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Leading Sports Medicine into the Future

The 5-Minute Sports Medicine Consult

2ND EDITION

Editor

Mark D. Bracker, MD
Professor
Department of Family and Preventative Medicine
University of California, San Diego
San Diego, California

Co-Editors

Suraj A. Achar, MD, FAAFP
Associate Professor
Department of Family and Preventive Medicine
University of California School, San Diego
San Diego, California

Andrea L. Pana, MD, MPH
Team Physician
University of Texas Athletics
Austin, Texas

Kenneth S. Taylor, MD
Associate Professor
Department of Family and Preventive Medicine
Director Sports Medicine
University of California, San Diego
San Diego, California

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FRACTURE, PELVIC

David Carfagno

BASICS

Pediatric Considerations

- Children can have proportionately greater hemorrhage.
- Nonaccidental trauma is a concern.
- The most widely utilized classification scheme is the Young-Burgess system, which focuses on the mechanism of injury.
- Lateral compression (LC): Anterior injury-rami fractures:
  - The most common mechanism of pelvic fractures
  - This usually involves rami fractures anteriorly with a sacral impaction iliac wing fracture. This type of injury is rotationally unstable but usually vertically stable. LC I: Sacral fracture on side of impact; LC II: Crescent fracture on side of impact (iliac wing fracture); LC III: Type I or II injury on side of impact with contralateral open-book injury.
  - Fracture of individual pelvic bone with no break in ring continuity
  - Isolated rami fractures: Commonly seen in falls in the elderly
  - Avulsion fractures: 4 types: Anterior superior, inferior iliac spine, and ischial tuberosity: The ischial tuberosity is the most common location for apophyseal avulsion injury in the pelvis and usually results from a forceful contraction of the hamstring muscles. Avulsion of the ischial tuberosity is most often associated with intense athletic activity, such as sprinting, or with excessive passive lengthening of the hamstring muscles, as often occurs during cheerleading or gymnastics. The patient may experience a popping sensation at the time of injury and typically presents with severe posterior thigh or gluteal pain and complains of difficulty walking:
    - Iliac wing fractures (Duverney's fractures) due to direct trauma or lateral compression
    - Sacral fractures
    - Coccygeal fractures
- Anterior-posterior compression (APC): Anterior injury = symphysis diastasis/rami fractures:
  - The 1st point of failure is the symphysis pubis. As increasing external rotation is applied, the sacrotuberous, sacrospinous, and anterior sacroiliac (SI) ligaments fail under tension. APC I: Minor opening of symphysis and SI joint anteriorly; APC II: Opening of anterior SI, intact posterior SI ligaments; APC III: Complete disruption of SI joint.
  - Significant urogenital, vascular, and neurological injury is accompanied by the APC and vertical shear (VS) injuries due to the stretch and traction placed on these structures as the injuring forces are applied.
  - Open book fracture:
    - Wide separation of symphysis pubis (often >2.5 cm) associated with sacroiliac joint disruption from anterior/posterior pelvic compression
  - 2 ipsilateral ischiopubic rami fractures; most common Type II fracture
  - Symphysis pubis fracture: often associated with genitourinary injury
- Vertical shear (VS type): Vertical displacement of hemipelvis with symphysis diastasis or rami fractures anteriorly, iliac wing, sacral facture, or SI dislocation posteriorly
- Combination (CM type): Any combination of above injuries:
  - Multiple breaks in pelvic ring continuity
  - High risk for associated injuries and pelvic hemorrhage
  - Malgaigne fracture
  - Anterior and posterior break in the ring on the same side
  - Straddle fracture:
    - Fractures of all 4 pubic rami or ipsilateral fracture of 2 pubic rami with dislocation of symphysis pubis
    - Due to lateral compression or straddle injury (ie, fall on object)
  - Severe multiple fractures and crush injuries or falls resulting in multiple fractures and gross instability
- *Cautions:*
  - Pneumatic antishock garment (PASG) is an option, particularly when faced with a prolonged transport time or hemodynamically instability.
  - Aggressive fluid resuscitation must occur before deflation of the PASG.

