Pelvis & Perineum
Pelvis
Lecture Objectives

• Describe the structure of bony pelvis, perineum, and pelvic diaphragm.
• Discuss the nerves and blood vessels of the pelvis.
• Describe the radiographic images and the surface landmarks of the pelvis.
Bony Pelvis

• Functions
  – Transmit weight to femur
  – Supports & protects pelvic viscera
  – Muscle attachment

• Content
  – 2 hip bones
  – Sacrum & coccyx
Pelvic (Hip) Girdle

- Each coxal (hip) bone consists of three bones that fuse together: ilium, pubis, and ischium
- The two coxal bones are joined anteriorly by the pubic symphysis (fibrocartilage)
- Joined posteriorly by the sacrum forming the sacroiliac joints
The Ilium

• Largest of the three hip bones
• Ilium is the superior part of the hip bone
• Consists of a superior *ala* and inferior *body* which forms the acetabulum (the socket for the head of the femur)
• Arcuate line separates ala & body
The Ilium

- Superior border - iliac crest
- *Hip pointer* - occurs at anterior superior iliac spine
- Greater sciatic notch - allows passage of sciatic nerve
- Iliac fossa for muscle attachment
- Gluteal lines indicating muscle attachment
- Sacroiliac joint at auricular surface & iliac tuberosity
Ischium

- Ischium - inferior and posterior part of the hip bone
  - Most prominent feature is the **ischial tuberosity**, it is the part that meets the chair when you are sitting
  - ischial spine
  - lesser sciatic notch
  - ramus
Pubis

- Pubis - inferior and anterior part of the hip bone
  - Superior and inferior rami
    - Iliopectineal line
  - Body
    - Pubic crest & tubercle
• **Union of 5 vertebrae (S1 - S5) by age 30**
  – median sacral crest was spinous processes
  – sacral ala is fused transverse processes

• **Sacral promontory** (anterosuperior margin)

• Sacral canal ends at sacral hiatus (laminae don’t meet)

• Auricular surface & sacral tuberosity of SI joint

• Anterior and posterior sacral foramina
  – Ventral and dorsal rami of spinal nerves respectively
Coccyx

- Shape ..
- Coccygeal cornua
- Union of 4 vertebrae (Co1 - Co4) by age 30
Orientation of the Pelvis

- Front of pubic symphysis of pubis & ASIS at the same vertical plane
- The anterior surface of sacrum & pubic symphysis are directed backward & downward
False and True Pelves

- **Pelvic brim** - a line from the sacral promontory to the upper part of the pubic symphysis
  - Through iliopectineal line
- **False pelvis** - lies above pelvic brim
- **True pelvis** - lies below pelvic brim
- **Pelvic axis** - path of baby during birth
False Pelvis

- **False pelvis**
  - Lies above the pelvic prim
  - Boundaries
    - Lumber vertebrae, iliac fossae & abdominal wall
    - Part of the abdomen
  - Little clinical significance
  - Support abdominal viscera, and uterus during pregnancy
True Pelvis

- Pelvic inlet (pelvic brim)
  - Boundaries
    - Sacral promontory, iliopectineal line & pubic symphysis

- Pelvic outlet
  - Boundaries
    - Coccyx, ischial tuberosities, sacrotuberous ligament & pubic arch

- Pelvic cavity
  - Between inlet & outlet
  - Short curved canal
  - Shallow anterior & deep posterior walls
Comparing Male and Female Pelves

• Males
  – Bone are larger and heavier
  – Pelvic inlet is smaller and heart shaped
  – Pubic arch is less than 90°

• Female
  – Wider and shallower
  – Pubic arch is greater than 90°
  – More space in the true pelvis
Comparing Male and Female Pelvises

**TABLE 8.1**

<table>
<thead>
<tr>
<th>POINT OF COMPARISON</th>
<th>FEMALE</th>
<th>MALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>General structure</td>
<td>Light and thin.</td>
<td>Heavy and thick.</td>
</tr>
<tr>
<td>False (greater) pelvis</td>
<td>Shallow.</td>
<td>Deep.</td>
</tr>
<tr>
<td>Pelvic brim (inlet)</td>
<td>Larger and more oval.</td>
<td>Smaller and heart-shaped.</td>
</tr>
<tr>
<td>Acetabulum</td>
<td>Small and faces anteriorly.</td>
<td>Large and faces laterally.</td>
</tr>
<tr>
<td>Obturator foramen</td>
<td>Oval.</td>
<td>Round.</td>
</tr>
<tr>
<td>Pubic arch</td>
<td>Greater than 90° angle.</td>
<td>Less than 90° angle.</td>
</tr>
</tbody>
</table>

