

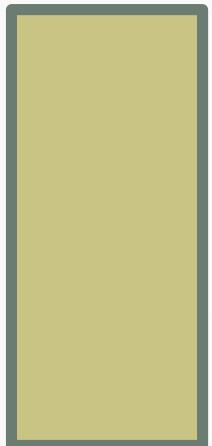
# EVALUATION OF THE PELVIS

**Ina S. Irabon, MD, FPOGS, FPSRM, FPSGE**

Obstetrics and Gynecology

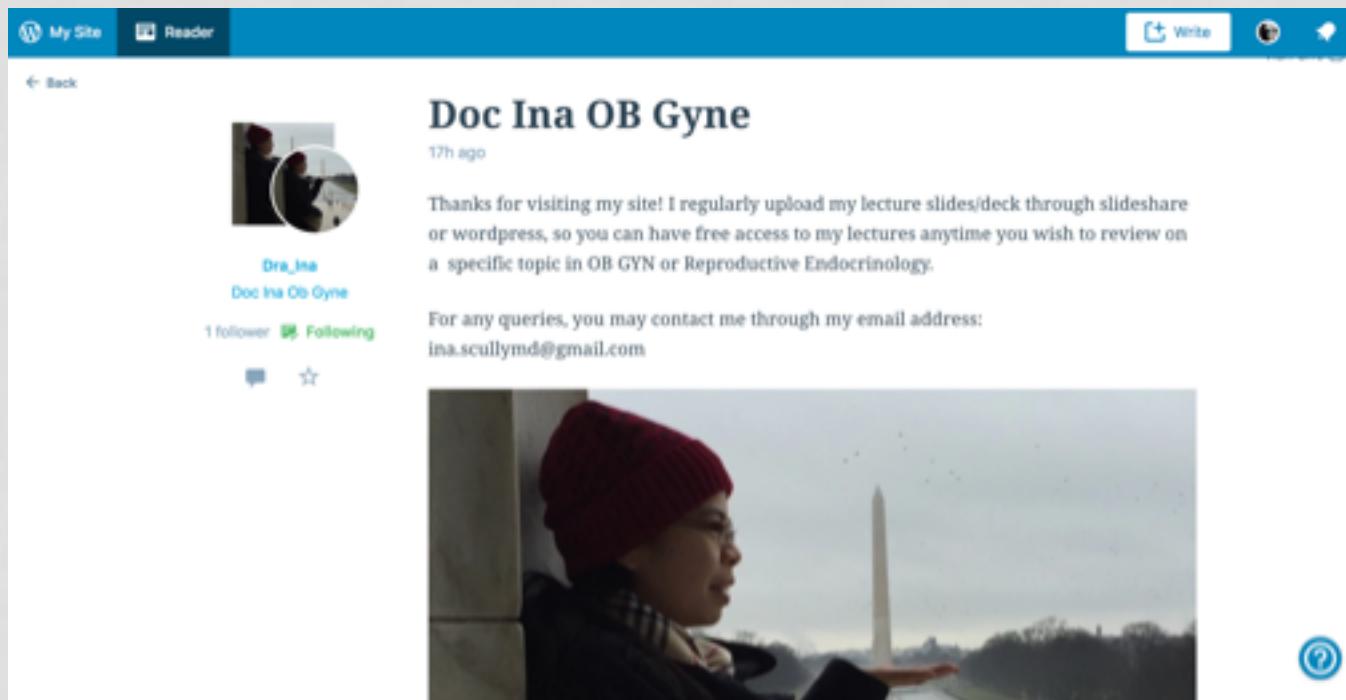
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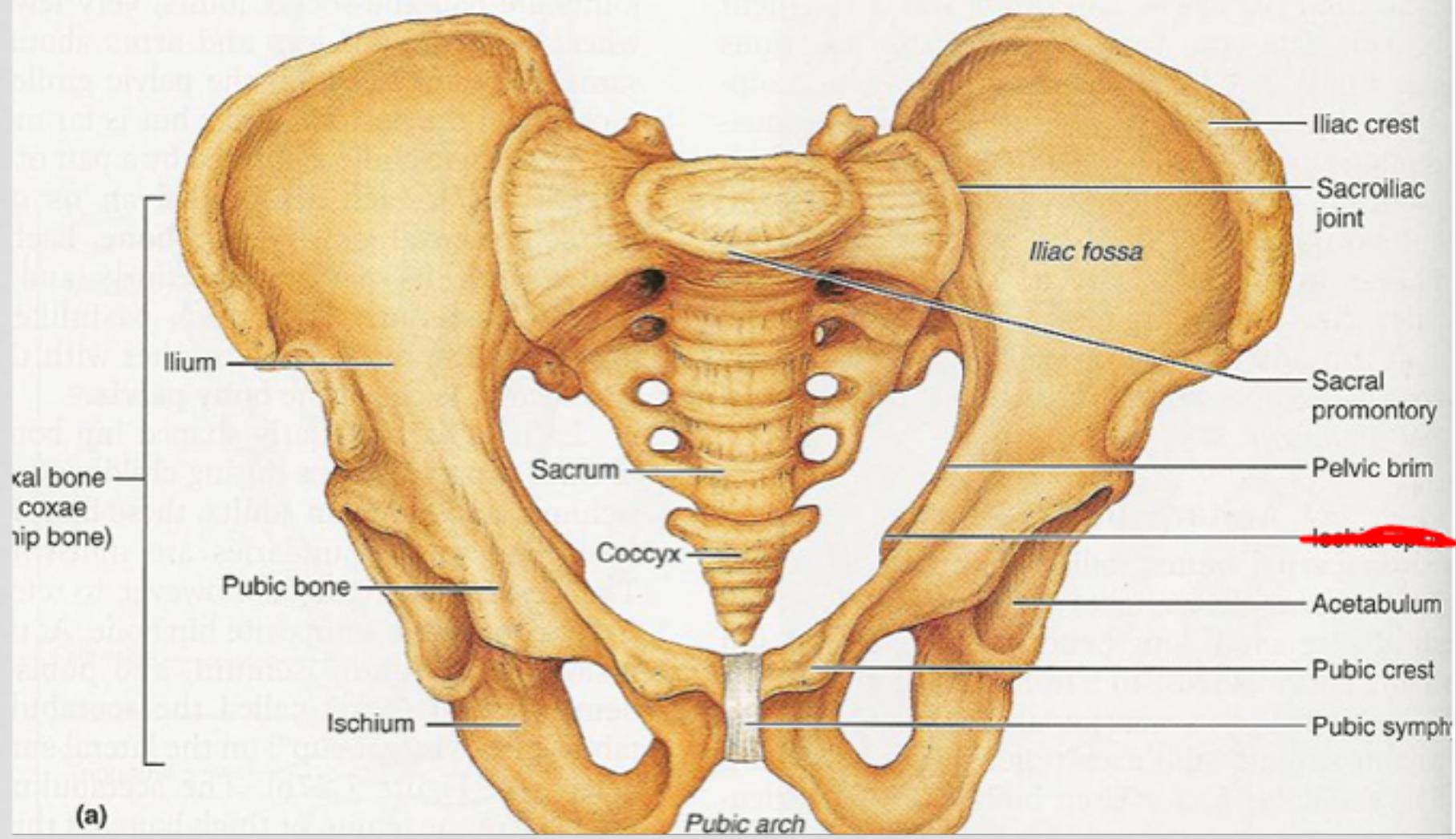
# REFERENCE

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
- Sampaico WW, Ocampo-Andres IS, Blanco-Capito LR, Diamante An, Gamilla ZN. (eds). Textbook of Obstetrics 3<sup>rd</sup> edition. Chapter 23 The Passages