RISK FACTORS

Etiologies of pelvic fractures in descending order of frequency:

- Motorcycle crash
- Vehicle-pedestrian collision
- Side-impact motor vehicle collision
- Fall >15 feet
- Motor vehicle crash

ETIOLOGY

- The incidence of pelvic fractures in the U.S. is estimated to be more than 100,000 per year.
- 60% of pelvic fractures occur from motor vehicle accidents, most commonly pedestrians struck by automobiles.
- 30% are due to falls from heights.
- Represent the third most common cause of death in motor vehicle accidents
- Mortality rate from pelvic fractures reported is 5–42%.
- Increases to nearly 50% with hemorrhagic shock
- Significant pelvic hemorrhage can occur in unstable pelvic fractures, particularly Type III fractures:
  - Bleeding most commonly arises from the venous plexuses.
  - Significant hemorrhage results in retroperitoneal hematoma formation that may tamponade in the enclosed pelvic space.

DIAGNOSIS

- Pelvic radiology is the most valuable initial diagnostic test.
- A single anteroposterior (AP) view of the pelvis should be obtained as early as possible.
  - Most significant unstable pelvic fractures will be seen on the single AP view.
  - Other views include:
    - Inlet projection: 30° caudal view, allows visualization of posterior arch
    - Outlet projection: 30° cephalic angulation, allows visualization of sacrum
    - Judet oblique views (internal and external): Allows evaluation of acetabulum

PHYSICAL EXAM

- Does the patient have pelvic pain?
- Are there neurologic deficits involving sciatic, femoral, or obturator nerves?
- Are there contusions, ecchymoses, or abrasions at or near the bony prominences of the pelvis?
- Are there ecchymoses of the scrotum or perineum?
- Is there blood at the urethral meatus?
- Is there blood in or around the rectum, and is the prostate normal?
- Are there open wounds of the groin, buttock, or perineum?
- Is there a leg length difference, or is the resting position of one leg different from the other?
- Is there pain or abnormal pelvic motion on compression of the anterior iliac spines, lateral compression of the iliac crests, rotation of the lower extremity, or hip flexion-extension?

DIAGNOSTIC TESTS & INTERPRETATION

- CT scan may further delineate pelvic fracture(s) and retroperitoneal hematoma.
- MRI is indicated when there is evidence of neurologic injury.
- Abdominal US or diagnostic peritoneal lavage (DPL) are rapid bedside evaluations for intraperitoneal hemorrhage:
  - There is a high mortality rate in victims with pelvic fractures who undergo celiotomy; caution must be exercised to avoid false-positive results.
  - In the setting of pelvic fracture, the supraumbilical open approach for DPL should be used.
  - Angiography may be necessary in complicated pelvic fractures where vascular concern is an issue:
    - According to the Pelvic Injury Symposium in 2000, physicians can determine when interventional radiology may be needed based on certain scenarios.
    - Hemodynamic instability, poorly responsive to fluid challenge, no hemoperitoneum, pelvic fracture
    - Hemodynamic stability, little hemoperitoneum, pelvic fracture, more than 4–6 units transfusion over 24 hr to 48 hr, respectively

- Large or expanding retroperitoneal hematoma encountered at laparotomy or active bleed on CT scan
- Angiography is usually used in these above scenarios within the first few hours with a 90% rate of finding extravasation.