Table 08.01a Tortora - PAP 12/e
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Comparing Male and Female Pelves

<table>
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<tr>
<th>POINT OF COMPARISON</th>
<th>FEMALE</th>
<th>MALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iliac crest</td>
<td>Less curved.</td>
<td>More curved.</td>
</tr>
<tr>
<td>Greater sciatic notch</td>
<td>More movable and more curved anteriorly.</td>
<td>Narrow.</td>
</tr>
<tr>
<td>Coccyx</td>
<td>Shorter, wider (see anterior views), and less curved anteriorly.</td>
<td>Less movable and less curved anteriorly.</td>
</tr>
<tr>
<td>Sacrum</td>
<td></td>
<td>Longer, narrower (see anterior views), and more curved anteriorly.</td>
</tr>
</tbody>
</table>

Pelvic outlet
- **Wider.**
- Shorter, farther apart, and more medially projecting.

Ischial tuberosity
- **Narrower.**
- Longer, closer together, and more laterally projecting.
Male pelvis
Female pelvis
Pelvic Walls

• Bones
• Ligaments
• Muscles
• Fascia
• Parietal peritoneum
Anterior Pelvic Wall

- The shallowest wall
- Content
  - Bodies of the pubic bones
  - Pubic rami
  - Symphysis pubis
Posterior Pelvic Wall

- Sacrum
- Coccyx
- Piriformis muscle
  - From sacrum to greater trochanter
    - Through the greater sciatic foramen
Lateral Pelvic Wall

- **Hip bones**
- **Obturator membrane**
  - Fibrous sheet that closes the obturator foramen
    - Obturator canal
- **Sacrotuberous ligament**
  - From sacrum, coccyx & PIIS to the ischial tuberosity
- **Sacrospinous ligaments**
  - From sacrum & coccyx to the ischial spine
- **Obturator internus muscle**
  - From obturator membrane & surrounding bones to the greater trochanter
    - Through the lesser sciatic foramen
Sacroiliac Joint

- Auricular surfaces of the sacrum and the iliac bone
- No movement; transmit body weight from vertebral column to pelvis
- In elderly people synovial cavity disappear and becomes fibrous joint
- Associated ligaments
  - Posterior sacroiliac ligament
  - Interosseous sacroiliac ligament (between tuberosities of sacrum and iliac bone)
  - Anterior sacroiliac ligament
- Accessory ligaments
  - Sacrotuberous ligament
  - Sacrospinous ligament
  - Iliolumbar ligament
- Nerve supply: sacral spinal nerves
Inferior Pelvic Wall (Pelvic Diaphragm)

- Support the pelvic viscera
- Inferior pelvic wall (pelvic floor) formed by the pelvic diaphragm
- The levator ani and coccygeus muscles, along with the fascia which covers them, form the pelvic diaphragm.
- The pelvic diaphragm separates the pelvic cavity above from the perineum below
- Pelvic diaphragm is deficient anteriorly (urogenital hiatus)
Levator Ani Muscle

- Wide thin sheet
- Originate laterally from the pubic body, obturator internus fascia & ischial spine
- Orientation – downward and medially
Levator Anai Muscle: Fibers

- **Anterior fibers** (levator prostatae or sphincter vaginae)
  - Inserts to the perineal body
- **Intermediate fibers**
  - Puborectalis – around the anorectal junction
  - Pubococcygeus
    - Inserts into the anococcygeal body
- **Posterior fibers** (iliococcygeus)
  - Inserted into the anococcygeal body & coccyx
<table>
<thead>
<tr>
<th>Name of Muscle</th>
<th>Origin</th>
<th>Insertion</th>
<th>Nerve Supply</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piriformis</td>
<td>Front of sacrum</td>
<td>Greater trochanter of femur</td>
<td>Sacral plexus</td>
<td>Lateral rotator of femur at hip joint</td>
</tr>
<tr>
<td>Obturator internus</td>
<td>Obturator membrane and adjoining part of hip bone</td>
<td>Greater trochanter of femur</td>
<td>Nerve to obturator internus from sacral plexus</td>
<td>Lateral rotator of femur at hip joint</td>
</tr>
<tr>
<td>Levator ani</td>
<td>Body of pubis, fascia of obturator internus, spine of ischium</td>
<td>Perineal body, ano-coccygeal body, walls of prostate, vagina, rectum, and anal canal</td>
<td>Fourth sacral nerve, pudendal nerve</td>
<td>Supports pelvic viscera; sphincter to anorectal junction and vagina</td>
</tr>
<tr>
<td>Coccygeus</td>
<td>Spine of ischium</td>
<td>Lower end of sacrum; coccyx</td>
<td>Fourth and fifth sacral nerve</td>
<td>Assists levator ani to support pelvic viscera; flexes coccyx</td>
</tr>
</tbody>
</table>

