International Journal of Surgery 33 (2016) 231–236

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Review

Pelvic angioembolization in trauma – Indications and outcomes

Edgardo S. Salcedo [a, *], Ian E. Brown [a], Michael T. Corwin [b], Joseph M. Galante [a]

[a] University of California, Davis School of Medicine, Department of Surgery, Division of Trauma, Acute Care Surgery and Surgical Critical Care, 2315 Stockton Blvd, Room 4206, Sacramento, CA 95817, USA
[b] University of California, Davis School of Medicine, Department of Radiology, 4860 Y Street, ACC Suite 3100, Sacramento, CA 95817, USA

HIGHLIGHTS

- Pelvic angioembolization controls hemorrhage in hemodynamically stable and unstable patients with pelvic fractures.
- Intervention is most effective when done promptly; 24-h access to angiography is essential.
- Patients intra-abdominal injury require laparotomy before embolization – algorithms with FAST or CT help direct therapy.

ARTICLE INFO

Article history:
Received 30 September 2015
Received in revised form
25 January 2016
Accepted 13 February 2016
Available online 18 February 2016

Keywords:
Trauma
Angioembolization
Pelvis
Retroperitoneal hemorrhage

ABSTRACT

Introduction: Pelvic stabilization with angioembolization (AE) is steadily supplanting operative management for the treatment of pelvic hemorrhage in trauma. We aimed to provide a brief review of the indications, effectiveness and complications associated with AE for pelvic injuries.
Methods: We conducted a literature search using the terms "trauma," "angioembolization," and "pelvis" limited to studies published in the English language. Abstracts and full text were manually reviewed to identify suitable articles.
Results: The current brief review is based on content from articles published in the last 10 years related to pelvic AE for retroperitoneal hemorrhage after trauma.
Discussion: Pelvic injuries often require complex management because the high energy transfer causes concomitant injuries. Outcomes for hemodynamically unstable patients may be better with AE than with operative management.
Conclusion: Pelvic AE is the most effective intervention for management of hemorrhage associated with pelvic fracture in both hemodynamically stable and unstable patients. It can be used as the primary definitive intervention or in conjunction with operative management in the setting of concomitant intra-abdominal injury.

1. Introduction

Pelvic injuries can be extremely difficult to manage, causing significant morbidity and mortality. Ruatti and colleagues report global mortality in patients with polytrauma including pelvic ring fractures may be as high as 33% [1]. Motorcycle crashes account for a large number of pelvic fractures, with automobile crashes and gunshot wounds also contributing significantly. The high mortality of pelvic fractures is due primarily to the injury type and the associated anatomy. Pelvic fractures associated with hemorrhage require a substantial amount of energy and are often associated with concomitant injuries. Anatomically, the pelvis presents several challenges. From a surgical perspective, pelvic hemorrhage is difficult to access because of the physical constraints of the anatomical space. With unstable pelvic fractures, the volume of the pelvis can increase significantly, as much as 20% with a 5 cm pubic diastasis [2,3]. The larger volume reduces the tamponade effect of the pelvis, resulting in greater hemorrhage.

Margolies and colleagues described pelvic angioembolization (AE) in 1972 as an effective alternative to surgical management of retroperitoneal hemorrhage [4]. Pelvic AE provides a means of selectively or non-selectively accessing relevant pelvic arteries to control hemorrhage. Figs. 1 and 2 demonstrate successful selective embolization with control of hemorrhage as demonstrated by lack of contrast blush after embolization. Notably, arterial bleeding, while less common than venous bleeding in the pelvis, is more often present in patients that are persistently hypotensive. Arterial

* Corresponding author.
E-mail addresses: esalcedo@ucdavis.edu (E.S. Salcedo), iebrown@ucdavis.edu (I.E. Brown), mtcorwin@ucdavis.edu (M.T. Corwin), jmgalante@ucdavis.edu (J.M. Galante).

http://dx.doi.org/10.1016/j.ijsu.2016.02.057
1743-9191/

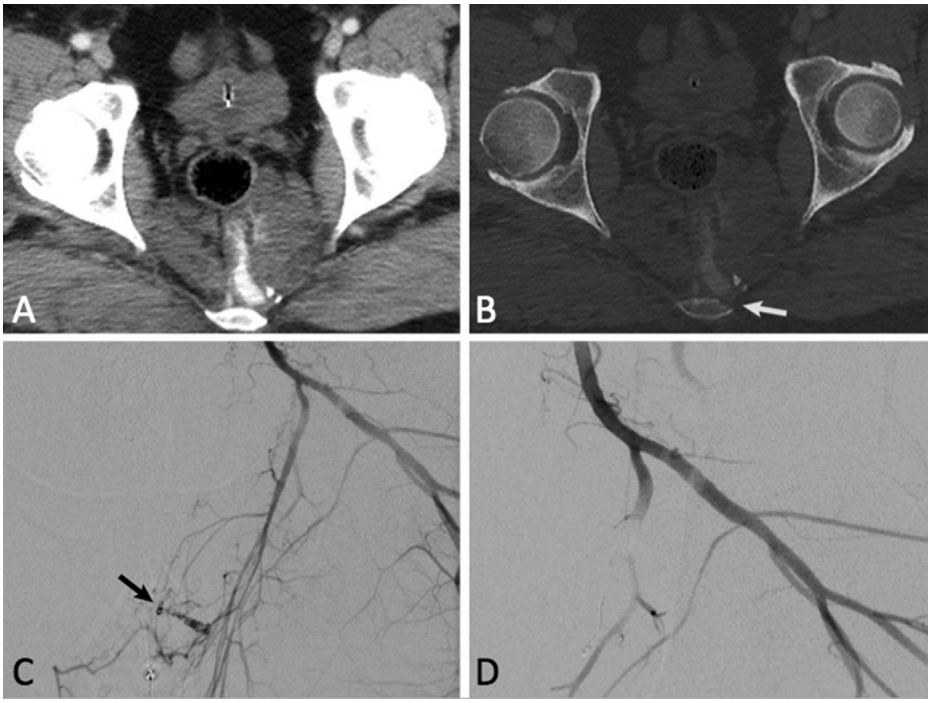

Fig. 1. A. Contrast-enhanced axial CT shows a large pre-sacral hematoma with a blush consistent with active extravasation. B. CT image at the same level using bone windows reveals a left sacral fracture (arrow). C. Digital subtraction angiogram after internal iliac artery injection reveals contrast extravasation from the obturator artery (arrow). D. Digital subtraction angiogram after coil and gelfoam embolization of the obturator artery reveals resolution of the blush.

embolization may also help with venous bleeding.

Nearly two decades later in 1991, Ben-Menachem and colleagues described a culture reluctant to take patients with pelvic trauma to the angiography suite rather than the operating room [5]. While pelvic AE was initially adopted slowly, it has since become the standard of care for management of retroperitoneal hemorrhage in pelvic trauma. The driving forces for the shift are: increasingly detailed and rapidly acquired computed tomography (CT) scan imaging for improved patient selection, efficiency of hemorrhage control in an anatomic area that is often difficult to

Fig. 2. A. Axial contrast enhanced CT through the pelvis reveals a large right pelvic hematoma with contrast blush consistent with active extravasation. B. Digital subtraction angiogram after a right obturator artery injection reveals contrast extravasation from the obturator artery (arrow). C. Digital subtraction angiogram after coil and gelfoam embolization of the right obturator artery reveals resolution of the blush.