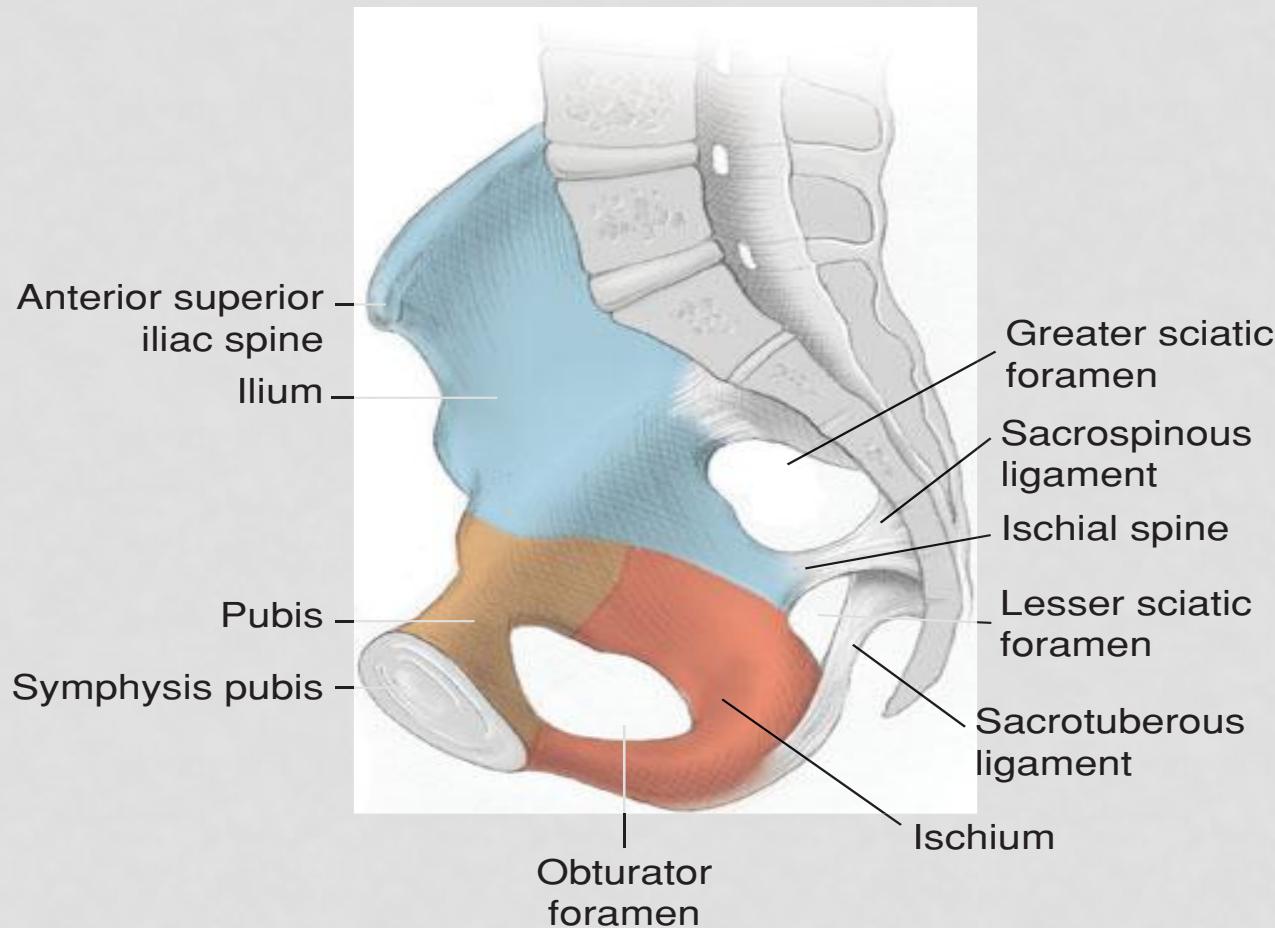
# OUTLINE

1. Composition of the bony pelvis
2. Pelvic anatomy
  - true pelvis
  - false pelvis
3. Planes of the bony pelvis
  - inlet
  - midpelvis
  - outlet
4. Pelvic shapes
  - gynecoid, android, anthropoid, platypelloid
5. Soft parts of the pelvis
  - levator ani
  - pelvic diaphragm

# COMPOSITION OF THE BONY PELVIS



# COMPOSITION OF THE BONY PELVIS



**FIGURE 2-16** Sagittal view of the pelvic bones.

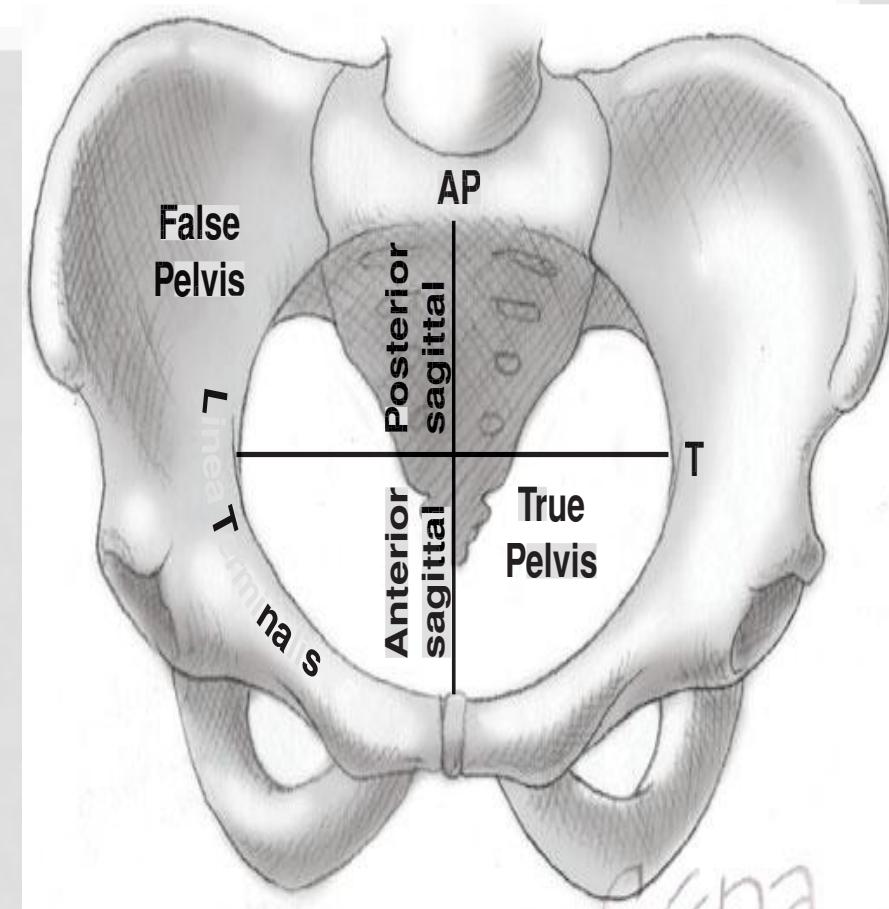
# PELVIC ANATOMY

## 1. False (Greater) pelvis

- Above linea terminalis
- Posterior: lumbar vertebra
- Lateral: iliac fossae
- Front: lower anterior abdominal wall

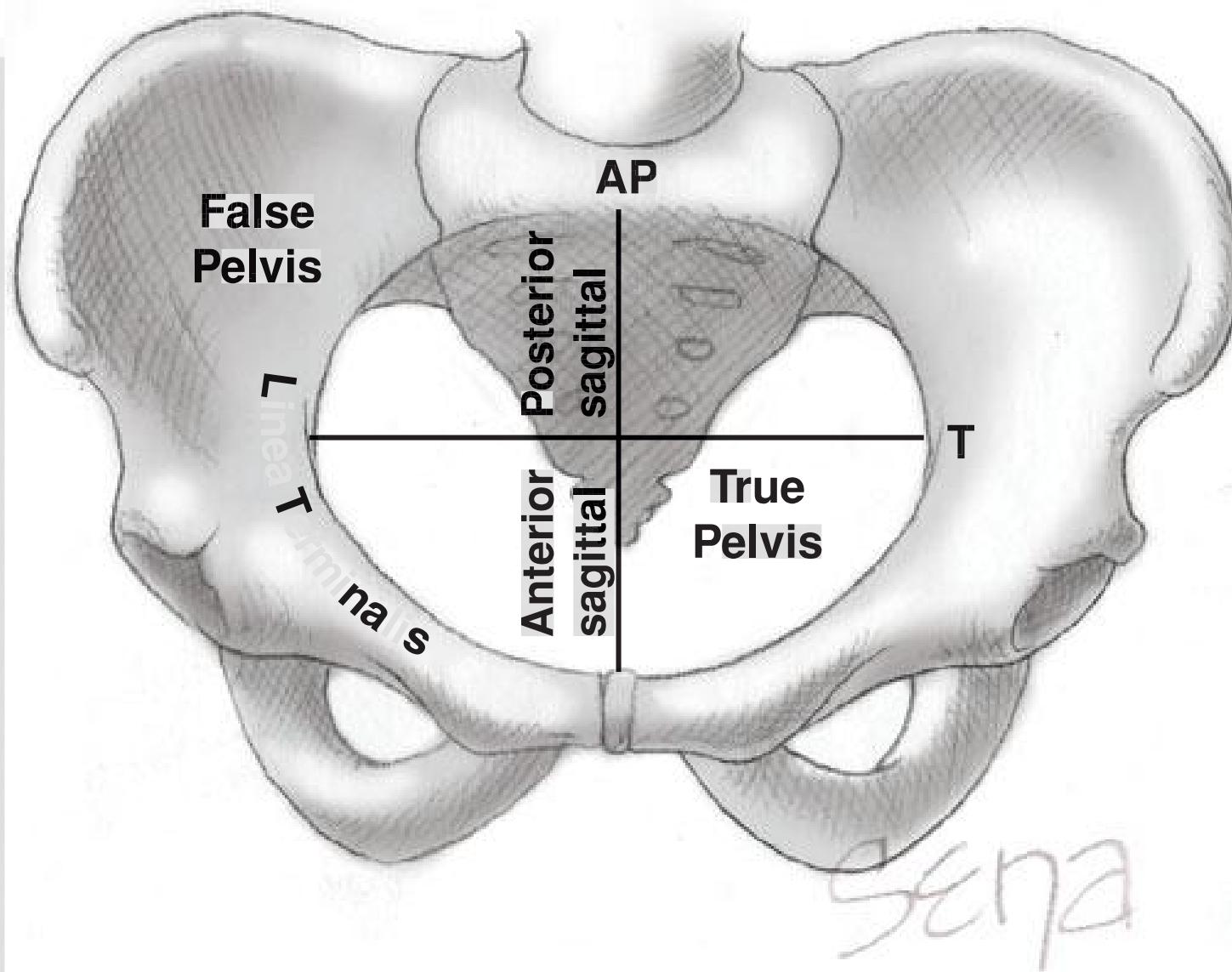
## 2. True (Lesser) Pelvis

- Below linea terminalis
- Superior: linea terminalis
- Posterior: promontory and alae of the sacrum
- Anterior: upper margin of pubic bones, ascending superior rami of the ischial bones and obturator foramina
- Inferior: pelvic outlet
- Lateral: inner surface of ischial bones and sacrosciatic notches and ligaments



