



Relative hypotension increases the probability of the need for angioembolisation in pelvic fracture patients without contrast extravasation on computed tomography scan



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ABSTRACT

Introduction: In the evaluation of haemorrhage in trauma patients with pelvic fractures, contrast extravasation (CE) on computed tomography (CT) scan often implies active arterial bleeding. However, the absence of CE on CT scan does not always exclude the need for transcatheter arterial embolisation (TAE) to achieve haemostasis. In the current study, we evaluated the factors associated with the need for TAE in patients without CE on CT scan. These factors may be evaluated as adjuncts to CT scanning in the management of patients with pelvic fractures.

Methods: We retrospectively reviewed our trauma registry and medical records of patients with pelvic fractures. When CE was observed, indicating active haemorrhage, the patients underwent TAE to achieve haemostasis. In contrast, patients without CE were held for observation and treatment of their injuries, and if their condition deteriorated after a delayed interval, they were then also referred for TAE if no other focus of haemorrhage was found. Patients without CE on CT scan but with retroperitoneal haemorrhage requiring TAE were investigated. Their demographic characteristics, associated injuries, fracture patterns, and changes in systolic blood pressure were described and analysed.

Results: In total, 201 patients with pelvic fracture underwent CT scan examination; 47 (23.4%) had CE by CT scan, whereas the other 154 (76.6%) did not. Of the 154 patients who did not show CE by CT scan, 124 (80.5%) patients never underwent TAE; however, 30 (19.5%) of these patients did eventually undergo TAE. In comparing the patients who underwent TAE to those who did not undergo TAE among patients without CE on CT scan, the systolic blood pressure (SBP) on arrival (median: 100.0 mmHg vs 136.0 mmHg, $p < 0.01$) and the lowest SBP recorded in the ED (median: 68.0 mmHg vs 129.0 mmHg, $p < 0.01$) were significantly lower in the patients who underwent TAE. The ROC curve analysis revealed that the most appropriate cutoff value of decrement of SBP (SBP on arrival minus the lowest SBP in the ED) was 30 mmHg (AUC = 0.89).

Conclusion: In the management of pelvic fracture patients, greater attention should be directed toward patients with relative hypotension. The higher likelihood of haemodynamic deterioration and the need for TAE for haemorrhage control should remain under consideration in such cases, despite the absence of CE by CT scan.

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Introduction

Pelvic fracture is an injury that results from a high kinetic trauma mechanism [1], and is often comorbid with injuries of other organs and systems [2–4]. Most importantly, the associated pelvic haemorrhage may be lethal [5,6]. The source of the haemorrhage can be divided into three categories: bleeding from the arteries, bleeding from the venous plexus, and bleeding from

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the cancellous bone itself [7]. Most haemorrhage may be controlled conservatively; however, active arterial haemorrhage may require a haemostatic procedure. Transcatheter arterial embolisation (TAE) has been reported as an effective procedure in the management of pelvic fracture-related retroperitoneal arterial haemorrhage [8–10].

In the evaluation of pelvic fracture, computed tomography (CT) provides several diagnostic advantages, including higher sensitivity for identifying small fractures and the convenient assessment of associated injuries [11,12]. With respect to haemorrhage evaluation, contrast extravasation (CE) observed on CT scan often implies active arterial bleeding in trauma patients [13]. The detection of active bleeding by CE is not only diagnostically valuable but also indicates the need for surgical or radiological intervention, such as TAE. However, the absence of CE by CT scan does not always exclude the need for TAE [14,15]. In addition to CE, pelvic fracture patients may also require TAE to achieve haemostasis under certain conditions, such as deterioration after resuscitation without another focus of haemorrhage or a persistent need for blood transfusion [16,17]. Furthermore, it has also been reported that CE does not always indicate a need for TAE [18,19]. Therefore, the controversy surrounding the significance of CE as an indication for TAE may create a dilemma for physicians.

In the current study, we evaluated factors associated with the requirement for TAE in patients without CE by CT scan. These factors may be evaluated as adjuncts to CT scan findings in the management of patients with pelvic fractures.