Pelvic Fascia

- Above is continuous with the fascia lining the abdominal walls
- Below is continuous with the fascia of the perineum
- Layers
  - Parietal layer
    - Lines the walls of pelvis - covers the pelvic diaphragm
    - Continuous anteriorly with the fascia covering the lower surface of the diaphragm
  - Visceral layer
    - Covers & supports the pelvic viscera
      - Fascial ligaments - connects some viscera to the pelvic walls (pubovesical & sacrocervical ligaments)
- Parietal peritoneum
  - Lines the pelvic walls
  - Covers the viscera and continue as visceral peritoneum
Nerves of the Pelvis

- Branches of lumbar plexus
  - Lumbosacral trunk
  - Obturator nerve
- Sacral plexus
  - Anterior to periformis muscle
  - Posterior to internal iliac vessels and rectum
- Autonomic nerves
Sacral Plexus

- Ventral rami L4-S4
- Anterior to the sacrum and posterior pelvic wall
- Form in front of periformis m.
- Supplies buttocks, perineum & part of lower limb
- Branches exit from the greater sciatic notch
- Branches exit inferior to periformis m. except the superior gluteal n.
Autonomic Nerves

- Pelvic part of sympathetic trunk
  - Posterior to common iliac vessels
  - Anterior to sacrum
  - Medial to sacral foramina
  - 4-5 ganglia
  - Ganglion impar

- Pelvic splanchnic nerves
  - Parasympathetic (S2-S4)
  - Inferior hypogastric plexus
  - Inferior mesenteric plexus

- Superior hypogastric plexuses
  - In front of promontory
  - Forms right & left hypogastric nerves

- Inferior hypogastric plexuses
  - Hypogastric nerve + pelvic splanchnic nerve
  - Lateral to rectum, bladder & vagina
Arteries of the False Pelvis

• Common iliac a.
  – Divides at the pelvic prim in front of the sacroiliac joint
• External iliac a.
  – Continue at the brim
  – Pelvic branches
    • Deep circumflex iliac
    • Inferior epigastric
  – Leave the false pelvis deep to the inguinal lig.
Arteries of the True Pelvis

- **Internal iliac a.**
- **Superior rectal a.**
  - Continuation of inferior mesenteric a.
  - Mucus membrane of rectum & upper anal canal
- **Ovarian a.**
  - From abdominal aorta – L1
  - Cross the external iliac at the brim
  - Reach the ovary by passing through suspensory lig. – broad lig. – mesovarium
- **Median sacral a.**
  - Rise at the bifurcation of aorta
  - Descend anterior to sacrum & coccyx
Internal Iliac Artery

- Supply the pelvic viscera & walls, perineum, & buttocks
- It divides at the upper margin of the greater sciatic foramen
- Divisions
  - Anterior
  - Posterior
Internal Iliac Artery
Anterior Division

• Umbilical a.
  – Superior vesical a.
• Obturator a.
• Uterine a.
  – Cross the ureter superiorly
  – Ascend on the lateral side of the uterus
    • Through the broad lig.
    • Anastomose with ovarian a.
• Inferior vesical a. (Vaginal a.)
  – Artery to the vas deferens
• Middle rectal a.
• Internal pudendal a.
  – Leave via GSF
  – Come back via LSF
  – Inter the pudendal canal with the nerve
• Inferior gluteal a.
  – Below piriformis m. via GSF
Internal Iliac Artery
Posterior Division

• Iliolumbar a.
  – Ascend posterior to external iliac vessels, psoas & iliacus mm.
• Lateral sacral aa.
• Superior gluteal a.
  – Above piriformis m. via GSF
Veins of the Pelvis

- **External iliac v.**
  - Medial to the external iliac a.
  - Tributaries
    - Deep circumflex iliac
    - Inferior epigastric
- **Internal iliac v.**
  - Tributaries correspond to the arteries
- **Median sacral v.**
  - Drain into the left common iliac v.