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# PELVIC ANATOMY



# OBSTETRIC PLANES AND DIAMETERS

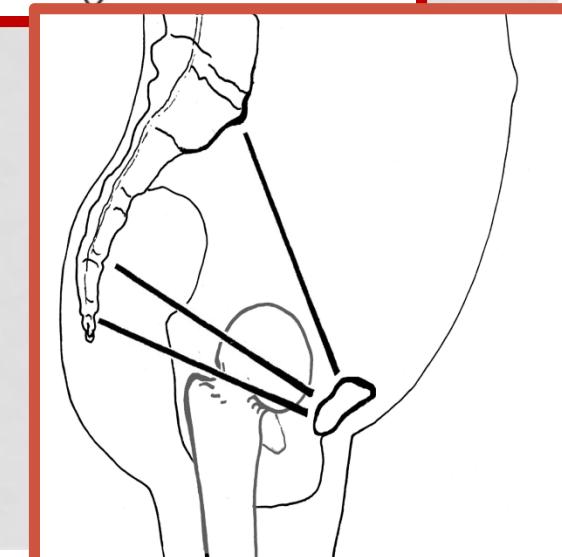
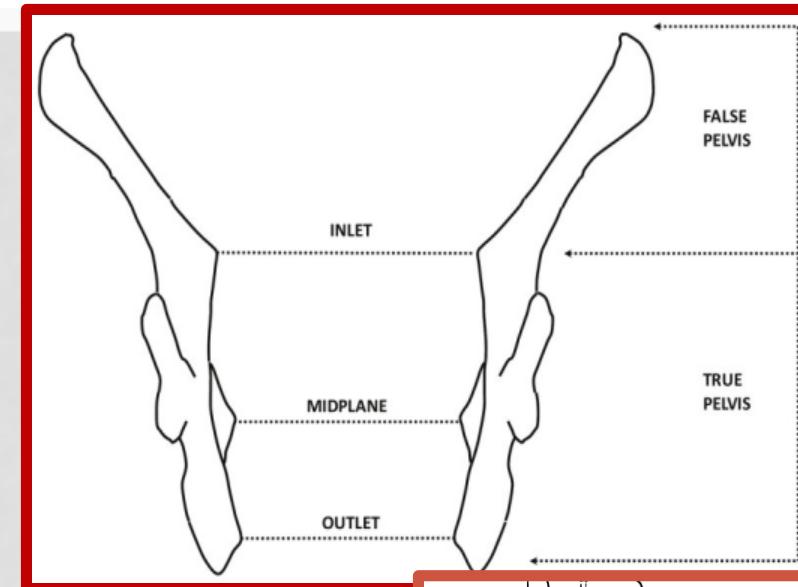
- the pelvis is described as having **four imaginary planes**:
- 1. plane of the **pelvic inlet**—the superior strait.
- 2. plane of the **pelvic outlet**—the inferior strait.
- 3. plane of the **midpelvis**—the least pelvic dimensions.
- 4. plane of **greatest pelvic dimension**—of no obstetrical significance.

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# OBSTETRIC PLANES AND DIAMETERS

3 important planes:

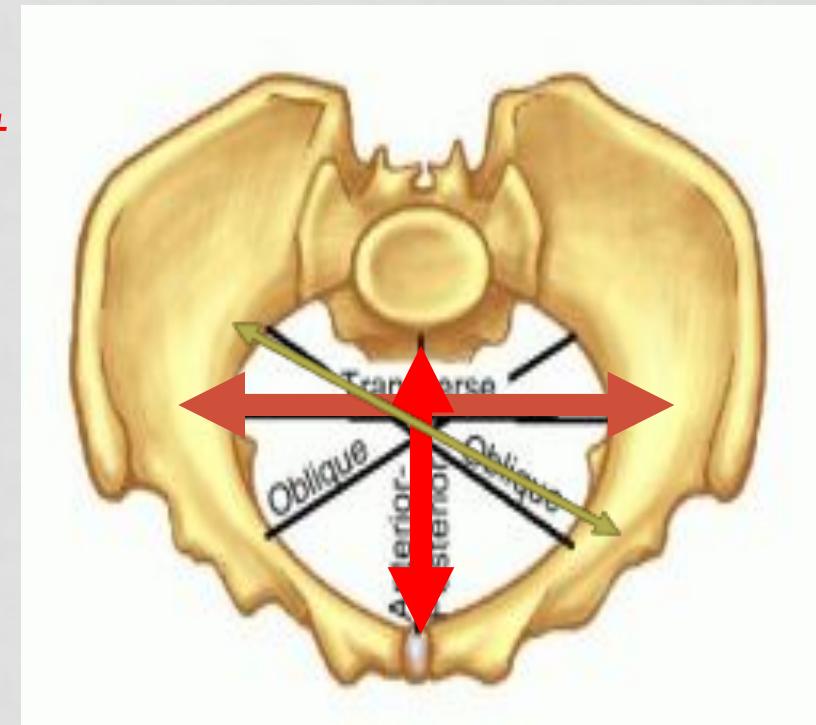
1. Pelvic inlet
2. Midpelvis
3. Pelvic outlet



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy)
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# 1. PELVIC INLET

- Forms the brim of the true pelvis
- Also called the *superior strait*
- the pelvic inlet is also the superior plane of the true pelvis
- Has 4 diameters:
  1. Anteroposterior (AP)
    - a) Diagonal conjugate
    - b) True conjugate
    - c) Obstetric conjugate
  2. Transverse
  3. Obliques (2)



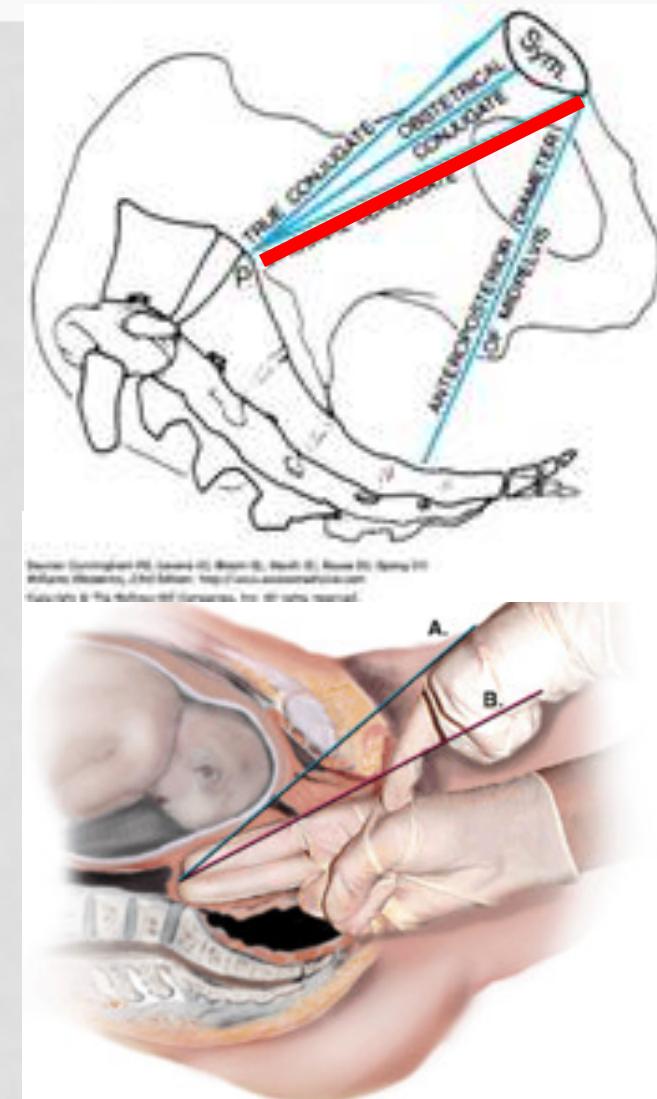
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# PELVIC INLET: ANTEROPosterior DIAMETER

