Abdomen: Pelvis and female reproductive organs

PELVIC BONES - GENERAL & ORIENTATION

Anterior superior iliac spine
Anterior inferior iliac spine
Superior pubic ramus
Symphysis pubis
Obturator internus on obturator fascia
Obturator internus on obturator fascia
Iliac crest
Sacro-iliac joint
Sacro-iliac ligament
Posterior superior & inferior iliac spines
Greater sciatic notch
Sacropinous ligament
Lesser sciatic notch
Sacrotuberous ligament
White line on levator ani

ORIENTATION OF PELVIS

Tip of greater trochanter
Tip of ischial spine
Centre of femoral head
On a horizontal line

Tip of coccyx
Horizontal line
Vertical line
Right angle
Top of pubis
Anterior superior iliac spine
SACRUM - GENERAL & SACRO-ILIAC JOINT

- 5 fused vertebrae (may be 6 or 7)
- L5 may be sacralised
- Spina bifida occulta common
- Iliolumbar ligament from iliac crest to tip of 5th lumbar transverse process. Quadratus lumborum arises from it

Lateral view

Posterior sacro-iliac ligament strong ++
Anterior sacro-iliac ligament (thickening of joint capsule) weaker

Viewed from above

All these ligament need to be strong to prevent sacrum sliding forwards

Sacroiliac joint jagged surfaces minimal movement but synovial

Anterior view

Attachment of pelvic fascia (Waldeyer's)

Piriformis (lateral mass & costo-transverse bar of 2,3,4)

Order of structures from posterior to anterior is:
Bone, perioisteum, piriformis, anterior ramus, pelvic fascia, lateral sacral artery, branches of iliac artery, ureter, peritoneum, bowel

Central mass
Median sacral artery
Sympathetic chain
Lateral sacral artery
Lateral mass
Costotransverse bar
4 sacral foramina (anterior/posterior aligned)
Lines of vertebral fusion
Sacral fascia
Anterior rami
SACRUM - POSTERIOR ATTACHMENTS
& DURAL SAC

Posterior view of sacrum
Laminae
Posterior sacro-iliac ligament
Posterior ramus
Erector spinae
Sacrotuberous ligament
Gluteus maximus
Sacrospinous ligament
Sacral cornua & hiatus
(a superficial part of the posterior sacroccocygeal ligament closes this off)

Median spinous crest
Articular facet
Medial articular crest
(fused articular processes)
Sacro-iliac joint
(plane- synovial)
Lateral transverse crest
(fused transverse processes)
Posterior & middle layers of lumbar fascia
Pubococcygeus
Iliococcygeus
Coccygeus

Anococcygeal body

SACRAL Dimple
- S2
- End of dural sac
- Posterior inferior iliac spine
- Mid sacro-iliac joint

Lateral view of sacrum
Dural sac (subarachnoid space) ends at S2. It contains CSF, nerve roots & filum terminale (pia that extends to the coccyx)

S2 end of dural sac
Spinalcord ends at lower border of L1
Extradural space below S2 with loose fat and veins
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PELVIC BONES - SEX DIFFERENCES

Looking at the pelvic bones it should be possible to tell whether they come from a male or a female. Many of the pointers here will be helpful. Remember that the purpose of bones is to give form, provide muscle attachments, give protection, provide movement and they also have metabolic functions.

<table>
<thead>
<tr>
<th>FEMALE</th>
<th>MALE</th>
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<tbody>
<tr>
<td>Not so heavy</td>
<td>Heavy</td>
</tr>
<tr>
<td>Short segment of long cone</td>
<td>Long segment of short cone</td>
</tr>
<tr>
<td>Gynaecoid</td>
<td>Android</td>
</tr>
<tr>
<td>1/3 1/3 1/3</td>
<td>1/4 1/2 1/4</td>
</tr>
<tr>
<td>&gt;90°</td>
<td>&lt;90°</td>
</tr>
<tr>
<td>Oval</td>
<td>Round</td>
</tr>
<tr>
<td>Minimal</td>
<td>Marked</td>
</tr>
<tr>
<td>Smooth</td>
<td>Rough (crura)</td>
</tr>
<tr>
<td>ISCHIOPUBIC CREST</td>
<td>Elongated (triangular)</td>
</tr>
<tr>
<td>OBTRURATOR FOSSA</td>
<td>GOTURED (oval)</td>
</tr>
<tr>
<td>NEARLY RIGHT ANGLED</td>
<td>Less than right angle (J shaped)</td>
</tr>
<tr>
<td>GREATER SCIATIC NOTCH</td>
<td></td>
</tr>
<tr>
<td>PUBIC TUBERCLE TO ACETABULAR MARGIN V DIAMETER OF ACETABULUM</td>
<td>Equal or less</td>
</tr>
</tbody>
</table>

