Frequency of External Iliac Artery Branch Injury in Blunt Trauma: Improved Detection with Selective External Iliac Angiography

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ABSTRACT

Purpose: To assess the utility of selective external iliac artery (EIA) angiography and the frequency of injury to branches of the EIA in cases of blunt pelvic trauma.

Materials and Methods: A retrospective review of pelvic angiograms in 66 patients with blunt pelvic trauma was conducted over a 12-month period. Pelvic and femur fracture patterns were correlated to the presence of EIA injury. Pelvic arteriography was compared versus selective EIA angiography for the detection of arterial injury.

Results: Fifty-four of 66 patients (82%) exhibited pelvic arterial injury or elicited enough suspicion for injury to warrant embolization. Internal iliac artery embolization was performed in 50 of 66 (76%). EIA branch injury was identified in 11 of 66 patients (17%), and 10 were successfully embolized. EIA branch vessel injury was identified more frequently when there was ipsilateral intertrochanteric fracture ($P = .07$) or ipsilateral ilium fracture ($P = .07$). The sensitivity of nonselective pelvic angiography in the detection of EIA branch vessel injury was 45%.

Conclusions: EIA branch injury occurs in a substantial fraction of patients with blunt pelvic trauma who undergo pelvic angiography. Selective EIA angiography should be considered in all patients undergoing pelvic angiography in this situation.

ABBREVIATIONS

CI = confidence interval, EIA = external iliac artery, IIA = internal iliac artery, LCFA = lateral circumflex femoral artery, MCFA = medial circumflex femoral artery, NNT = number needed to treat, OR = odds ratio

Mortality rates can be 40% or higher in patients with pelvic trauma, often related to uncontrolled hemorrhage (1–3). In select trauma patients, catheter-directed therapy plays an important role in the management of pelvic hemorrhage (4). The conventional approach to diagnostic angiography in this setting consists of careful evaluation of the distal aorta and selective interrogation of the internal iliac arteries (IIAs) (5). Branches of the IIA such as the obturator and internal pudendal arteries are frequently jeopardized by their positions relative to bony or other rigid structures such as the posterior ligaments (6,7). Direct or anastomotic communication between the obturator artery and external iliac artery (EIA) is termed the "corona mortis" (8). The frequency of this anatomic variant is perhaps greater than had been appreciated, and its proximity to the superior pubic ramus may predispose it to laceration in pelvic trauma (9,10). Otherwise, the frequency and clinical significance of EIA branch injury in blunt trauma has not been thoroughly investigated (7,11,12). The purpose of this study is to assess the utility of selective EIA angiography and frequency of injury to branches of the EIA when pelvic angiography is performed for blunt trauma.

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MATERIALS AND METHODS

This retrospective study was approved by the hospital's institutional review board, and was performed in full compliance with Health Insurance Portability and Accountability Act regulations. The institutional review board waived the need for written informed consent.

A retrospective review of all pelvic angiograms performed for blunt pelvic trauma between January 1, 2010, and December 31, 2010, was completed. The interventional radiology section at the institution employed a searchable Health Insurance Portability and Accountability Act–compliant patient database.

At our institution, indications for immediate trauma angiography included hemodynamic instability in the setting of pelvic fractures at radiography with (i) negative findings of diagnostic peritoneal lavage, (ii) negative findings of Focused Abdominal Sonography for Trauma ultrasound examination, or (iii) contrast-enhanced computed tomography (CT) of the abdomen or pelvis that showed hemorrhage or active extravasation with or without pelvic fractures. Therefore, some patients in unstable condition underwent angiography on the basis of pelvic fractures at radiography and negative findings of diagnostic peritoneal lavage or Focused Abdominal Sonography for Trauma examination. In those patients, CT was completed after angiography.

Baseline and demographic information were recorded, including sex, age, etiology of trauma, and baseline laboratory values. Fracture patterns were classified based on the Young–Burgess major categories of vertical shear, anteroposterior compression, or lateral compression (13). Fractures involving the acetabulum were recorded. Femur fractures were classified as transcervical/basicervical, intertrochanteric, or subtrochanteric. In several cases, the fracture pattern was not classified at the time of original reporting; in such cases, images were retrospectively reviewed (by C.K.S.) for categorization.

Each patient underwent aortic bifurcation injection for pelvic arteriography followed by bilateral selective internal and EIA angiography. Embolization was performed at the discretion of the interventional radiologist when arterial injury was identified or suspected, and postembolization angiography was performed.

To compare the sensitivity of nonselective pelvic arteriography versus that of selective external iliac angiography for identification of EIA injury, angiographic images were retrospectively reviewed. Each pelvic arteriogram was evaluated for evidence of arterial injury by an interventional radiologist (S.A.P.) who was blinded to knowledge of potential EIA injury. The author categorized the findings as (i) no evidence of injury, (ii) EIA branch injury, (iii) IIA branch injury, or (iv) arterial injury with uncertain source. Angiographic evidence of arterial injury was defined as contrast material extravasation, vessel truncation, or pseudoaneurysm formation.

STATISTICAL ANALYSIS

Results are presented as counts and percentages per patient or per hemipelvis. Patients and hemipelves were grouped by fracture pattern. Associations between EIA injury and fracture pattern are summarized as odds ratios (ORs) and 95% confidence intervals (CIs), and were tested by using a Fisher exact test (patient-level comparisons only) or logistic regression. In cases in which logistic regression could not be run as a result of the absence of any EIA injuries in a group (ie, OR of 0 or ∞), a permutation test approach was used to determine statistical significance (14). No CIs were computed in those cases. Logistic regression based on generalized estimating equations was used when assessing associations between hemipelvic fractures and ipsilateral EIA injury to account for any dependence between hemipelves of the same patient (15). All statistical calculations were performed by using R (version 2.14.1; R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was defined by a P value lower than .05.

The accuracy of EIA injury detection by nonselective pelvic arteriography and selective angiography of the IIA were summarized by the sensitivity (ie, true positive rate) and the false positive rate, with selective EIA angiography as the gold standard. The number needed to treat (NNT) was computed as the inverse of the absolute detection rate difference.

RESULTS

Sixty-six patients underwent pelvic angiography for blunt pelvic trauma. Forty-three patients (65%) had CT imaging before angiography, of whom 36 (84%) showed pelvic hematoma. Sixty-five of 66 patients (98%) exhibited pelvic fracture at CT.

Angiography

Of 66 patients undergoing angiography, 49 (74%) had angiographic signs of pelvic arterial injury. Signs of vessel injury are described in **Table 1**. Pelvic arterial injury patterns at angiography are depicted in **Figure 1**. IIA branch vessel injury was identified (n = 45) or suspected (n = 5) in 50 patients (76%); 18 (36%) had bilateral IIA injuries, totaling 68 hemipelves. External iliac branch injury (**Fig 2**) was identified in 11 of 66 patients (17%), of whom three had bilateral arterial injuries (14 of 132 hemipelves; 11%). The injured EIA branch vessels are

Table 1. Signs of Arterial Injury at Angiography in 66 Patients

Angiographic Sign	No. of Pts.
Contrast material extravasation	33 (50)
Vessel truncation	9 (14)
Vasospasm	7 (11)
Normal (no finding)	17 (26)

Values in parentheses are percentages.