

Structure of the Pelvis: Bones, Joints, Muscles, Fascia

Learning Outcomes

1. Identify and describe the bones and key ligaments of the pelvis, including their anatomical features and functional significance.
2. Explain the muscle components of the pelvis, detailing the origins, insertions, and actions of major pelvic muscles.
3. Describe the structure and role of pelvic fascia, including its relationship with pelvic organs and muscles.
4. Locate and explain the anatomical gaps and pathways that connect the pelvis to the abdomen and lower limb, highlighting their clinical importance.
5. Describe the anatomy of the pelvic inlet, pelvic outlet, pelvic walls, and pelvic floor, and explain their relevance to pelvic function.
6. Compare and contrast sex differences in pelvic skeletal anatomy and discuss how these differences relate to function and clinical considerations.

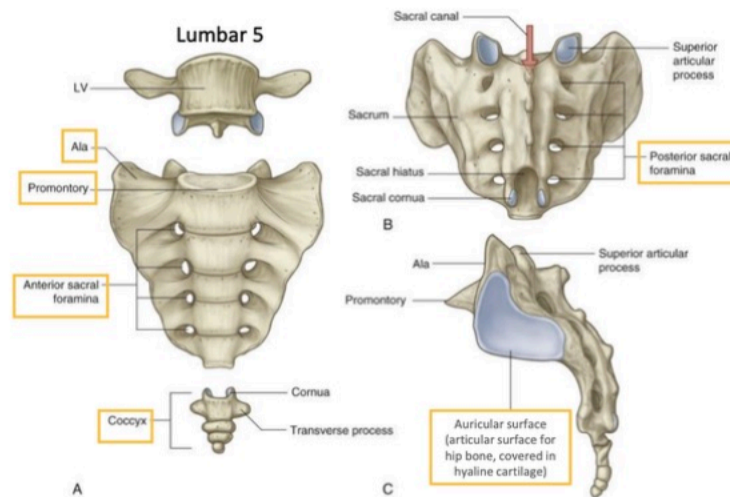
Overview of the Pelvic Girdle

The pelvic girdle, also known as the pelvis, consists of the hip bones (pelvic bones) and the sacrum. It is important to distinguish between the pelvic bones and the hip joint; the pelvic bones form the girdle, while the hip joint involves the femur and acetabulum. The pelvic bones are made up of three parts: the ilium, ischium, and pubis, which are part of the appendicular skeleton. The sacrum, a fusion of five sacral vertebrae, connects the two hip bones and is part of the axial skeleton. These components fuse during development to form a continuous structure, with the acetabulum serving as the socket for the head of the femur, where the three bones meet.

Key Features of the Pelvic Bones

The sacrum articulates with the fifth lumbar vertebra and features a prominent ridge called the promontory, an important landmark for the pelvic brim. The sacral foramina are openings at the front and back for nerve passage, and the canal within the sacrum allows passage of the cauda equina. The coccyx, located below the sacrum, joins it and provides attachment points for ligaments and muscles. The sacral hiatus at the lower end allows nerves and the filum terminale to exit, anchoring the spinal cord.

The auricular surface of the sacrum, covered in hyaline cartilage, articulates with the ilium at the sacroiliac joint, which is an atypical synovial joint involving hyaline and fibrocartilage. The joint's stability is reinforced by ligaments, despite its limited mobility.



Components of the Hip Bone (Pelvic Bone)

The hip bone, or os coxa, comprises three fused bones: the ileum, ischium, and pubis. During development, these bones start as cartilage and fuse over time, with the fusion points visible in the acetabulum. The ileum is the upper part, the ischium forms the posterior and inferior part (the bone you sit on), and the pubis is at the front.

Important landmarks include:

- **Anterosuperior Iliac Spine (ASIS):** attachment point for the inguinal ligament.
- **Pubic Tubercle:** also involved in ligament attachment.
- **Iliac Crest:** the superior border of the ileum.
- **Obturator Foramen:** a large opening covered by membrane, allowing passage of vessels and nerves.
- **Ischial Spine and Tuberosity:** sit bones, with the tuberosity supporting weight when sitting.

Sacroiliac Joint and Related Structures

The sacroiliac joint is formed between the auricular surfaces of the ileum and sacrum. The sacral surface is covered in hyaline cartilage and reinforced by ligaments posteriorly, making it a strong, limited-mobility joint. The joint's articular surface is ear-shaped, called the auricular surface, and the iliac surface is covered in fibrocartilage.

The joint's stability is crucial for weight transfer from the upper body to the lower limbs.

Other notable features include:

- **Greater Sciatic Notch:** becomes a foramen via ligaments, allowing passage of nerves and vessels.
- **Lesser Sciatic Notch:** another passageway for structures like the pudendal nerve.
- **Ischial Spine and Tuberosity:** important for muscle attachment and sitting support.

Pelvic Landmarks and Their Significance

The pelvis forms a basin-like structure, with the false pelvis above the pelvic brim and the true pelvis below. The false pelvis contains abdominal organs like intestines, while the true pelvis houses reproductive organs, the bladder, rectum, and anal canal. The pelvic inlet, marked by the pelvic brim, separates these regions and is formed by specific bony landmarks.

The pelvic brim is a circular boundary made up of several key landmarks:

1. **Sacral Promontory:** anterior edge of the sacrum.
2. **Sacral Ala:**
3. **Arcuate Line:** on the ileum, part of the pelvic inlet boundary.
4. **Pectineal Line:** on the pubis, provides attachment for muscles.
5. **Pubic Crest and Symphysis:** anterior joint where pubic bones meet.

The linea terminalis is a continuous line that forms the boundary of the pelvic inlet, extending from the arcuate line to the pubic crest.

The entire circle of landmarks defines the pelvic brim, which is crucial for understanding pelvic dimensions and obstetric considerations.

Function of Pelvic Bones

The term "pelvis" derives from Latin meaning "basin," reflecting its basin-like shape. The pelvis's structure supports weight bearing and transfer, provides attachment points for muscles and ligaments, forms pelvic floor (attachment of related muscles and fascia), attachment of erectile bodies (external genitalia), and protects pelvic viscera. Despite being a synovial joint, the sacroiliac joint has limited mobility, emphasizing stability over movement.

Inlet, Brim, and Pelvic Regions

The pelvis is divided into different regions, notably the inlet, brim, and the true pelvis. The inlet marks the transition from the false pelvis to the true pelvis, extending from the false to the true pelvis. The brim, or pelvic inlet, is composed of several bony landmarks that are essential to identify for clinical and anatomical understanding. When standing, the pelvis is tilted forward, with the tubercles and symphysis aligning with the anterior superior iliac spine (ASIS) in a vertical plane. The pelvic cavity projects posteriorly, while the inlet tilts forward at approximately 50-60 degrees in the horizontal plane. This tilt is crucial for understanding how the pelvis sits in a standing position and how structures are oriented relative to each other.

The Pelvic Inlet and Its Orientation

The orientation of the pelvic inlet is significant in clinical assessments, especially in obstetrics. The tilt ensures that the inlet is not facing directly upward but inclined forward, facilitating childbirth. The tilt angle, roughly 50-60 degrees, influences how the pelvis accommodates the