OUTLET: From coccyx to inferior border of symphysis pubis
INLET: From promontary ot sacrum to superior border of symphysis pubis
**PELVIS - GENERAL**

- True pelvis is below pelvic brim
- False pelvis is above pelvic brim

**LATERAL WALL**
- Ilium, ischium, pubis
- Obturator membrane & internus muscle
- Sacrotuberous & sacrospinous ligaments
- Pelvic fascia
- Piriformis

**ANTERIOR WALL**
- Symphysis pubis
- Body of pubis
- Pubic rami

**POSTERIOR WALL**
- Sacrum
- Coccyx
- Piriformis
- Sacral plexus
- Sacral fascia

- Obturator-
  - foramen
  - membrane
  - muscle (internus)
  - fascia
  - canal
- White line for attachment of levator ani
- Sphincter urethrae & deep transverse perinei
- Ischiocavernosus
- Piriformis
- Sacrospinous ligament
- Sacrotuberous ligament
- Superficial transverse perinei
**SCIATIC FORAMINA**

**STRUCTURES ENTERING & LEAVING**

**VIA GREATER SCIATIC FORAMEN**
- Superior gluteal vessels
- Superior gluteal nerve (L4,5,S1)
  - Piriformis (S1,2)
- Inferior gluteal vessels
- Inferior gluteal nerve (L5,S1,2)
- Sciatic nerve (L4,5,S1,2,3)
- Perforating cutaneous nerve (S2,3)
- Posterior femoral cutaneous nerve (S1,2,3)
- Nerve to quadratus femoris (L4,5,S1)
- Nerve to obturator internus (L5,S1,2)
- Pudendal nerve (S2,3,4)
- Internal pudendal vessels

**VIA LESSER SCIATIC FORAMEN**
- Tendon of obturator internus
- Nerve to obturator internus
- Internal pudendal vessels
  - Pudendal nerve

There are six nerves that arise from the roots of the sacral plexus that have the letter “P”

Piriformis, nerve to: S1,2  
Remains in pelvis to supply this muscle

Posterior femoral cutaneous nerve: S1,2,3  
Leaves pelvis via greater sciatic foramen

Perforating cutaneous nerve: S2,3  
Leaves pelvis via greater sciatic foramen

Pudendal nerve: S2,3,4  
Leaves pelvis via greater sciatic foramen

Pelvic splanchnic (parasympathetic) nerves: S2,3,4  
Remains in pelvis to supply pelvic organs

Perineal branch of S4: S4  
Remains in pelvis to supply levator ani

3 nerves remain in the pelvis & 3 exit via the greater sciatic foramen
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- membrane
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POSTERIOR WALL

- Sacrum
- Coccyx
- Piriformis
- Sacral plexus
- Sacral fascia
PELVIC FLOOR FROM BELOW

- Covered superiorly and inferiorly with fascia (epimysium)
- Nerve supply for levator ani is perineal branch of S4, S5 for coccygeus

![Diagram of the pelvic floor from below with labeled structures](image)

- Dorsal vein of penis
- Puboprostatic & pubovesical ligaments
- Pubovaginalis
- Levator prostaticae
- Perineal body
- Tendon of obturator internus emerging from less sciatic foramen
- Greater sciatic foramen

1= Sacrospinous ligament
2= Sacrotuberous ligament
UTERUS - GENERAL

- Pear shaped
- Usually anteverted to 90 degrees & anteflexed to 170 degrees
- Has no submucosa
- Histology - Cervix: Tall columnar epithelium becoming squamous outside, alkaline mucus
  Rest of uterus: Endometrium with glands, arterioles, smooth whorls of muscle, columnar epithelium
- Nerves - Motor: Parasympathetic activate muscle
  Sympathetic relax muscle. Both from pelvic plexus
  Sensory: Parasympathetic for cervix
  Sympathetic for uterus
- Blood supply (see broad ligament)
- Venous drainage: Highly plexiform to vesical and rectal plexuses
- Relations: Anterior- vescicouterine pouch, posterior/superior bladder
  anterior fornix, small bowel
  Posterior- Pouch of Douglas, ileum, sigmoid
  Lateral- Uterine vessels, ureter, lateral fornix, broad
  ligament

Fallopian tube. 10cm long
Ciliated columnar epithelium
Outer longitudinal & inner
  circular muscle

Uterine part of tube
  piercing uterine wall

Tube is open to
  peritoneal cavity

Fundus
Cavity
Body

Cornu

Ampulla
Infundibulum
  leading to
  fimbria

Cervical canal
Lateral fornix
Internal os
External os

Isthmus
UTERUS - SUPPORTS & DEVELOPMENT

- Suspensory ligament of ovary, round ligament & broad ligament are NOT supportive
- Ligaments:
  - LATERAL: Transverse cervical (cardinal, Mackenrodt's)
  - POSTERIOR: Uterosacral
  - ANTERIOR: Pubocervical
- Muscles: Pubovaginalis & puborectalis are part of levator ani, perineal body & urogenital diaphragm

These ligaments/Supports are condensations of fascia known as parametrium.

