Haemodynamically Unstable Patient with Pelvic Fractures Clinical Guideline

Scope

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<th>Site</th>
<th>Department, Division or Operational Area</th>
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<td>Royal Perth Hospital</td>
<td>Trauma Service</td>
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Definition

Haemodynamically unstable pelvic fracture patient

A patient who needs ongoing appropriate resuscitation without reaching a target systolic blood pressure of 90 mmHg and pelvic trauma is, together or not with other traumatic injuries, responsible for this haemodynamic status.

General Information/Preamble

Most pelvic fractures are stable and occur with a low-energy mechanism of injury. Haemodynamically unstable pelvic fractures, however, are usually caused by high energy trauma mechanisms such as motor vehicle crash. Patients who sustain these injuries not only have osseous injury, but also often have concomitant life-threatening injuries. Early death after these injuries is usually due to haemorrhage, multi-organ failure or sepsis. These high-energy pelvic fractures require a multidisciplinary approach to treatment.¹
1. Aetiology and pathophysiology

Young and Burgess\textsuperscript{2} described different pelvic injury patterns observed with varying mechanisms of injury:

Anterior-posterior compression (APC): In head-on type collisions, an anterior-posterior (AP)–directed force results in opening of the pelvic ring and an external rotation force on the innominate bones.

Lateral compression (LC): With side-impact compression, lateral impaction injuries are observed in the pelvic ring.

Vertical shear (VS): A VS injury results in vertical translation of the hemipelvis (see the image below). The typical mechanism for this injury involves a fall from a height and landing on an extended limb. Anteriorly, the injury usually involves the pubic symphysis, but fractures through the pubic rami are not uncommon. Posteriorly, the force is directed through the SIJ, causing a complete disruption of this joint.

Combined mechanisms (CM): CM injuries have features of at least two of the above-mentioned categories. The most common variety is the combination of LC and VS injuries.

The Tile pelvic injury classification system\textsuperscript{3} describes three types of fractures according to stability:

- Type A - These fractures, which include avulsion fractures, iliac wing fractures, and transverse fractures of the sacrum, are stable and do not fracture through the pelvic ring or soft tissues; the posterior ligamentous arch is intact
- Type B - These fractures, which include open-book and lateral compression (LC) injuries, are rotationally unstable but vertically stable; an incomplete disruption of the posterior pelvic arch is present
- Type C - These fractures are vertically and rotationally unstable, with complete disruption of the posterior arch and pelvic floor; the hemipelvis thus is completely unstable

A comparison of the Tile and Young-Burgess classifications systems carried out by Osterhoff et al\textsuperscript{4} did not identify any clinical relevant differences between the two with respect to their ability to predict mortality, transfusion or infusion requirement, or concomitant injuries

2. Presentation \textsuperscript{1}

Upon admission to the emergency department (ED), treatment of a multiple injured patient with a pelvic ring injury requires a multidisciplinary trauma team approach. Initial evaluation should be according to Advanced Trauma Life Support (ATLS) principles for assessment and stabilisation of airway, breathing and circulation.

Wherever possible, obtain history using the Mechanism, Injury, Signs and Symptoms, and Treatment (MIST) approach in order to predict the injury pattern and determine the patient’s physiological and haemodynamic status:

- Mechanism of injury: to determine the energy with which the injury has occurred
Injuries: known or suspected

Signs & Symptoms: haematoma (inguinal or scrotal); rotational deformity of the pelvis or lower extremities; leg length discrepancy; lower extremity neurological symptoms (particularly in suspected sacral fractures and Sacroiliac disruptions); rectum and/or vaginal lacerations; perineal and/or meatus blood

Treatment: response to fluid resuscitation

3. Haemorrhage

Pelvic fractures are frequently associated with large amounts of blood loss. The internal iliac artery and its branches are the most important vascular structures in pelvic trauma. The anterior division consists of the inferior gluteal artery, the internal pudendal artery, the obturator artery, the inferior vesicular artery, and the middle rectal artery. The posterior division consists of the superior gluteal artery, iliolumbar artery, and lateral sacral artery.

The superior gluteal artery is the largest branch of the internal iliac artery. It courses along the SIJ and exits through the greater sciatic notch superior to the piriformis. This artery supplies the gluteus medius, gluteus minimus, and tensor fascia lata muscles. The superior gluteal artery is the most commonly injured artery in pelvic fractures.

Most bleeding after pelvic fractures results from venous injury. The pelvic viscera lie on a large thin-walled venous plexus that drains into the internal iliac vein. Massive bleeding may result from disruption of this venous plexus. Other neurovascular structures that lie in close proximity to the bony pelvis may be damaged when a pelvic fracture occurs.

Other sources of bleeding can be from associated injuries such as ruptured bladder and lacerated vagina or rectum.

Open pelvic fractures (open perineal wounds) are of greater risk of mortality due to loss of tamponade effect.

4. Imaging

Anteroposterior (AP) pelvic x-ray: In a haemodynamically unstable patient with suspected pelvic fractures, an anteroposterior (AP) x-ray of the pelvis should be performed. The standard AP pelvis x-ray demonstrates 90% of cases of posterior instability. The pattern of injury should alert the clinician to high risk of vascular injury and may assist in further decision-making regarding interventional radiology (IR).