- **Lymphatics of the pelvis**
  - Lymph drains into the node associated with arteries
    - External iliac, internal iliac & common iliac lymph nodes
Perineum
Lecture Objectives

• Describe the perineum and its boundaries.
• Describe the anal triangle including anal canal, levator ani muscles and anal sphincters.
• Describe the urogenital triangle.
Perineum

- Diamond-shaped area medial to thighs and buttocks of males and females
- The **perineum** is inferior to the pelvic diaphragm that
- Extends from the pubic symphysis anteriorly, to the coccyx posteriorly, and to the ischial tuberosities laterally.
- Composed of anal triangle and urogenital triangle
- Contains external genitalia and anus
Anal Triangle

- **Boundaries**
  - Coccyx – posteriorly
  - Sacrotuberous lig. & ischial tuberosity – laterally
- **Content**
  - Anal canal & anus
  - Ischioanal (ischiorectal) fossae
Anal Canal

- 4 cm length
- Oriented downward & backward
- Relations
  - Posteriorly – anococcygeal body
  - Laterally - Ischioanal fossae
  - Anteriorly – perineal body & content of the urogenital triangle
    - Male
    - Female
Anal Canal: Structure

• Upper half
  – Columnar epithelium
  – Anal columns & valves
  – Blood supply: superior rectal vessels
  – Nerve supply: autonomic hypogastric plexuses
  – Lymphatics: along the superior rectal a.
  – pararectal nodes – inferior mesenteric nodes

➤ Pectinate line

• Lower half
  – Stratified squamous epithelium
  – Blood supply: inferior rectal vessels
  – Nerve supply: inferior rectal nerve (somatic)
  – Lymphatics: superficial inguinal nodes
Anal Canal

- **Muscle coat** - smooth m.
  - Outer – longitudinal
  - Inner - circular
- **Anal sphincters**
  - Internal sphincter - smooth m.
    - Thickening of the inner circular m.
  - External sphincter - skeletal m.
    - Subcotaneous part
    - Superficial part
    - Deep part
      - With puborectalis form anorectal ring
    - Puborectalis m.
      - Anorectal angle
<table>
<thead>
<tr>
<th>Name of Muscle</th>
<th>Origin</th>
<th>Insertion</th>
<th>Nerve Supply</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>External anal sphincter</td>
<td>Encircles anal canal, no bony attachments</td>
<td>Coccyx</td>
<td>Inferior rectal nerve and perinea branch of fourth sacral nerve</td>
<td>Together with puborectalis muscle forms voluntary sphincter of anal canal</td>
</tr>
<tr>
<td>Subcutaneous part</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superficial part</td>
<td>Perineal body Encircles anal canal, no bony attachments</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deep part</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Puborectalis (part of levator ani)</td>
<td>Pubic bones</td>
<td>Sling around junction of rectum and anal canal</td>
<td>Perineal branch of fourth sacral nerve and from perineal branch of pudendal nerve</td>
<td>Together with external anal sphincter forms voluntary sphincter for anal canal</td>
</tr>
</tbody>
</table>
Ischioanal fossa

- **Wedge-shaped space**
- **Boundaries**
  - Obturator internus m. laterally
  - Levator ani m. & anal canal medially
  - Skin inferiorly
- **Content**
  - Filled with dense fat
  - Pudendal n. & internal pudendal vessels
    - In pudendal canal on the lateral wall
  - Inferior rectal n., a., v.
Ischioanal fossa

- **Pudendal nerve**
  - Supply external anal sphincter & muscles & skin of perineum
  - Branches
    - Inferior rectal nerve
      - External anal sphincter
      - Mucus membrane of lower half of anal canal & perianal skin
    - Dorsal nerve of the penis (clitoris)
    - Perineal nerve
      - Urogenital triangle mm.
      - Skin of posterior scrotum (labia majora)

- **Internal pudendal a.**
  - Inferior rectal a.
  - Branches to the penis (clitoris & labia)
Urogenital Triangle

• **Boundaries**
  – Pubic arch – anteriorly
  – Ischial tuberosities – laterally

• **Content**
  – In male – penis & scrotum
  – In female – external genitalia & orifices of urethra & vagina

