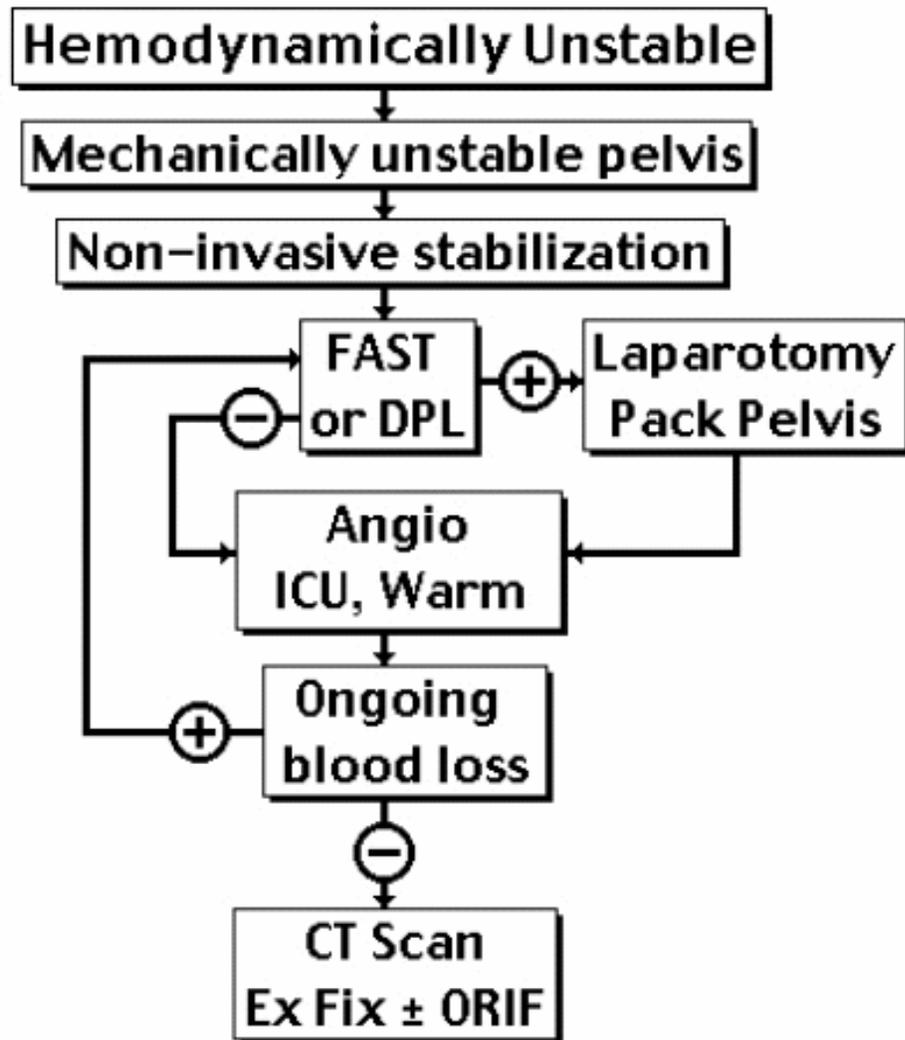


EXSANGUINATING PELVIC TRAUMA

Karim Brohi, M.D.

Most patients with pelvic trauma are haemodynamically normal and have mechanically stable injuries. Mortality in this group is below 5%. However, patients with unstable pelvic fractures presenting in shock have a mortality of 20%. When there is an associated intra-peritoneal solid organ injury, mortality approaches 50%.

For these exsanguinating patients there must be a clear decision-making process, early identification of injuries and rapid arrest of haemorrhage. The exact meaning of 'exsanguination' is difficult to define but in practical terms this definition may be applied to those patients who would not survive, or deteriorate during, a trip to the CT scanner. When CT is possible, it is invaluable in demonstrating pelvic injury morphology and contrast extravasation of pseudoaneurysm.



PELVIC STABILISATION

Bleeding from pelvic injury comes from fractured bone surfaces, venous plexi and arterial injury. Stabilisation of the pelvis will reduce and control bleeding from bone and veins, but not arterial haemorrhage. Early stabilisation allows clot to form while the patient is warm and has normal clotting function. There is no evidence to suggest that one form of stabilisation is more effective than another. In this group of patients, where pelvic injury morphology is unknown, non-invasive stabilisation using some

form of pelvic splint is preferred. If there is no major arterial injury, patients may become haemodynamically stable following application of the pelvic splint.