Materials and methods

From January 2005 to February 2012, we retrospectively reviewed the trauma registry and medical records of patients with pelvic fractures in our institutions. During the 85-month investigational period, pelvic fracture patients were identified and treated according to our established protocol (Fig. 1). Pelvic X-ray was used as an adjunct to the primary evaluation to assess the fracture patterns and pelvic stability. Unstable patients who did not respond to resuscitation (systolic blood pressure [SBP] less than 90 mmHg after an initial IV fluid bolus of 2000 mL lactated Ringer's solution or normal saline) received definitive treatment without a secondary evaluation. Stable patients received either conservative treatment or contrast-enhanced abdomen/pelvis CT scan as a further evaluation for associated intra-abdominal injuries or haemorrhage. When CE was noted, indicating active haemorrhage, these patients underwent TAE to achieve haemostasis. In contrast, the patients without CE by CT scan underwent close observation. If their condition deteriorated (hypotensive episode or persistent blood transfusion requirement) over a delayed interval, a repeat evaluation would be performed (physical examination, X-ray, or sonography) to exclude another focus of haemorrhage. In addition to the evaluation for CE, other findings on their initial CT scan may have indicated the possibility of retroperitoneal haemorrhage (retroperitoneal haematoma or sacroiliac joint disruption). Therefore, these patients were referred for TAE if no other focus of haemorrhage was found (Fig. 1).

During the angiographic examination, the abdominal aorta, lumbar arteries, bilateral common iliac arteries, bilateral external

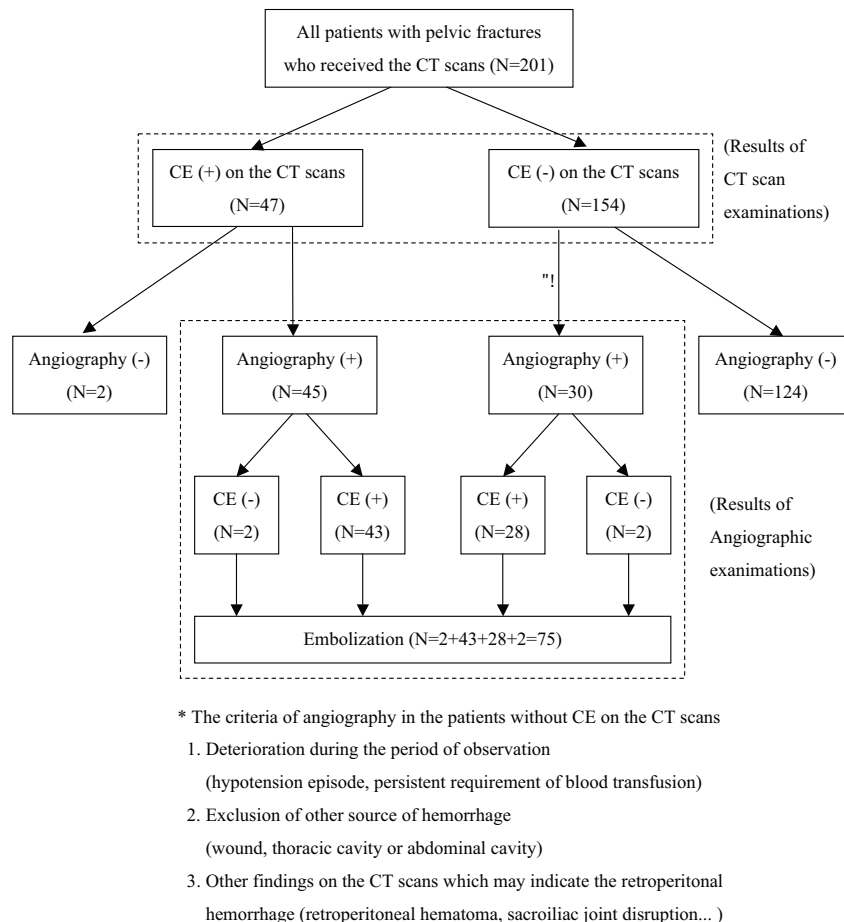


Fig. 1. The patient distribution and the results of their imaging studies in the current study.

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