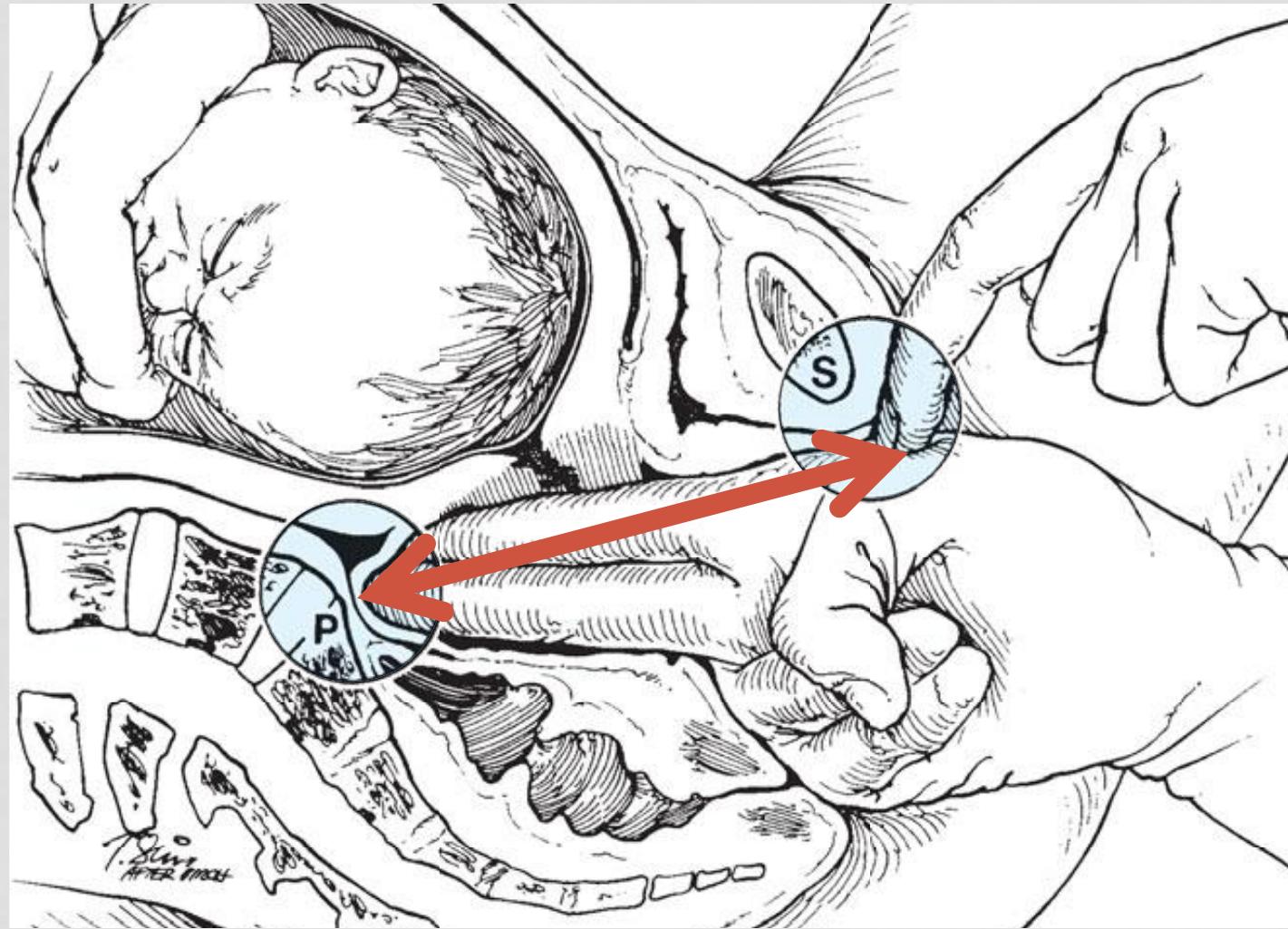
## 1. Diagonal conjugate:

- distance between lower border of symphysis pubis to midpoint of sacral promontory
- measures approx 12 cm
- ***The only AP diameter that can be measured clinically***

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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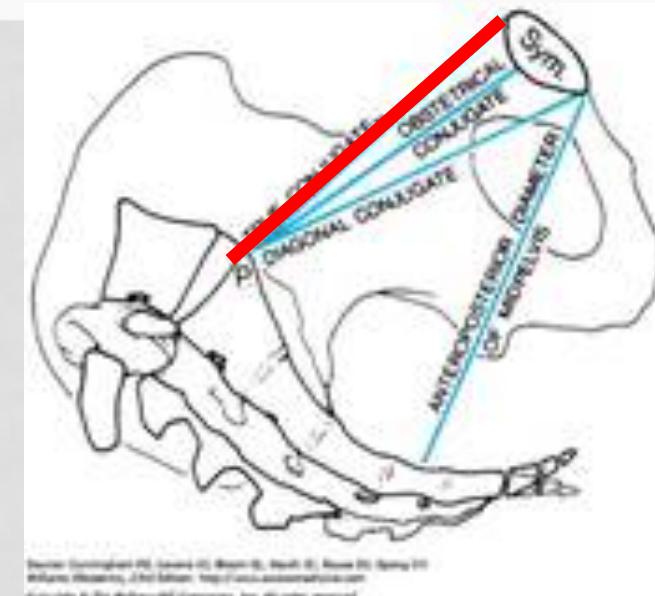
# VAGINAL EXAMINATION TO DETERMINE THE DIAGONAL CONJUGATE



# PELVIC INLET: ANTEROPosterior DIAMETER

## 2. True or anatomic conjugate

- distance between upper margin of symphysis pubis to midpoint of sacral promontory
- measures approx 11 cm
- *Measured indirectly by subtracting 1.2 cms from the diagonal conjugate*

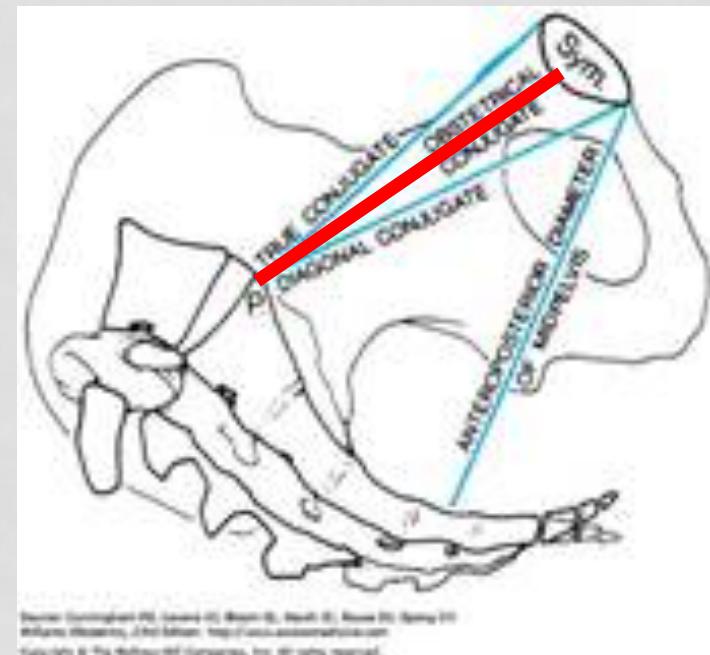


- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (2014); chapter 2 Maternal anatomy
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# PELVIC INLET: ANTEROPosterior DIAMETER

## 3. Obstetric conjugate

- distance between midpoint of inner surface of symphysis pubis to midpoint of sacral promontory
- This **clinically important** obstetrical conjugate is the **shortest distance between the sacral promontory and the symphysis pubis.**
- measures approx 10 cm
- Measured indirectly by subtracting **1.5 to 2 cms** from the diagonal conjugate

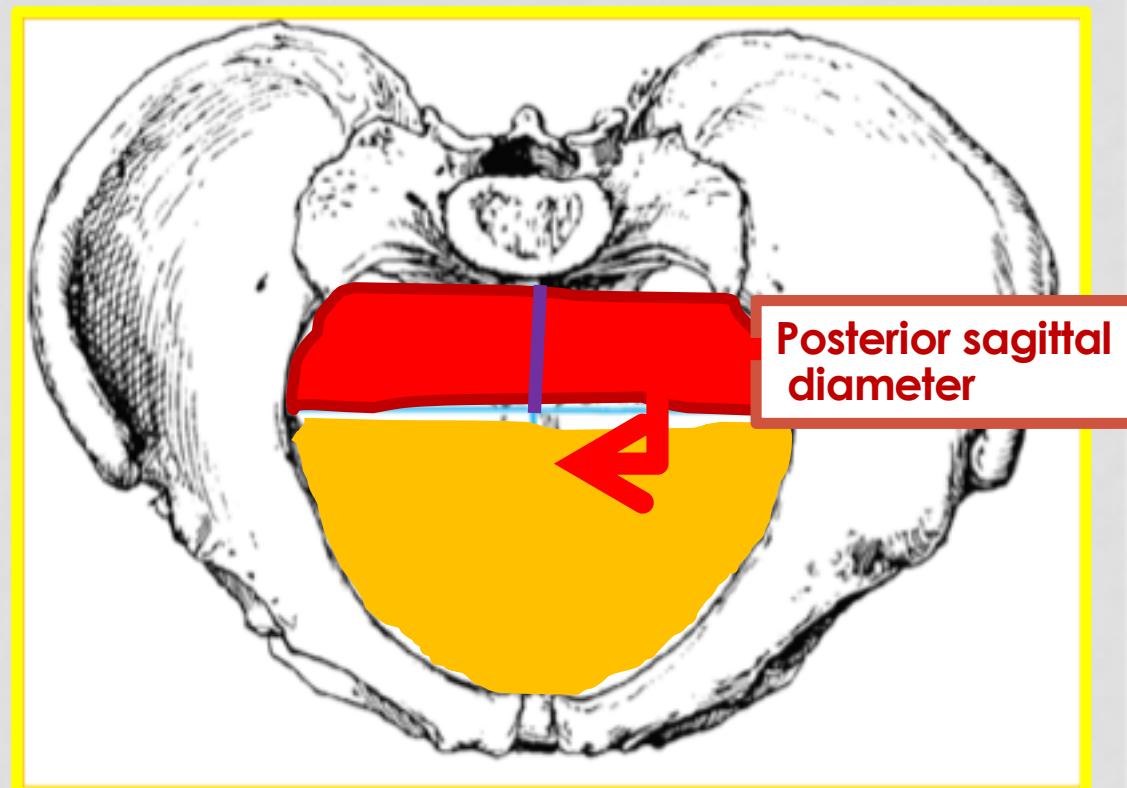


Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy

- Sumpaico WW, Ocampo-Andres IS, Blanco-Capito LR, Diamante An, Gamilla ZN. (eds). Textbook of Obstetrics 3<sup>rd</sup> edition. Chapter 23 The Passages