PARAMESONEPHRIC DUCTS (female)

- Mullerian
- Appear lateral to mesonephric ducts

In female: Uterus, tubes, upper 1/3 vagina

In male: Utricle, appendix testis. Ducts are destroyed by Mullerian Inhibiting Substance at 50 days

MESONEPHRIC REMNANTS

Blind tubules

- Anomalies
- Bicornuate uterus
- Unicollis (+/- rudimentary horn)
- Cervical atresia
- Vaginal atresia

Epoophoron in mesosalpinx
Paraoophoron in base of broad ligament
Gaertner’s duct in lateral fornix

Lower 2/3 of vagina is from the lower part of the urogenital sinus
UTERUS - BROAD LIGAMENT

- Double layer of peritoneum draped over uterus and tubes. Distal ends of tubes stick out of posterior layer of it and lie free.
- Between two layers are arteries and veins, round ligament, ligament of ovary, lymphatics. The ovary is partially covered by a separate posterior fold of the broad ligament (mesovarium) but the surface of the ovary is devoid of peritoneum to allow exit of the ova.
- The tubes lie in the upper edge of the broad ligament (mesosalpinx).
- The ureters pass through the base of the broad ligament in close relationship to the uterine artery which lies in base of broad ligament, at level of os, to supply uterus, vagina and anasomoses with ovarian artery superior to ureter.
- Fallopian tube is 10 cm long. Outer longitudinal & inner circular muscle and ciliated columnar lining.
- Round ligament of uterus passes to labium majus. Blood supply branch of ovarian & inferior epigastric arteries.
- Sensory: General visceral afferents via pelvic plexus. In parasympathetics from cervix; in sympathetic for rest of uterus and tube. No parasympathetics to ovary.

POSTERIOR ASPECT OF BROAD LIGAMENT

Ovarian vessels, lymphatics and sympathetic nerves in suspensory ligament of ovary

- Fallopian tube
- Infundibulum
- Ampulla
- Mesosalpinx
- Isthmus
- Ovary
- Uterus
- Uterine artery
- Vaginal artery
- Ureter
- Round ligament of the uterus
- Lymphatics to para-aortic nodes

Ligament of ovary

- Ovary
- Uterus
- Broad ligament
- Lymphatics to external & internal iliac & sacral nodes

Transverse cervical ligament (condensation of pelvic fascia)

- Ovary
- Uterus
- Vagina
- Lymphatics to superficial inguinal nodes via round ligament
VAGINA - GENERAL

- 10cm long
- Potential space apart from posterior fornix which is real space
- Fornices: Anterior, lateral & posterior
- Artery: Vaginal branch of uterine, middle rectal, inferior vesical gives vaginal
- Veins: Pelvic floor plexus to internal iliac
- Nerves: Sympathetic from pelvic plexus for vasoconstriction, smooth muscle action, stretch sensation
  Somatic - perineal branches of pudendal, ilio-inguinal at anterior introitus
- Lymphatics: External/internal iliac, sacral, superficial inguinal below hymen
- Support: levator ani (pubovaginalis) & perineal body
- Structure: Non-keratinising stratified squamous epithelium, smooth muscle, sweat glands, no mucous glands
- Development: Upper third from paramesonephric ducts
  Lower two thirds from urogenital sinus
- Shape: Wider left to right at top
  Wider anterior to posterior at introitus

Diagram:
- Posterior
- Right
- Left
- Anterior
- Posterior fornix
- Lateral wall (shorter than posterior)
- Anterior view
- Peritoneum over posterior fornix
- Anterior wall (shorter than posterior)
- Sagittal view
- Long posterior wall
VAGINA - RELATIONS

ANTERIOR
- Bladder
- Urethra

POSTERIOR
- Pouch of Douglas
- Ampulla of rectum
- Perineal body
- Anal canal

LATERAL
- Ureter
- Uterine artery
- Levator ani
- Urogenital diaphragm

FEMALE: In females the uterus “sticks up” into the pelvis between the bladder & rectum giving two pouches. The vesicouterine pouch anteriorly & the rectouterine pouch posteriorly

VESTIBULE OF VAGINA

Greater vestibular glands

Interrupted line gives site of hymen

Deep perineal pouch

Superficial pouch containing:
- Hymen
- Greater vestibular glands
  (Bartholin’s glands)