FAST: Early consideration of Focused Assessment with Sonography for Trauma (FAST) as a first-line screen for intra-abdominal bleeding, as a cause of hypovolaemia, is recommended. Whilst FAST has adequate specificity in patients with unstable vital signs and pelvic fracture to recommend laparotomy to control haemorrhage, it is not sensitive enough to exclude intraperitoneal bleeding in the presence...
of pelvic fracture. (Level I Recommendation). In the haemodynamically stable patient with a pelvic fracture, subsequent CT of the abdomen and pelvis with intravenous contrast is recommended to evaluate for intra-abdominal bleeding (regardless of FAST results). (Level II Recommendation).

Computed Tomography (CT) scan: Once haemodynamically stable, an urgent arterial phase CT of the chest, abdomen, and pelvis should be performed. The scan assists in the evaluation of crescent fractures and sacral fractures. An unstable patient, however, should not undergo CT scan.

The chest, abdomen, and pelvis CT scans assist in the evaluation of concomitant injuries to the abdomen and chest, which are often life-threatening. CT identifies intra-abdominal bleeding, as well as the specific organ that is injured. When performing pelvic CT, it is vital to exclude bladder or membranous urethra injury.

If a head injury is suspected, a head CT scan is obtained.

All spine fractures or areas not well visualized on plain radiographs should be visualized with a CT scan.

5. Treatment (major recommendations from EAST5)

Patients with high-energy pelvic fractures often have abdominal, head, and thoracic injuries. Between 60% and 80% of patients have musculoskeletal injuries, 12% have urogenital injuries, and 8% have lumbosacral injuries.

Early external mechanical stabilisation

Whilst only Level III evidence, it is recommended that a pelvic orthotic device (POD), pelvic binder or C-clamp is used to reduce fracture displacement and decrease pelvic volume. C-clamp should only be applied by an appropriately trained clinician.

Emergency angiography and embolisation

Patients with pelvic fractures and hemodynamic instability or signs of ongoing bleeding after non-pelvic sources of blood loss have been ruled out should be considered for pelvic angiography/embolisation. (Level I Recommendation).

Patients with evidence of arterial intravenous contrast extravasation in the pelvis by computed tomography (CT) may require pelvic angiography and embolisation regardless of hemodynamic status. (Level I Recommendation).

Patients with pelvic fractures who have undergone pelvic angiography with or without embolisation, who have signs of ongoing shock after non-pelvic sources of blood loss have been ruled out, should be reassessed for other causes of shock (e.g. spinal; cardiogenic).

Although fracture pattern or type does not always predict arterial injury or need for angiography, anterior fractures are more highly associated with anterior vascular injuries, whereas posterior fractures are more highly associated with posterior vascular injuries. (Level III Recommendation).
Laparotomy and extraperitoneal/peritoneal packing

Extraperitoneal pelvic packing is effective in specifically controlling venous haemorrhage when used as a salvage technique after angiographic embolization or when used as part of a multidisciplinary clinical pathway including a POD/C-clamp. (Level III Recommendation).  

6. Rating Scheme for the Strength of the Recommendations

Level I
This recommendation is convincingly justifiable based on the available scientific information alone. It is generally based on Class I data or strong Class II evidence may form the basis for a Level I recommendation. Conversely, weak or contradictory Class I data may not be able to support a Level I recommendation.

Level II
This recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. It is usually supported by Class II data or a preponderance of Class III evidence.

Level III
This recommendation is supported by available data, but adequate scientific evidence is lacking. It is generally supported by Class III data. This type of recommendation is useful for educational purposes and in guiding future studies.
7. Algorithm for the management of haemodynamically unstable patients with pelvic fracture

ATLS resuscitation principles

Pelvic Binder
CXR/Pelvic x-ray
FAST (to exclude/confirm intraperitoneal haemorrhage)
REBOA (for exsanguinating patients)

+ve FAST

Stable
CT Abdo/Pelvis
Angio

Unstable
REBOA Zone I
OT
+/- ex-fix/ extraperitoneal packing

-ve FAST

Stable
CT Abdo/Pelvis
Angio

Unstable
REBOA Zone III
Angio
+/- CT abdo/Pelvis

Stable
CT Abdo/Pelvis
+/- Angio

Unstable
Angio

CT Abdo/Pelvis
Angio

+/- ex-fix/ extraperitoneal packing
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   17/09/2016
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   Bilaniuk, MD; Bryan R. Collier, DO; John Como, MD; Michelle Holevar, MD; Enrique A. 
   Sabater, MD; S. Andrew Sems, MD; W. Matthew Vassy, MD; Julie L. Wynne, MD. Eastern 
   Association for the Surgery of Trauma practice management guidelines for haemorrhage in 
   Accessed 20/06/2016

Additional resources

Related Standards

NSQHS

9.4.1  Mechanisms are in place to escalate care and call for emergency assistance

Acknowledgements

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Document Version Control

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