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Pelvic, acetabular and hip fractures: What the surgeon should expect from the radiologist

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KEYWORDS

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Abstract Pelvic ring fractures when caused by trauma, either violent or in demineralized bone, generally consist of injuries in both the anterior (pubic symphysis and rami) and posterior (iliac wing, sacrum, sacroiliac joint) portions. Injury classifications are based on injury mechanism and pelvic stability, and are used to determine treatment. Acetabular fractures, associated or not to pelvic ring disruption, are classified on the basis of fracture line, into elementary fractures of the acetabular walls, columns and roof, and into complex fractures. Fractures of the proximal end of the femur occur often on demineralized bone following low-energy trauma. The fractures are categorized by anatomic location (neck, trochanter and subtrochanteric region) and degree of displacement. These variables determine the risk of osteonecrosis of the femoral head, which is the main complication of such fractures.

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Pelvic ring fractures

Anatomy and biomechanics

The bony pelvis is made of two innominate bones and the sacrum. The innominate bone has three centers of ossification: ilium, ischium and pubis. They coalesce at the triradiate cartilage and fuse by the age of 16 years (Fig. 1).

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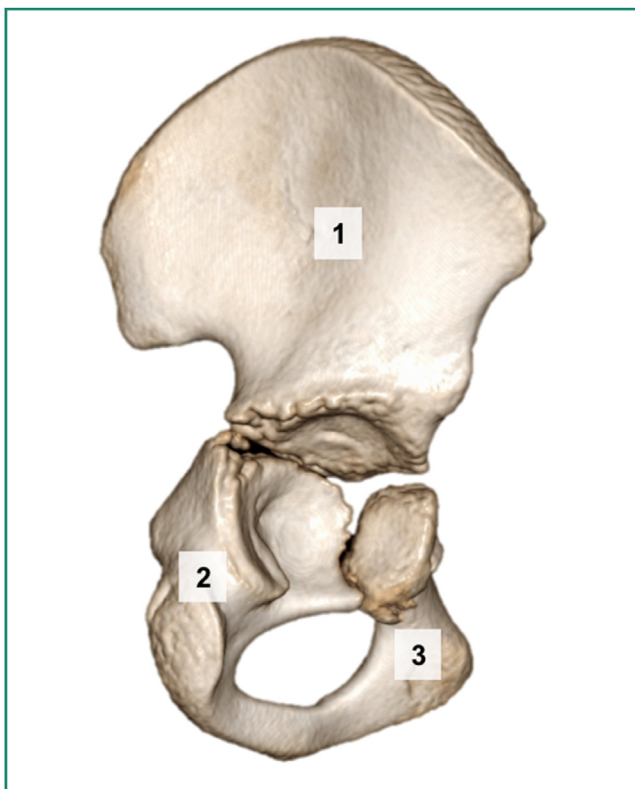


Figure 1. Exopelvic view of the right innominate bone in a 10-year-old child, that shows the triradiate cartilage joining the ilium (1), ischium (2) and pubis (3).

The pelvic ring is supported by ligaments (Fig. 2) that are stronger and more numerous in the posterior segment, where load is transferred from spine to lower limbs, while the pubic symphysis acts as a strut to provide pelvic ring stabilization. The pelvis also includes many muscle attachments (Fig. 3).

The sacroiliac joint is part synovial, anterior inferior, and part syndesmosis, posterior superior. It joins the tuberosities and is reinforced by a very strong interosseous ligament. Stability is ensured by a complex system of ligaments, including a very strong posterior sacroiliac ligament, anterior sacroiliac ligament, sacrotuberous ligament that

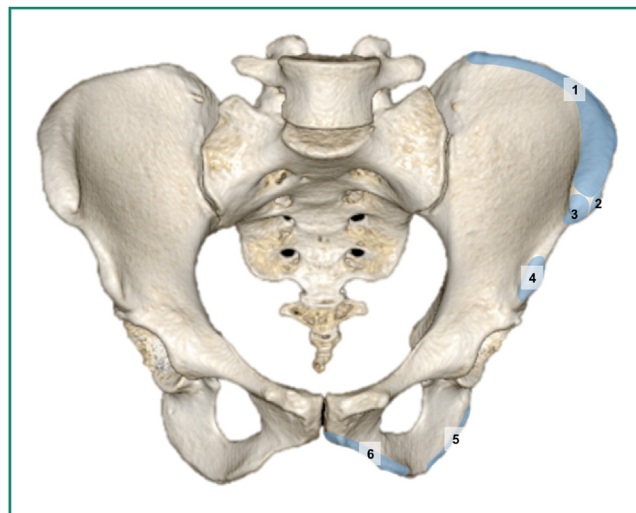


Figure 3. Pelvic muscle insertions: transverse and oblique abdominal muscles (1) on the iliac crest, tensor fasciae latae muscle (2) and sartorius (3) on the anterior superior iliac spine, direct tendon of the rectus femoris muscle (4) on the anterior inferior iliac spine, hamstring muscle complex tendons (5) on the ischial tuberosity and adductors (6) on the ischiopubic ramus and inferior pubis.

withstands vertical shear, and a sacrospinous ligament that provides rotational stability (Fig. 2) [1].

Anteriorly, the sacrum is larger at the top and appears to be the cornerstone of vertical stability. On the other hand, superiorly, the sacrum is larger at its anterior part: this way, the posterior ligament system acts as a suspension bridge, preventing anterior displacement of the sacrum.

Life expectancy following pelvic ring fractures depends on the extent of the injuries to the internal iliac artery and its posterior and anterior branches. The posterior branches include the superior gluteal artery that is at risk in case of displacement of the posterior segment, and the anterior branches include the obturator artery that is at risk in case of fracture of the iliopubic ramus. Injuries may also involve the lumbosacral plexus and its main branch, the sciatic nerve that exits the pelvis by way of the sciatic notch below the piriformis muscle (at risk in case of posterior hip dislocation)

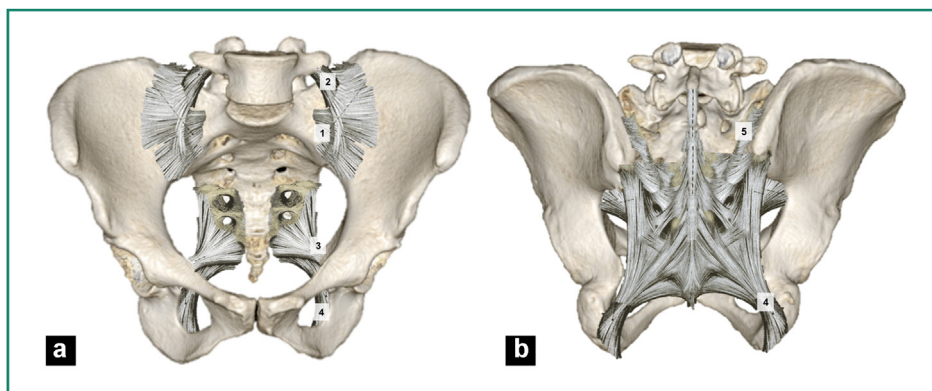


Figure 2. Anterior (a) and posterior view (b) of the pelvis. Ligaments: anterior sacroiliac (1), iliolumbar (2), sacrospinous (3), sacrotuberous (4) and posterior sacroiliac (5).

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