

Endovascular Treatment of Hemorrhage in Pelvic Trauma

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Indications: Bleeding which causes hemodynamic instability in patients with pelvic fractures is most often of venous origin or bleeding can occur at fracture surfaces. It is estimated that 10%-20% of hemodynamically unstable patients suffer from arterial bleeding. Arterial bleeding can be well controlled by the endovascular technique. Although DSA is the golden standard to show arterial laceration and bleeding, today, arterial phase contrast CT examination is an accurate method to reveal arterial bleeding, which is shown by extravasation of contrast media. Generally, if there is no contrast media extravasation there is no need for DSA or embolization. However, despite the negative CT, in some situations DSA may be indicated, for example, there is a large hematoma and persisting hemodynamic instability.

Anatomy: Most often hemorrhage originates from branches of the internal iliac arteries like superior gluteal, internal pudendal, obturator, lateral sacral, and iliolumbar arteries. However, branches from external iliac artery like inferior epigastric artery and deep circumflex iliac arteries or superior hemorrhoidal branches of inferior mesenteric artery should be kept in mind as a possible source of pelvic hemorrhage. In pelvis, there are a lot of collateral networks and traditionally it is accepted that if one of the three main blood vessels (two internal iliacs and one inferior mesenteric) is left open the other two can be closed.

Diagnostic DSA: Always a diagnostic DSA should be performed first. If possible femoral artery puncture should be made contralateral to the suspected lesion site. First, unselected injection with catheter in the caudal abdominal aorta, and then selective internal and external iliac injections should be performed to both sides. As a possible finding one can expect active extravasation of contrast indicating vessel transection or laceration, intimal tears, vessel occlusion, spasm, thrombosis, pseudoaneurysm and arteriovenous fistula.

Embolization technique: In the acute phase the aim is to superselectively occlude the bleeding vessel with platinum or steel coils or gel foam, or more rarely with histoacryl glue or ethylene vinyl alcohol copolymer (ONYX). Superselective embolization is obtained using a microcatheter coaxially in a diagnostic catheter or in a special guiding catheter. Continuous flushing of both the macrocatheter and the microcatheter with saline is recommended. If superselective embolization can not be performed larger vessel like internal iliac can be closed or gel foam can be injected unselectively. In an emergency situation lower abdominal aorta can be temporarily occluded with a balloon. Coils and glue serve as a permanent closure of the vessel, gel foam resolves in weeks.

Complications and disadvantages: Complications are rare, but there have been reported nontarget embolization of lower extremity vessels, skin and muscle necrosis, trombosis, impotence, infection, acute renal failure, colonic and ureteric

infarctions, rectal dysfunction, nerve injury, avascular necrosis of the femoral head, and death. The main disadvantage of the embolization is that it is time consuming; other therapeutical procedures are stopped for hours.

Conclusion: Arterial bleeding can be well controlled by the embolization technique in a hemodynamically unstable pelvic trauma patient, however patients with arterial damage represents only a minority among patients with pelvic hemorrhage. As embolization is time consuming, the stability of hemodynamics should be first achieved by intensive care manouveres.