• **Fascia**
  – Superficial fascia
  – Superficial perineal pouch
    • Content

• **Urogenital diaphragm**
  – Fascia
    • Deep perineal pouch
      – content
Urogenital Triangle
Superficial Fascia

• Fatty layer (fascia of camper)
  – Continuous with the fat of the ischioanal fossa
  – Replaced by dartos muscle in scrotum

• Membranous layer (Colles’ fascia)
  – Attachments
    • Posteriorly – to urogenital diaphragm & perineal body
    • Laterally – pubic arch
    • Anteriorly – continuous with the Scarpa’s fascia
    • At penis (clitoris) – form tubular sheath
Superficial Perineal Pouch

- Enclosed between the Colles’ fascia and the urogenital diaphragm, where they meet:
  - Posteriorly – at perineal body
  - Laterally – at pubic arch
- Anteriorly – continuous with the potential space between the Scarpas’ fascia and the abdominal mm.
Superficial Perineal Pouch: Content

• Root of the penis or clitoris
• Muscles
  – Bulbospongiosus mm.
    • In male – cover the pulp of penis
    • In female – cover the pulp of vestibule
  – Ischiocavernosus mm.
    • Cover the crura of the penis or clitoris
  – Superficial transverse perineal mm.
Urogenital Diaphragm
Deep Perineal Pouch

• Musculofascial triangle at the pubic arch

• Muscles
  – Sphincter urethrae
  – Deep perineal muscles

• Fascia – enclose the mm.
  – Superior fascial layer
  – Inferior fascial layer (perineal membrane)
  – Attachments
    • Anteriorly – the two layers fuse together
    • Posteriorly – the two layers fuse & attach to the perineal body
    • Laterally – pubic arch

• Deep perineal pouch – enclosed between the two layers of fascia
Deep Perineal Pouch: Content

- Muscles
  - Sphincter urethrae m.
    - Surrounds urethra and vagina
    - Deep transverse perineal mm.
- Internal pudendal a.
  - Branches
    - Artery of crus
    - Artery of pulp
    - Dorsal artery of penis (clitoris)
- Dorsal nerve of the penis (clitoris)
- Part of urethra
  - In male – membranous urethra
- Part of vagina
<table>
<thead>
<tr>
<th>Name of Muscle</th>
<th>Origin</th>
<th>Insertion</th>
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<tbody>
<tr>
<td><strong>Male Urogenital Muscles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bulbospongiosus</td>
<td>Perineal body</td>
<td>Fascia of bulb of penis and corpus cavernosum and cavernosum</td>
<td>Perineal branch of pudendal nerve</td>
<td>Compresses urethra and assists in erection of penis</td>
</tr>
<tr>
<td>Ischiocavernosus</td>
<td>Ischial tuberosity</td>
<td>Fascia covering corpus cavernosum</td>
<td>Perineal branch of pudendal nerve</td>
<td>Assists in erection of penis</td>
</tr>
<tr>
<td>Sphincter urethrae</td>
<td>Pubic arch</td>
<td>Surrounds urethra</td>
<td>Perineal branch of pudendal nerve</td>
<td>Voluntary sphincter of urethra</td>
</tr>
<tr>
<td>Superficial transverse perineal muscle</td>
<td>Ischial tuberosity</td>
<td>Perineal body</td>
<td>Perineal branch of pudendal nerve</td>
<td>Fixes perineal body</td>
</tr>
<tr>
<td>Deep transverse perineal muscle</td>
<td>Ischial ramus</td>
<td>Perineal body</td>
<td>Perineal branch of pudendal nerve</td>
<td></td>
</tr>
<tr>
<td><strong>Female Urogenital Muscles</strong></td>
<td></td>
<td></td>
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<td>Bulbospongiosus</td>
<td>Perineal body</td>
<td>Fascia of corpus cavernosum</td>
<td>Perineal branch of pudendal nerve</td>
<td>Sphincter of vagina and assists in erection of clitoris</td>
</tr>
<tr>
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<td>Ischial tuberosity</td>
<td>Fascia covering corpus cavernosum</td>
<td>Perineal branch of pudendal nerve</td>
<td>Causes erection of clitoris</td>
</tr>
<tr>
<td>Sphincter urethrae</td>
<td>Same as in male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Superficial transverse perineal muscle</td>
<td>Same as in male</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Deep transverse perineal muscle</td>
<td>Same as in male</td>
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