# PELVIC INLET: TRANSVERSE DIAMETER

- constructed at right angles to the obstetrical conjugate and represents the greatest distance between the linea terminalis on either side.
- It usually intersects the obstetrical conjugate at a point approximately 5 cm in front of the promontory
- Average: 13 cm
- Divides the inlet into anterior and posterior segments



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# PELVIC INLET: OBLIQUE DIAMETERS

- Extend from the sacroiliac joints to the opposite iliopubic eminence
- Measures <13 cm

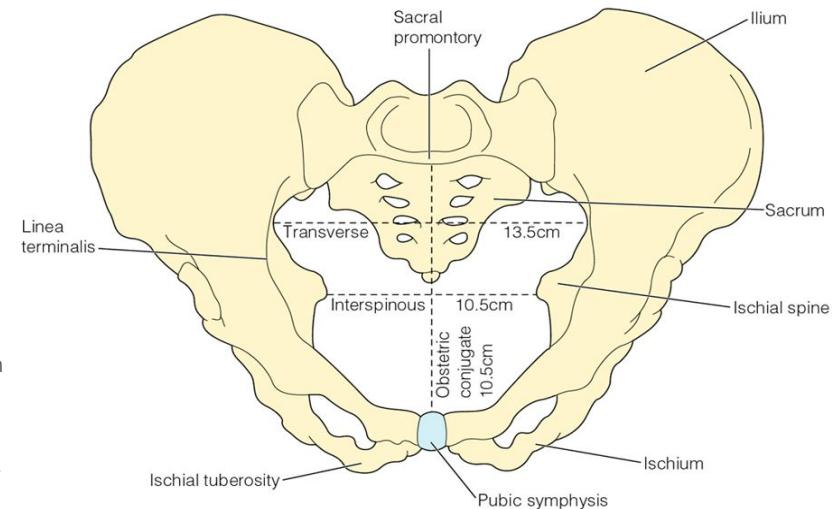
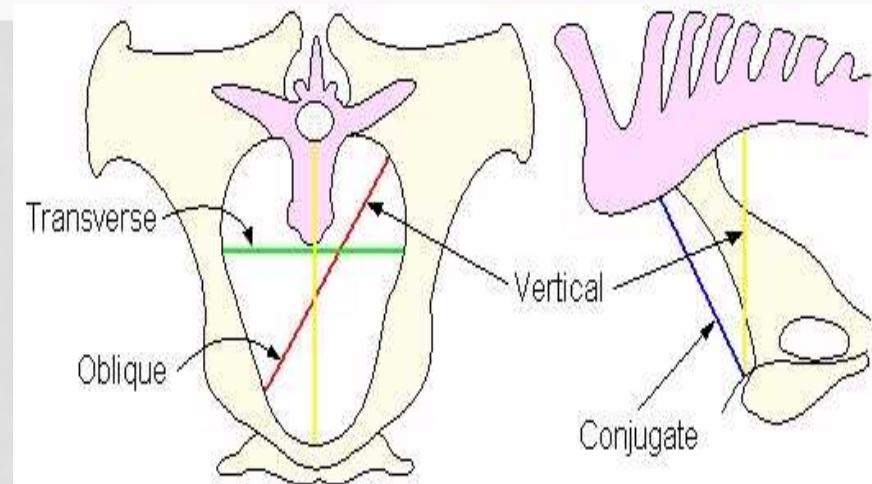
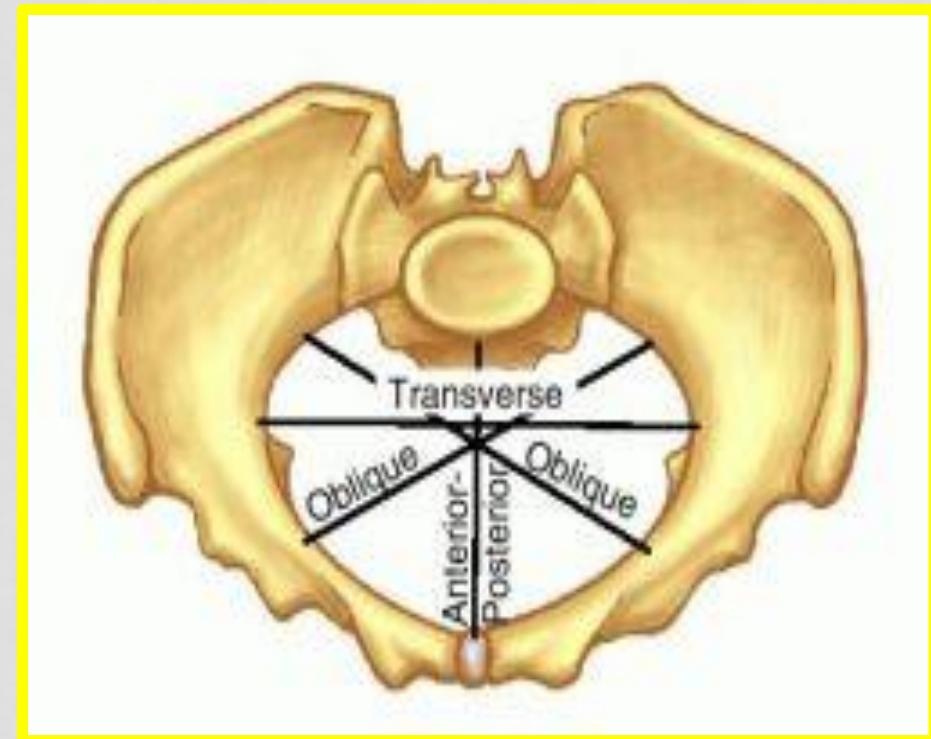


Figure 2-11 Pelvic planes: coronal section and diameters of the bony pelvis.

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# PLANE OF THE GREATEST PELVIC DIAMETER

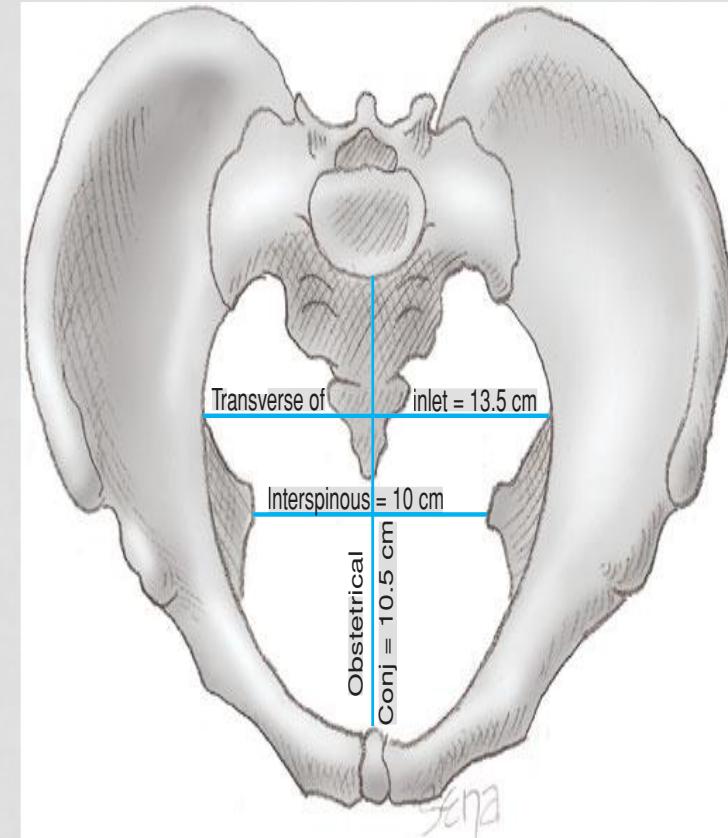
- Corresponds to the roomiest plane of the pelvis
- Posterior: 3<sup>rd</sup> to 4<sup>th</sup> sacral vertebrae
- Lateral: ischial bones
- Anterior: middle surface of symphysis pubis
- Its AP diameter and transverse diameters average 12.5cm



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# MIDPELVIS

- Measured at the level of the ischial spines
- also called the midplane or **plane of least pelvic dimensions**
- During labor, the degree of fetal head descent into the true pelvis may be described by station, and the midpelvis and ischial spines serve to mark zero station.
- The anteroposterior diameter through the level of the ischial spines normally measures at least 11.5 cm.

