

Prompt Computed Tomography and Direct Transcatheter Angioembolization in Abdominal Blunt Trauma in Pediatrics: A Case Report

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ABSTRACT

Transcatheter angioembolization in hemodynamically unstable pediatric patients may be feasible provided a structured and time-conscious algorithm is in place. Non-operative management is the preferred treatment for blunt liver trauma in children but may conceal other associated life threatening conditions if not detected by CT imaging.

Although CT is contra-indicated in the unstable hemorrhaging patient, CT room stay-time for a single event from entry to exit can be achieved rapidly and provide extremely valuable information for those patients who need it most. A prompt and direct transfer to the angiography suite following CT optimizes the likelihood of hemostatic control in children with severe active bleeding.

We present a pediatric case of massive intrahepatic subcapsular extravasation successfully managed by a short CT room stay-time allowing comprehensive imaging evaluation followed by a rapid patient transfer for angioembolization.

Keywords: angioembolization, liver trauma, blunt trauma, interventional radiology

INTRODUCTION

Trauma remains the leading cause of childhood death and severe traumatic injuries often result from blunt abdominal injuries, which constitute the third most common unrecognized cause of pediatric trauma deaths. [1] Nonoperative management (NOM) is the accepted standard of care and can successfully manage over 95% of isolated solid organ injuries without surgery. [2,3]

However, transcatheter arterial embolization (TAE) appears to play an increasing role and recent studies have demonstrated its safe and effective results in children. [4] Computed tomography (CT) imaging is essential in this scenario to screen for associated injuries. This NOM is well established in hemodynamically stable patients. Often those that are hemodynamically unstable are managed surgically, however NOM with combined CT-TAE under a rigorous time-conscious algorithm can help control pediatric trauma-related hemorrhage and possibly decrease mortality.

We present a case of a hemodynamically unstable 10 year-old female with severe hepatic injury associated

with massive extravasation that was successfully controlled by angioembolization preceded by rapid CT.

CASE PRESENTATION

A 10 year-old female was admitted in May 2015 to the St Marianna University school of medicine emergency department (Kawasaki city, Japan) with severe abdominal pain resulting from a direct blow to the abdomen. On admission, she was conscious and alert with a temperature: 37.5C, heart rate (HR): 78 beats/min (bpm), blood pressure (BP): 71/41 mmHg, respiratory rate: 25 breaths/min and oxygen saturation of 100% with oxygen mask at 5L/minute. FAST examination was positive and displayed fluid accumulation within the pouch of Douglas. The patient was immediately administered intravenous fluid and her HR and BP stabilized to 73 bpm and 123/40 mmHg respectively. After a 7 minute CT room stay-time from entry to exit, the CT images revealed subcapsular intrahepatic extravasation of the hepatic artery. (Figure 1) The patient was directly transferred to the angiography suite for immediate embolization. After anesthesia induc-

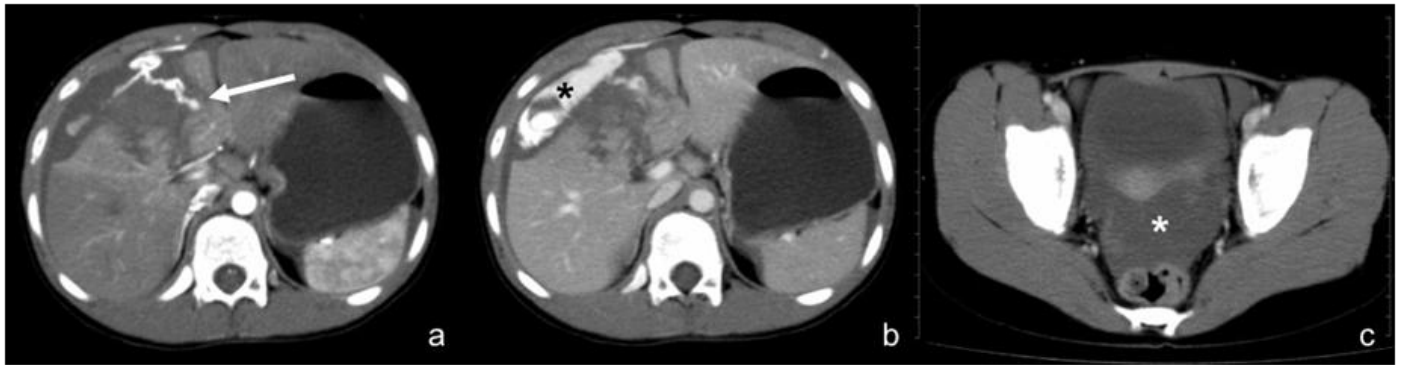


Figure 1: Contrast enhanced abdominopelvic CT. (a) Arterial phase image displays evident arterial extravasation of the contrast medium with the lacerated right hepatic lobe (arrow). (b) venous phase shows clear hyperdense hepatic subcapsular accumulation of contrast medium suggesting blood accumulating within the confined subcapsular space. (c) Large volume of hemoperitoneum within the pouch of Douglas confirming hepatic capsular rupture.

tion, a proximal embolization of the middle hepatic artery was performed with N-Butyl Cyanoacrylic acid (NBCA) (Figure 2). The total angioembolization lasted 18 minutes until completion. The remaining course was uneventful.

