Block 300-500 mics (By BIOCOMPATIBLES UK). Post-embolization angiogram was performed, which revealed no evidence of further bleeding, see figure 3. Femoral access sheath was removed, and hemostasis was secured by manual compression.

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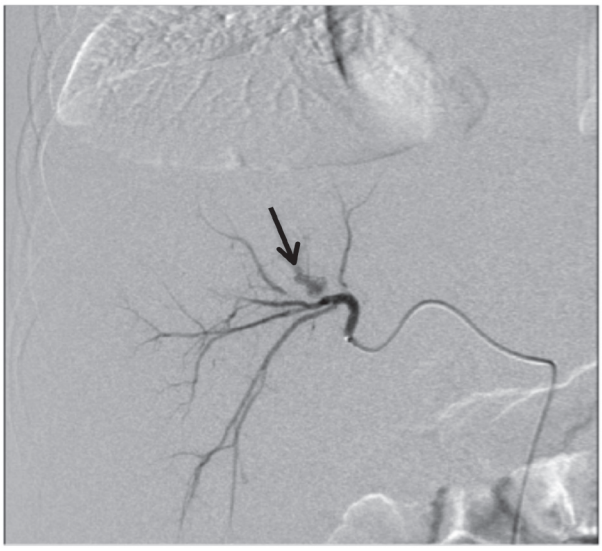

Figure 1: Selective Right Hepatic Artery Angiogram (Arterial Phase) Revealed Evident Extravascular Leaking (Arrow)

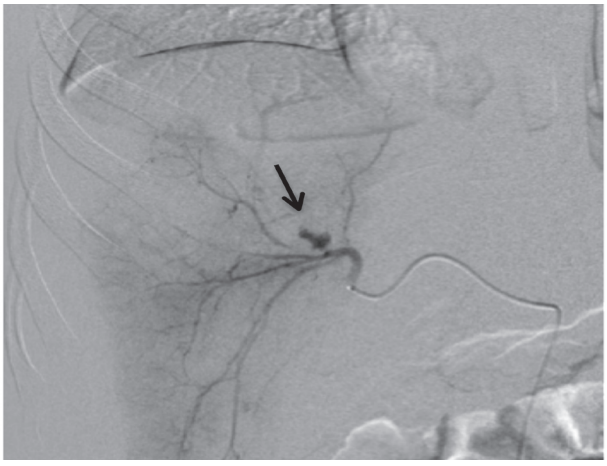

Figure 2: Delayed Arterial Phase Showed Persistent Contrast Leakage with No Wash Out (Arrow)

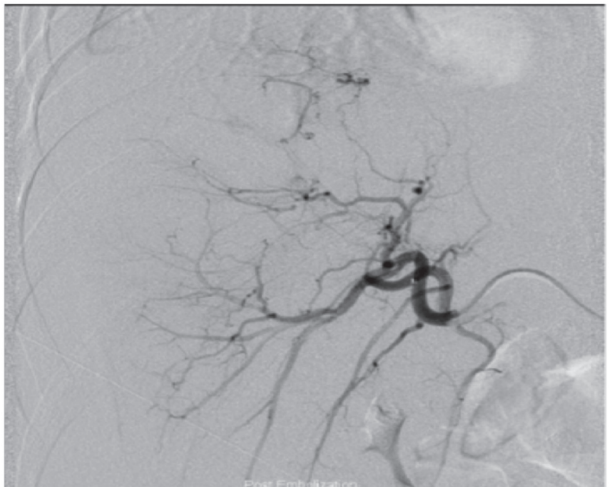

Figure 3: Post-Embolization Selective Hepatic Angiogram Revealed No Evident Leakage

DISCUSSION

The most common causes of abdominal trauma in children are motor vehicle and pedestrian accidents, 20% having liver injury[1,4,5]. The extension of liver below the thoracic cage and their small body surface area makes the liver vulnerable to injury. The right lobe is most commonly injured, probably due to its size in both children and adults[6]. Hepatic artery bleed could be acute or delayed due to delayed hematoma rupture, arteriovenous fistulae, pseudo-aneurysm and arterio-biliary fistulae[7].

Non-operative management has proved to be safe for blunt SOI injury, and such concept was propagated for pediatrics[2-4]. The natural history of SOI is not necessarily catastrophic to require surgical intervention and it could be diagnosed easily through CT scans[8]. Nonoperative management (NOM) involves close observation with strict bed rest, and may also involve intensive care unit admission, angioembolization and endoscopic procedures.

Pediatric patients have an extensive physiologic reserve that can mask the early physical signs of ongoing bleed, thus the presence of blush on CT indicates the necessity of intervention[9]. The concept of surgical hemostatic control is fading due to higher mortality rate and possible exacerbation of hemorrhage due to release of tamponed effect in the hemodynamically stable patients regardless of the grade of injury[6,10-11]. Furthermore, localizing the hepatic artery in a bleeding liver is challenging and may incite more bleeding[6]. Operative management is currently reserved for hemodynamically unstable patients or multiple intra-abdominal injuries or in whom NOM has failed.

The introduction of angiography and subsequent AE in pediatrics can decrease the failure rate of NOM for SOI[6-18]. Fallon et al reported 12 children with successful hepatic AE for primary bleeding[4]. Recent studies reported 10 cases[7,17]. Indications for hepatic AE for children were continuing hemorrhage and development of pseudo-aneurysm[13]. However, selection of patients for intervention largely depends on surgeons and interventionalists background, which may have led to variable reported rates of morbidity and mortality[13]. Some studies demonstrated successful use of AE in hemodynamically unstable patients[7,10-11]. Another found that the main benefit for AE is the reduction in transfusion rate for these patients[5,13-15]. One study concluded poor hemorrhage control with AE in patients who receive more transfusion before the procedure[16]. Fortunately, this was not encountered in our case.

The range of complications of angiography in pediatrics is similar to that of the adult population. Although there is hypothetical difficulty of angiography in pediatrics due to small vessels size; the reported complications rate is low. The majority of complications are minor, mostly angiography site hematoma[4]. Paupong et al reported a complication rate of 0.04% and nil mortality over ten years for all angiography procedures in a pediatric group[17]. Another study reported 4% mortality rate related to ineffective hemorrhage control; however, partially due to delayed intervention[16]. Other reported complications in hepatic AE cases include biloma requiring drainage, bile peritonitis, pleural effusion and rarely hepatic necrosis[5,7,13-15].

CONCLUSION

Hepatic AE is an important adjunct which could increase the success of NOM in the hemodynamically stable child. It is a safe, less invasive and time saving intervention, which should individualized based on patient selection.

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