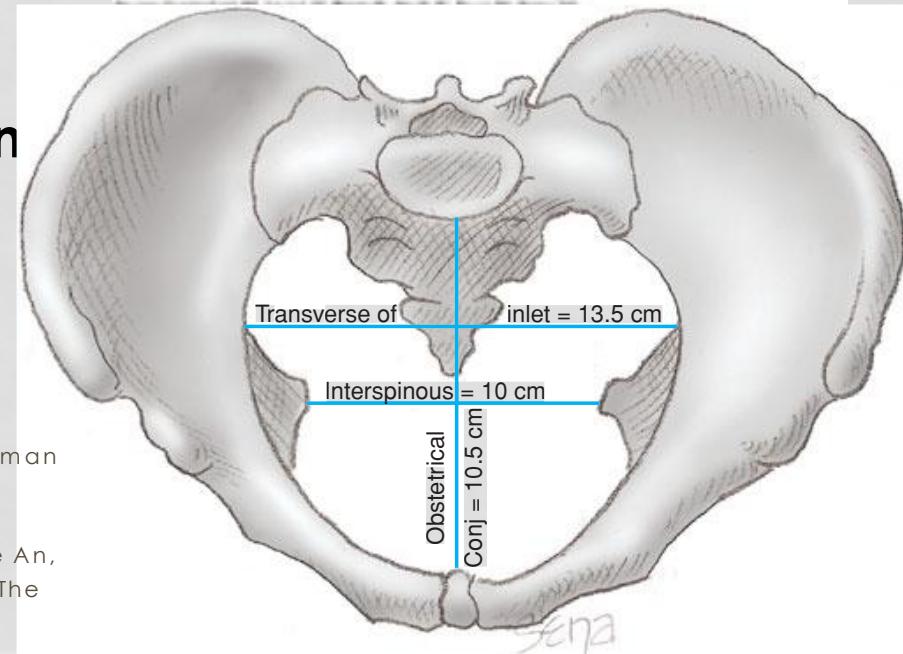
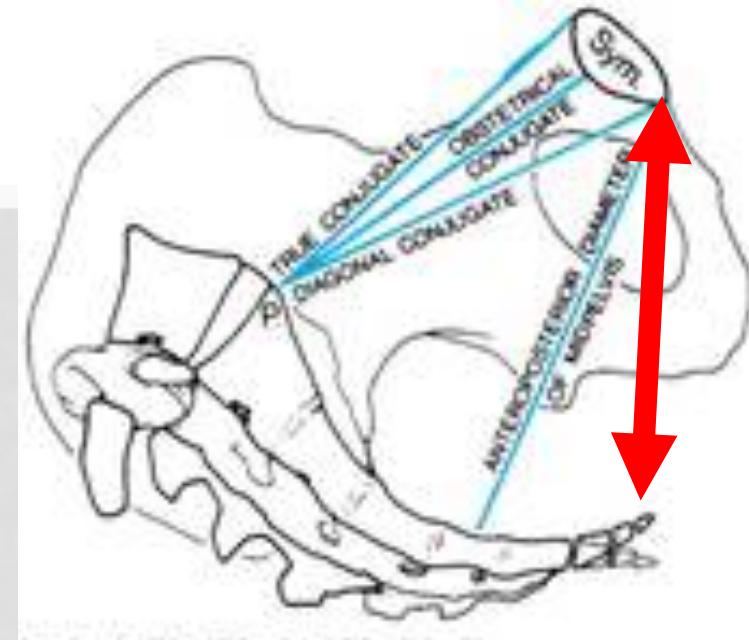


- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
- Sampaio WW, Ocampo-Andres IS, Blanco-Capito LR, Diamante An, Gamilla ZN. (eds). Textbook of Obstetrics 3<sup>rd</sup> edition. Chapter 23 The Passages

## 2. MIDPELVIS

- Extends from the lower margin of the symphysis pubis, through the level of the ischial spines, up to the tip of the sacrum
- Transverse diameter: distance between the 2 ischial spines (10.5 cm) → **interspinous diameter**

- The **interspinous diameter (station 0, when the BPD of fetal head passes this diameter)** is 10 cm or slightly greater, is usually the **smallest pelvic diameter**,



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (2014); chapter 2 Maternal anatomy
- Sumpaico WW, Ocampo-Andres IS, Blanco-Capito LR, Diamante An, Gamilla ZN. (eds). Textbook of Obstetrics 3<sup>rd</sup> edition. Chapter 23 The Passages

# MIDPELVIS

- Suspicion of midpelvis contraction is possible with the following:
  1. Prominence of the ischial spines
  2. Pelvic sidewalls are convergent
  3. Concavity of the sacrum is shallow
  4. Bi-ischial diameter of the outlet is < 8cm

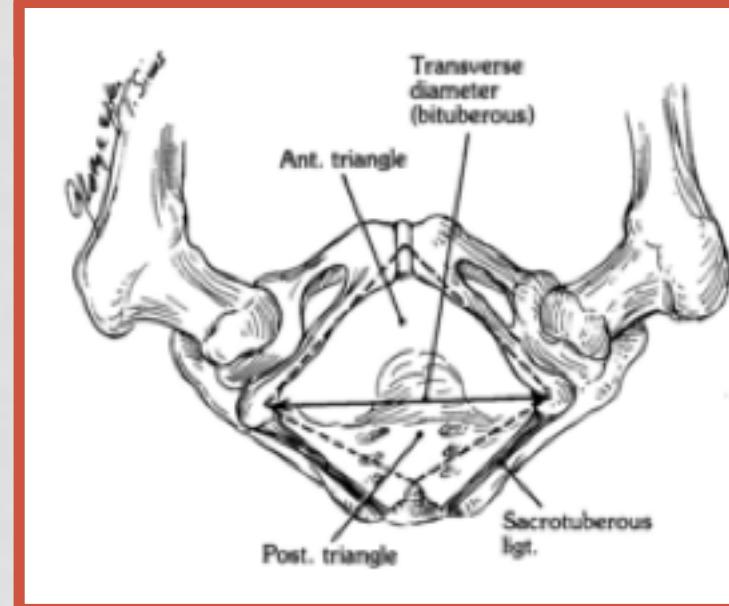
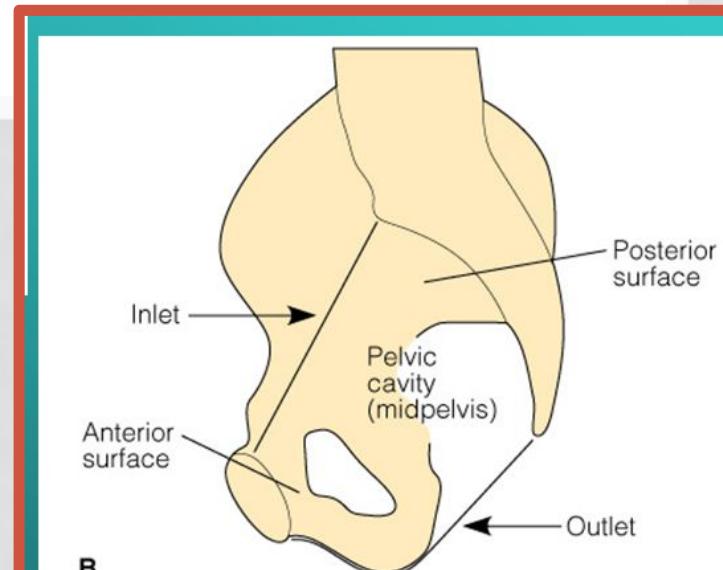


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### 3. PELVIC OUTLET

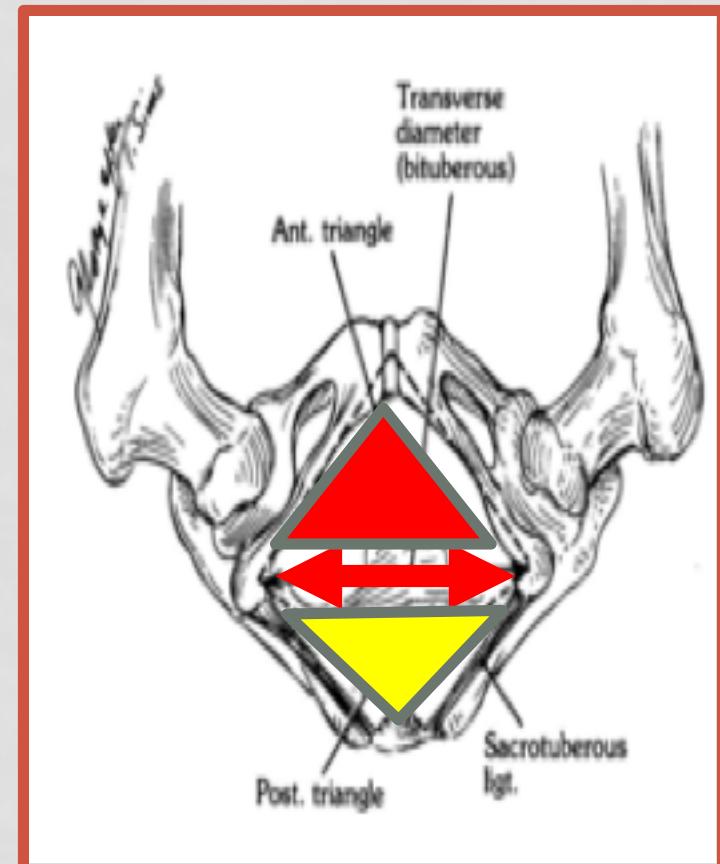
- Outlet is bounded anteriorly by the pubic arch, laterally by the ischiopubic rami, ischial tuberosity, and sacrotuberous ligament and posteriorly by the tip of the coccyx
- **Intertuberous (or bituberous) diameter:** 11cm
- AP diameter: 9.5-11.5cm

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (2014); chapter 2 Maternal anatomy
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# PELVIC OUTLET

- The pelvic outlet consists of **two** approximately ***triangular areas***.
  - ***Posterior triangle***
  - ***Anterior triangle***
- They have a common base, which is a line drawn between the two ischial tuberosities.
- Clinically, three diameters of the pelvic outlet usually are described—the anteroposterior, transverse, and posterior sagittal.



Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (2014); chapter 2 Maternal anatomy

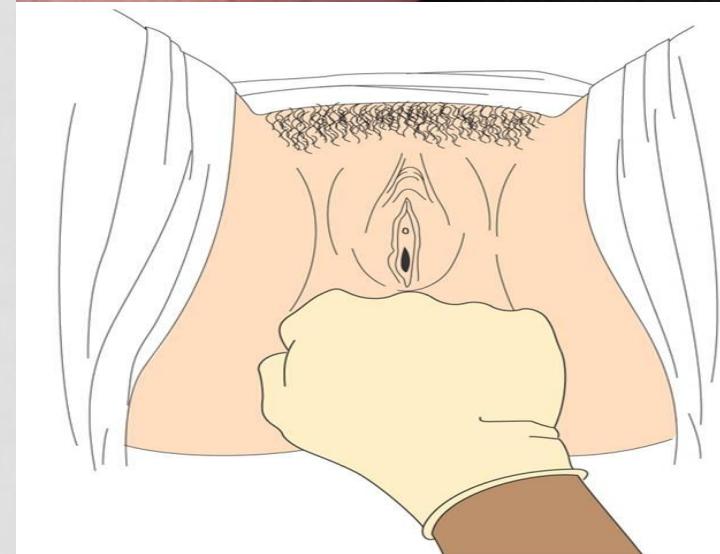
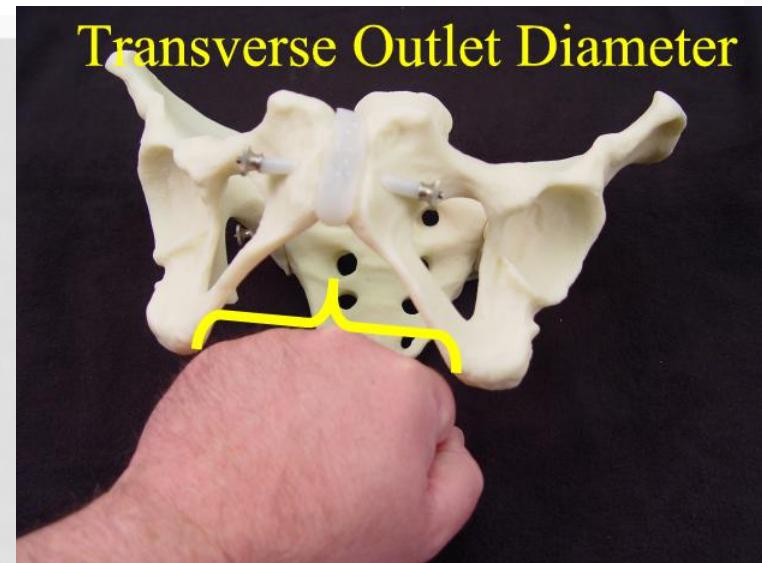
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# PELVIC OUTLET

- Intertuberous diameter may be measured by placing a closed fist against the perineum at the level of the tuberosities

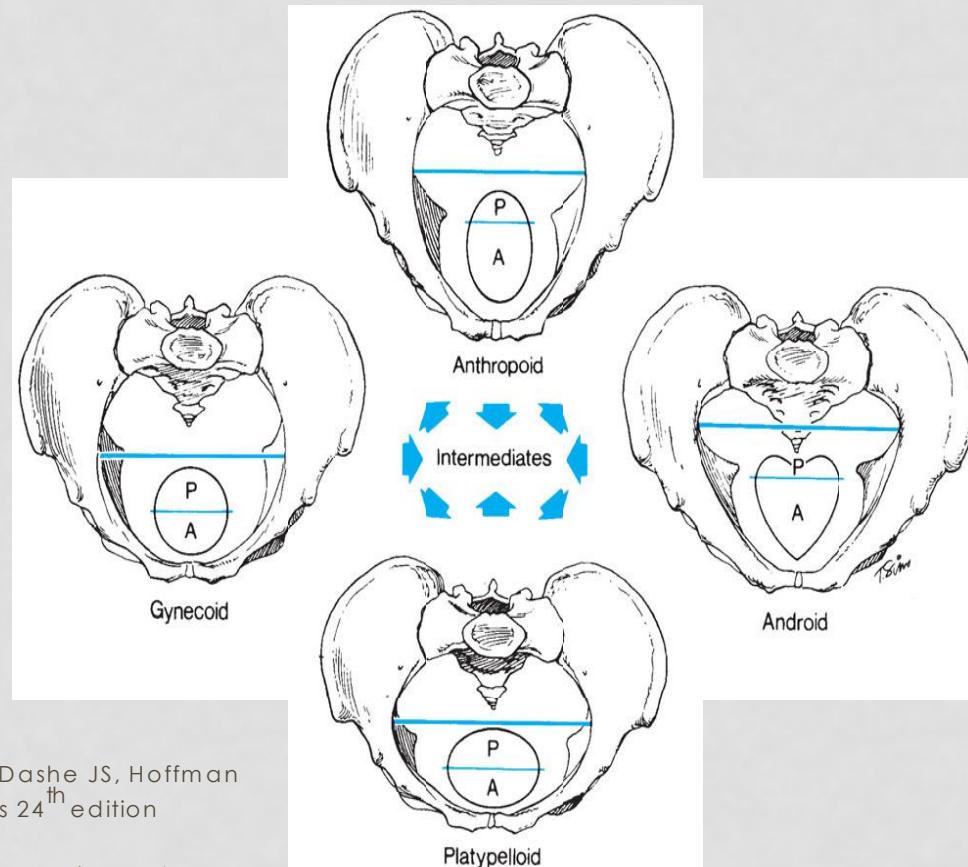
- **Thom's rule:** when transverse diameter + PSD > 15cm (xray pelvimetry) → outlet adequate

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# CALDWELL-MOLOY ANATOMICAL CLASSIFICATION OF THE PELVIS

- based on pelvic shape
- its concepts aid an understanding of labor mechanisms.



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (2014); chapter 2 Maternal anatomy
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# PELVIC SHAPES (CALDWELL-MOLOY CLASSIFICATION)

- the greatest transverse diameter of the inlet and its division into anterior and posterior segments are used to classify the pelvis as gynecoid, anthropoid, android, or platypelloid.
- The **posterior segment** determines the **type of pelvis**, whereas the **anterior segment** determines the **tendency**.
- For example: a gynecoid pelvis with an android tendency → posterior pelvis is gynecoid and the anterior pelvis is android shaped.

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# PELVIC SHAPES (CALDWELL-MOLOY CLASSIFICATION)