DISCUSSION

Transcatheter arterial embolization (TAE) is an established minimally invasive treatment that promptly achieves hemorrhage control in acute blunt trauma.[5] However, NOM is mostly implemented in pediatric abdominal trauma although approximately 20% of children with abdominal injury from a direct blow may require urgent operative intervention.[6] The anatomic and physiologic characteristics of children make them more susceptible to serious blunt abdominal trauma primarily affecting the liver and spleen. [1,7]

Children often demonstrate a powerful vasoconstrictive

and hemodynamic response to acute hemorrhage which can result in misleadingly stable vital signs. [8] Our subject was administered intravenous fluid and displayed hemodynamically stable vital signs which was invalidated by the CT findings. The CT demonstrated severe intrahepatic subcapsular and intraperitoneal extravasation of the hepatic artery. Notably, the shrunken diameter of the inferior vena cava strongly suggested severe blood volume loss providing sufficient evidence to dismiss the falsely stable BP and justify urgent embolization. Prior to embolization, the subject hemodynamically deteriorated.

In general, children will not manifest a decrease in systolic blood pressure until 30% of their circulating blood volume is lost and the falsely appearing normotensive blood pressure [9] may be misinterpreted and conceal a potentially lethal occult hemorrhage that would be undetectable without CT imaging, as in our patient. From this case, the pivotal role of CT scan cannot be overemphasized as it detected crucial data that would not be detectable either by physical examination, X-ray or FAST

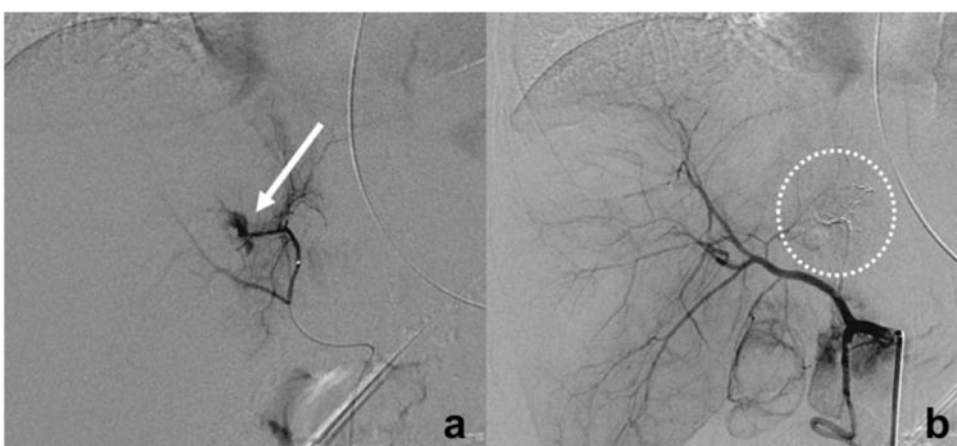


Figure 2: Transcatheter angioembolization. (a) Pre-embolization arteriography displays arterial extravasation from the middle hepatic artery (arrow). (b) Post-embolization arteriography shows disappearance of extravasation performed with NBCA (dotted circle).

examination. In fact, FAST is highly operator-dependent and not recommended as the sole diagnostic test in the hemodynamically stable patient, [10] not to mention the unstable patient as our subject.

Abdominal CT is highly sensitive, specific and has a negative predictive value (NPV) of almost 100% for the detection of solid-organ injury and quantification of peritoneal or extraperitoneal fluid. [12,13].

However successfully implementing rapid CT scanning combined with angioembolization necessitate a specific set of skills and training from the entire trauma team. Matsumoto et al. has demonstrated that a specifically tailored rigorous time-conscious protocol [15] can achieve a CT-room stay duration <8 minutes, followed by an immediate patient transfer to the angiography suite for embolization. Under such a strictly supervised environment, CT imaging and angioembolization can be used effectively in unstable hemodynamic patients.

CONCLUSION

The combination of rapid CT scanning with angioembolization can be used effectively in unstable hemodynamic patients.

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