INTRA-PERITONEAL HAEMORRHAGE

Laparotomy in the presence of major pelvic injury carries a high mortality and should not be performed unnecessarily. Intra-peritoneal haemorrhage is probably best identified by Focused Assessment with Sonography for Trauma (FAST) ultrasound. However FAST has a significant false-negative rate in the presence of a retroperitoneal haematoma. Supra-umbilical diagnostic peritoneal lavage (DPL) is an alternative.

LAPAROTOMY

If laparotomy is required, and there is ongoing pelvic haemorrhage, the pelvis will need to be packed at the time of operation. Some form of pelvic stabilisation must be in place during this procedure. This procedure should be a damage limitation exercise aimed at minimal intervention to achieve haemorrhage and sepsis control.

ANGIOGRAPHY

Where there is no intra-peritoneal haemorrhage, or following laparotomy and pelvic packing, patients should be transferred to the angiography suite for assessment and embolisation of arterial injury. Angiography is the best method of controlling pelvic arterial haemorrhage and haemodynamic instability should not prevent patients from having emergency angiography and embolisation.

Overall 7-11% of pelvic fractures will require embolization. Only 2% of lateral compression fractures have demonstrable arterial haemorrhage, compared to 20% of anteroposterio compression, vertical shear or combined mechanism injuries.

Three basic principles should guide the angiographer in performing embolisation:

1. The purpose is to slow the bleeding to the extent that the body will control its own hemorrhage, rather than create large areas of ischemia or necrosis.
2. If ischemia and necrosis must be created it should be limited to the smallest area possible.
3. The procedure must be done expeditiously, before the development of coagulopathy, hypothermia & acidosis develop.

Selective catheterisation of anterior & posterior divisions of the internal iliac arteries is vital for complete assessment of pelvic haemorrhage. As patients are hypovolaemic, contrast extravasation may not be appreciated. Vessels will often be narrow with sharp cut-offs, indicating injury and vessel spasm. It may be prudent to perform an initial pelvic embolisation, give further volume resuscitation to the patient while still in the angio suite, and then re-image the pelvic vessels. This extra time may be usefully utilised by angiography of intra-peritoneal solid organs and the aorta, if indicated.

'Physicians are often reluctant, for no valid reason, to transport haemodynamically unstable patients to the angiography suite. We urge them to abandon this attitude. Patients in hemorrhagic shock, with surgically correctable injuries, should be transported to the operating theatre, regardless of shock. By the same token, patients in hemorrhagic shock, with unknown sources of haemorrhage - as well as those with haemorrhage best treated by embolisation - should be transported to the angiographic suite, regardless of shock. Left where they are, be it the emergency department of intensive care unit, they may die of exsanguination.' – Yoram Ben Menachem, NY

References

1. Miller PR, Moore PS, Mansell E, et al. **External fixation or arteriogram in bleeding pelvic fracture: initial therapy guided by markers of arterial hemorrhage.** J Trauma. 2003 Mar;54(3):437-43.
2. Velmahos GC, Toutouzas KG, Vassiliu P, et al. **A prospective study on the safety and efficacy of angiographic embolization for pelvic and visceral injuries.** J Trauma. 2002 Aug;53(2):303-8; discussion 308.
3. Daniel N. Segina, Samuel G. Agnew, Tim Daniel et al **Hemodynamically Unstable Pelvic Fractures: Retrospective Review of Early Embolization.** OTA Annual Meeting 2000.
4. Bassam, D., G. A. Cephas, et al **A protocol for the initial management of unstable pelvic fractures.** Am Surg 1998 64(9): 862-7.
5. O'Neill PA; Riina J; Sclafani S; Tornetta P **Angiographic findings in pelvic fractures.** Clin Orthop 1996 Aug;(329):60-7.
6. Cerva DS Jr, Mirvis SE, Shanmuganathan et al. **Detection of bleeding in patients with major pelvic fractures: value of contrast-enhanced CT.** AJR Am J Roentgenol. 1996 Jan;166(1):131-5.