

Pediatric Abdominal and Pelvic Trauma: Safety and Efficacy of Arterial Embolization

Nghia-Jack Vo, MD, Morgan Althoen, MD, Daniel S. Hippe, MS, Somnath J. Prabhu, MD, Karim Valji, MD, and Siddharth A. Padia, MD

ABSTRACT

Purpose: Although transcatheter embolization is a well established technique to treat adults in the trauma setting, evidence is lacking in the pediatric population. This study assesses the safety and efficacy of arterial embolization for blunt abdominal and pelvic trauma in the pediatric population.

Materials and Methods: A retrospective review of abdominal and pelvic angiograms in 97 pediatric patients with blunt trauma was conducted over an 11-year period. Abdominal angiography and embolization was performed for ongoing hepatic, renal, splenic, or nonvisceral retroperitoneal injury. Pelvic angiography was performed in the setting of pelvic fracture with ongoing pelvic hemorrhage. Complications and clinical success rates of these procedures were assessed.

Results: Of the 97 pediatric patients who underwent angiography for acute abdominal or pelvic trauma, 54 (56%) required embolization involving 62 separate sites. Injury severity score greater than 15 was present in 94% of patients. Targets of embolization included the pelvis (n = 39), liver (n = 8), kidney (n = 7), spleen (n = 6), and retroperitoneum (n = 2). Effective hemorrhage control was achieved in 47 patients (87%). Overall mortality rate was 22% (12 of 54), with most deaths related to traumatic brain injury. Five complications occurred in four patients (7%), including three major complications (hepatic abscess, bile leak, and urinary incontinence).

Conclusions: Angiography and embolization is relatively safe and potentially effective in the setting of abdominal and pelvic trauma in the pediatric population. Angiography with embolization should be considered in the treatment algorithm for this patient population.

ABBREVIATIONS

CI = confidence interval, ISS = injury severity score, PRBC = packed red blood cell

In adults, transcatheter arterial embolization is an established minimally invasive approach to achieve rapid hemorrhage control in acute blunt or penetrating abdominal and pelvic trauma (1). On the contrary, surgical laparotomy for hemostatic control can be challenging and may even exacerbate bleeding with release of any tamponade effect (1–4). In children, clinically significant

traumatic injuries are most frequently associated with a blunt injury (5). Nonoperative management is considered the standard of care in children with blunt solid organ injury who are in hemodynamically stable condition, with success rates exceeding 90% (6). Still, endovascular techniques are increasingly being used in children in unstable condition to control hemorrhage and offer an opportunity for organ preservation.

In contrast to the abundant literature proving the utility of embolotherapy for acute hemorrhage in adult trauma patients, the evidence in children is sparse and largely confined to small series or case reports (7–9). The purpose of the present retrospective study is to assess the outcomes and complications of abdominal and pelvic arterial embolization in a relatively large cohort of acute pediatric trauma patients.

MATERIALS AND METHODS

This retrospective study was approved by the hospital's institutional review board, with waiver of informed

From the Department of Radiology and Section of Pediatric Interventional Radiology and Vascular and Interventional Radiology (N.J.V.), Seattle Children's Hospital and the University of Washington; and Section of Interventional Radiology (M.A., S.J.P., K.V., S.A.P.) and Department of Radiology (M.A., D.S.H., S.J.P., K.V., S.A.P.), University of Washington, Seattle, Washington. Received August 7, 2013; final revision received September 19, 2013; accepted September 20, 2013. Address correspondence to N.J.V., Department of Pediatric Imaging, Section of Pediatric Vascular and Interventional Radiology, Medical College of Wisconsin and Children's Hospital of Wisconsin; 9000 W. Wisconsin Ave., MS 721, Milwaukee, WI 53226; E-mail: nvo@chw.org

S.A.P. is a paid scientific advisor to Nordion (Ottawa, Ontario, Canada). None of the other authors have identified a conflict of interest.

© SIR, 2014

J Vasc Interv Radiol 2014; 25:215–220

<http://dx.doi.org/10.1016/j.jvir.2013.09.014>

consent. Data sources including the interventional radiology and institutional trauma database, electronic medical records, radiology information system, and picture archiving and communication system were reviewed to identify all pediatric patients (age < 18 y) who underwent catheter angiography in the setting of acute abdominal or pelvic trauma at a single level I trauma center from January 1, 2000, through August 31, 2011.