Lab

- Type and crossmatch
- Hemoglobin/hematocrit, platelet count, and coagulation studies (prothrombin time/partial thromboplastin time)

Pathological Findings

Clinical signs that suggest an increased risk of ongoing pelvic fracture bleeding:

- Pre-hospital hypotension
- Admission base deficit >5
- Persistent tachycardia in face of normal oxygenation and adequate pain control
- Recurrent hypotension during resuscitation
- Requirement for 6 U blood during first 24 hr

DIFFERENTIAL DIAGNOSIS

- Normal variants (ie, os acetabuli epiphyseal line can mimic type I fracture on x-ray)
- Ligamentous injury
- Spinal injury
- Intra-abdominal injury and hemorrhage

TREATMENT

- LC-1/AP-1:
  - Protected weight-bearing on the affected side and treated conservatively with bed rest, analgesics, and comfort measures
  - Further surgical treatment may be needed if displacement of the fracture occurs after the patient starts to bear weight.
  - Follow-up x-rays can determine displacement after 2–5 days of physical therapy.
- AP-2/LC-1:
  - Marked displacement of the anterior ring without complete ring disruption. Consult orthopedic surgery.
- LC-II, LC-III, AP-III, and VS:
  - Complete disruption of the posterior ring, and in general, require stabilization of both the anterior and posterior rings. Consult orthopedic surgery; patient should remain NPO.
  - May require emergency department pelvic stabilization measures
  - Assess for pelvic hemorrhage (see below).
- Pelvic hemorrhage:
  - Angiography and selective vessel embolization
  - Direct operative control of pelvic bleeding
- Prioritization of studies: CT, angiography, or surgery:
  - In the hemodynamically *unstable* patient, a rapidly performed DPL or US can determine treatment course:
    - If the DPL or US is positive, the patient should go for celiotomy with external pelvic fixation followed by selective angiography.
    - If the DPL or US is negative, the patient should go to angiography.
    - In the hemodynamically stable patient, the patient can go to CT scan for evaluation of the abdomen, pelvis, and retroperitoneum.

ED TREATMENT

Determine which pelvic fractures are stable and unstable (see "Treatment").

MEDICATION

- Crystalloid fluids: Normal saline or Lactated Ringers, IV bolus 2 L; peds: 20 cc/kg
- Blood products: Cross-matched, type-specific, or 0-negative 4–6 IU; peds: 10 cc/kg

SURGERY/OTHER PROCEDURES

- Several factors play into the initial approach to bony stabilization, including hemodynamic status and response to resuscitation, fracture pattern, associated injury, and inflammatory status.
- Hemodynamic status is of particular concern, as the pelvis may be the primary source of bleeding or be contributing very little to bleeding. In the presence of ongoing thoracic or abdominal hemorrhage, orthopedic management beyond placement of a pelvic binder is delayed. Associated long bone fractures should be immediately splinted with coverage of open wounds.

IN-PATIENT CONSIDERATIONS

Initial Stabilization

ABCs of trauma care:

- Avoid using lower extremity IV sites.
- Aggressive resuscitation with blood or crystalloid, 0-negative or type-specific blood if hemodynamically unstable
- Immobilize the pelvis to prevent further injury and decrease bleeding.
- PASG: Use in emergency department (ED) is controversial, but allows rapid pelvic immobilization and pelvic compression to slow bleeding
- External fixator requires more time to place than PASG, but "splints" pelvis in a similar manner; contraindicated in severely comminuted pelvic fracture
- Placement of a stabilization device should not interfere with further workup and care (DPL, etc.).

Admission Criteria

- Hemodynamic instability, and pelvic hemorrhage to the ICU
- "Triad of death" is a term coined to describe patient decompensation in the presence of acute blood loss, resulting in hypothermia, coagulopathy, and acidosis.
- Type III or IV pelvic fracture
- Other related injuries (genitourinary, intra-abdominal, neurologic, etc.)
- Intractable pain

Discharge Criteria

Type I or II fractures; hemodynamically stable with no evidence of other injuries

ONGOING CARE

COMPLICATIONS

- Vascular injury leading to blood loss
- Closed head injuries
- Visceral injury (bladder and urethral, small bowel, diaphragm)
- Nerve injury
- Deep venous thrombosis
- Atelectasis/pneumonia
- Musculoskeletal back pain
- Sexual dysfunction
- Malunion/nonunion of pelvic fracture

ADDITIONAL READING

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CODES

ICD9

- 808.0 Closed fracture of acetabulum
- 808.2 Closed fracture of pubis
- 808.41 Closed fracture of ilium