All patients were initially evaluated by the trauma service on arrival to the trauma center and before interventional radiology consultation. Solid organ abdominal trauma resulting in acute hypovolemic shock was addressed with rapid medical resuscitative measures and emergent laparotomy. Catheter angiography was performed in children who had ongoing clinical suspicion for abdominal hemorrhage and who did not meet criteria for emergent laparotomy. The clinical determinants for ongoing hemorrhage were serial decreasing hematocrit level, requirement for pharmacologic pressor support to maintain blood pressure, or persistent tachycardia despite pain control. Clinical indicators of pelvic hemorrhage associated with pelvic fractures were evaluated primarily with catheter angiography instead of primary operative intervention.

For all procedures, arterial access was obtained via the common femoral artery. The use of ultrasound guidance along with the use of a 21-gauge micropuncture needle set or an 18-gauge vascular access needle (Cook, Bloomington, Indiana) for the initial arterial puncture was at the discretion of the interventional radiologist. A 4- or 5-F sheath was used to maintain arterial access throughout the procedure. For abdominal trauma, a nonselective abdominal aortogram was initially obtained. This was followed by selective catheterization of the aortic branch vessel(s) of interest. For pelvic trauma, each patient underwent nonselective aortic bifurcation injection for pelvic arteriography, followed by bilateral selective internal and external iliac artery angiography. In all cases, embolization was performed at the discretion of the interventional radiologist based on the identification of an arterial injury; postembolization angiography was always completed.

Angiographic findings that prompted embolization included contrast agent extravasation, major vessel truncation, petechial hemorrhage, arterial spasm located in the distribution of hemorrhage, pseudoaneurysm, vessel transection, and arteriovenous fistula. For hepatic injury, selective embolization was performed distal and proximal to the site of injuries when technically possible. For splenic lacerations, proximal embolization was performed to minimize the risk of splenic infarction and abscess formation (10). Renal injuries were treated with selective embolization. Pelvic injury was treated by nonselective embolization of the internal iliac artery unless a discrete source of hemorrhage was identified. Embolization was performed by using gelatin slurry,

fibered coils (Cook), and/or polyvinyl alcohol particles (150–710 μm ; Boston Scientific, Cork, Ireland). Particles and/or coils were used for discrete localized hemorrhage.

Outcome measures for embolization include the success of hemorrhage control and complications following embolization, the need for postembolization operative intervention or repeat embolization, and survival to discharge. Hemorrhage control was classified according to a three-tier scale as defined in **Table 1**. Category 1 was considered effective hemorrhage control. Complications were defined per Society of Interventional Radiology classification system for major and minor adverse outcomes (11). Solid organ injuries were graded according to the American Association for the Surgery of Trauma organ injury scale when the patient underwent computed tomography (CT) before angiography (12).

Categoric variables were summarized as counts and percentages, and continuous and ordinal variables were summarized with the median and range. The precision of the outcome rates were summarized by using 95% confidence intervals (CIs). Patients missing values for a particular variable were excluded from analyses involving that variable. To identify univariate predictors of effective or ineffective hemorrhage control, patients were divided into two groups based on outcome after embolization and demographic, injury, treatment, and embolization variables were compared between them. Ordinal variables were compared by using the nonparametric Mann–Whitney *U* test, and categoric variables were compared by using a Fisher exact test. All statistical analyses were conducted by using the statistical software R (version 2.14.1; R Foundation for Statistical Computing, Vienna, Austria) (13). Throughout, two-tailed tests were used with a *P* value lower than .05 denoting statistical significance.

RESULTS

A total of 175 pediatric patients (age < 18 y) underwent catheter angiography in the setting of acute trauma during the study period, of whom 97 underwent catheter angiography specifically for abdominal and/or pelvic trauma. The remaining 78 patients underwent angiography for trauma related to other regions: head, neck, chest, and extremities. Arterial embolization for acute hemorrhage was performed in 54 of 97 patients (56%),

Table 1. Clinical Outcomes of Patients following Angiography and Embolization

Category	Description
1	Hemodynamically stable; no additional angiographic or operative intervention
2	Ongoing hemorrhage necessitating repeat angiography or operative intervention
3	Exsanguination and death

Download English Version:

<https://daneshyari.com/en/article/4237815>

Download Persian Version:

<https://daneshyari.com/article/4237815>

[Daneshyari.com](https://daneshyari.com)