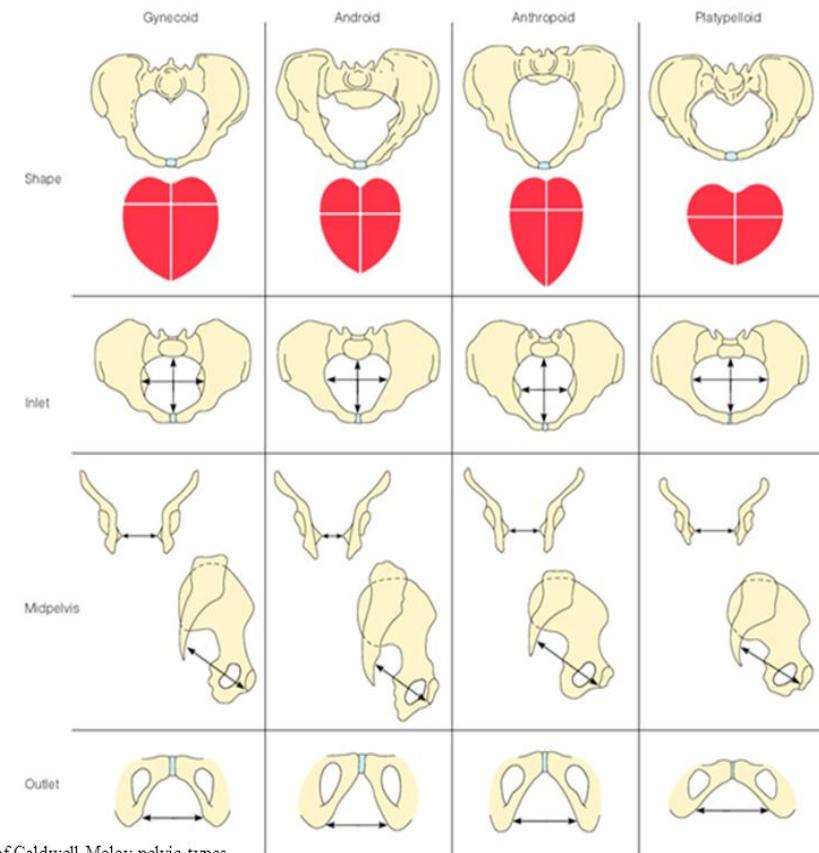
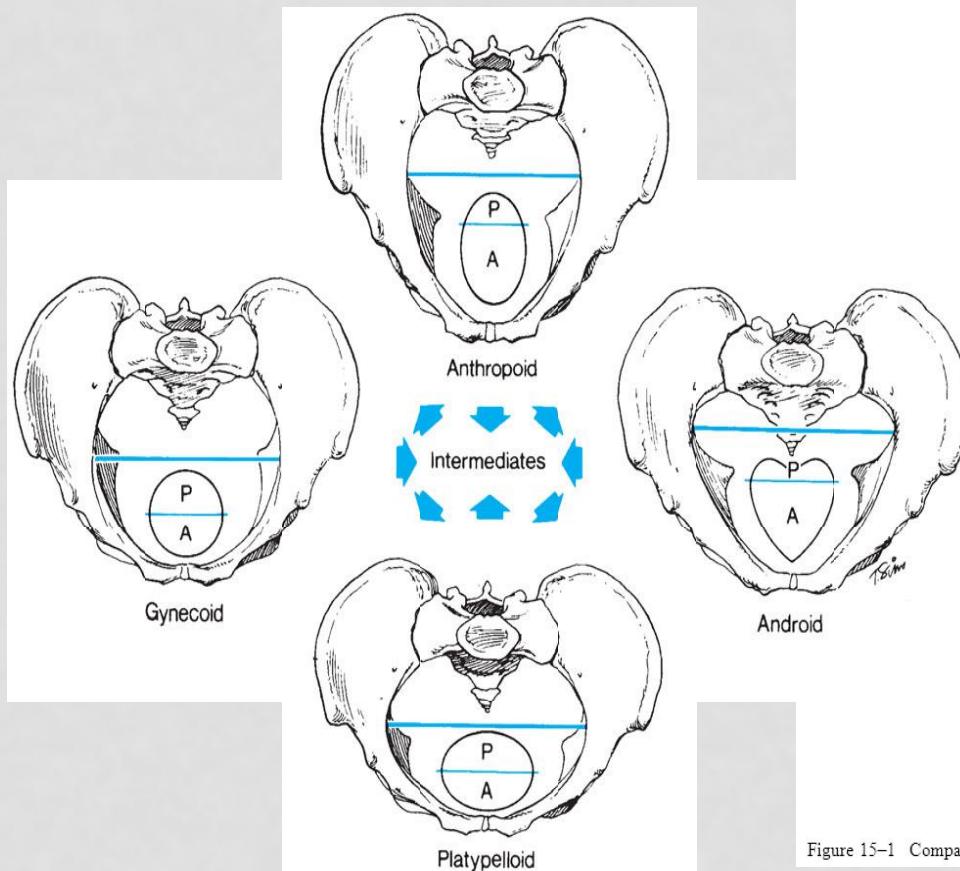
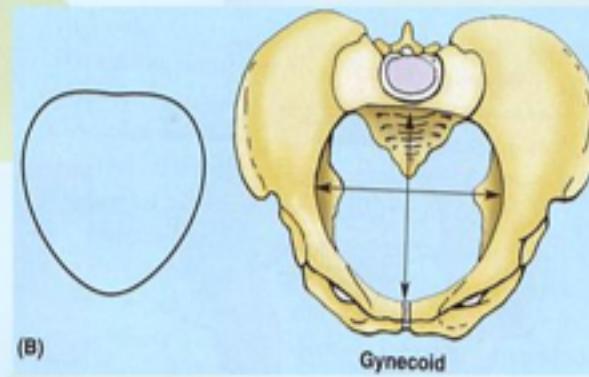
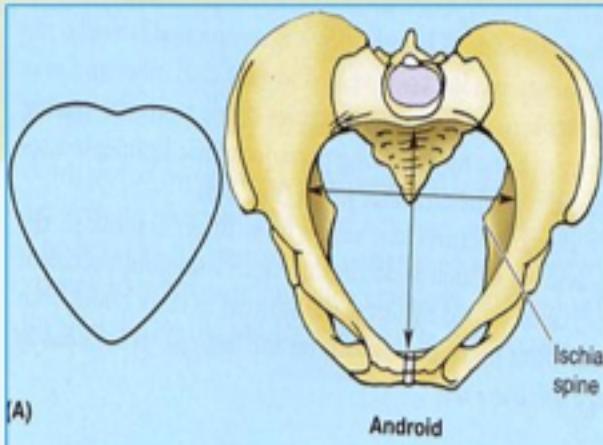
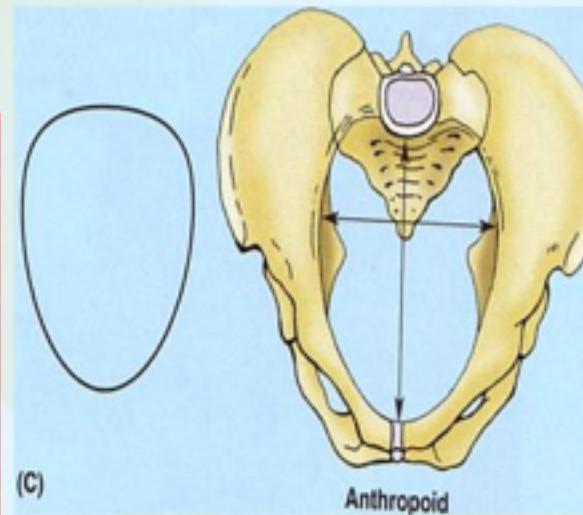
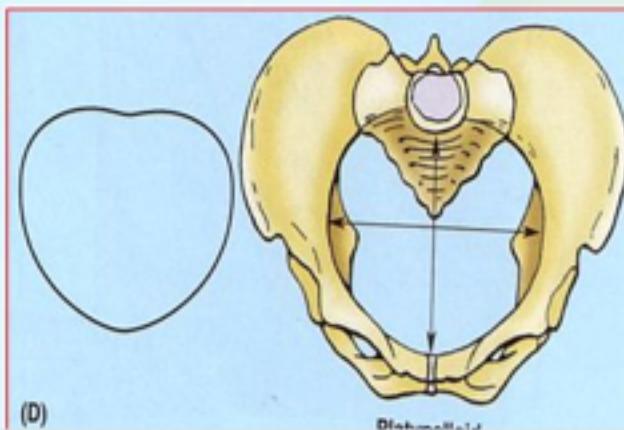


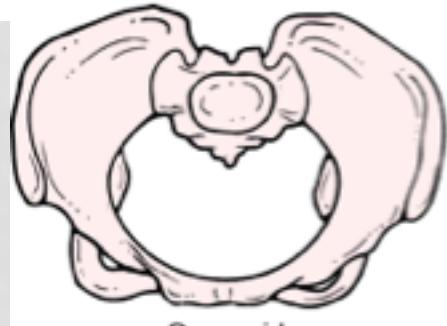
Figure 15-1 Comparison of Caldwell-Moloy pelvic types.

# Types of Female Bony Pelvis



Information of the shape and dimensions of the female pelvis is of **great importance for obstetrics**, because it is the bony canal through which the child passes during birth.





Gynecoid

"Female" pelvis  
Most common (41% to 42 % of women)

Ideal for childbearing

Well-rounded anterior, lateral and posterior segments



Android

"Male" pelvis

Occurs in 32.5 % white women, 15.7% non-white women  
Heavy, heart-shaped pelvis, increased incidence of posterior fetal position

Increased incidence of forceps delivery

Contracted midplane and outlet increase cesarean delivery



Anthropoid

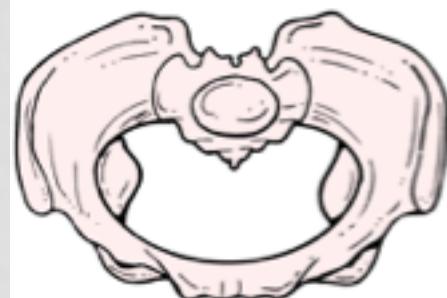
Occurs in 40.5% non-white and 23.5% white women

Oval shape, with anteroposterior(AP) diameter greater than the transverse

Well-rounded posterior and oval inlet

Anterior segment narrower than posterior

Favors posterior fetal position, but adequate for vaginal delivery



Platypelloid

Rare

Not conducive to vaginal delivery

< 3% occurrence in white and non-white women

Flattened gynecoid-type pelvis

Wide transverse diameter and short AP diameter

Widest of all pelvic types

#### *Bony pelvis measurements:*

Typical obstetric pelvic measurements that are adequate for vaginal delivery include:

- The transverse inlet is the measurement of the greatest distance between the linea terminalis on either side of the pelvis, and it should be 12 cm or more.
- The obstetrical conjugate is the measurement extending from the middle of the sacral promontory to the middle of the inner surface of the symphysis pubis, and should be 10 cm or more.

# CALDWELL MOLOY CLASSIFICATION

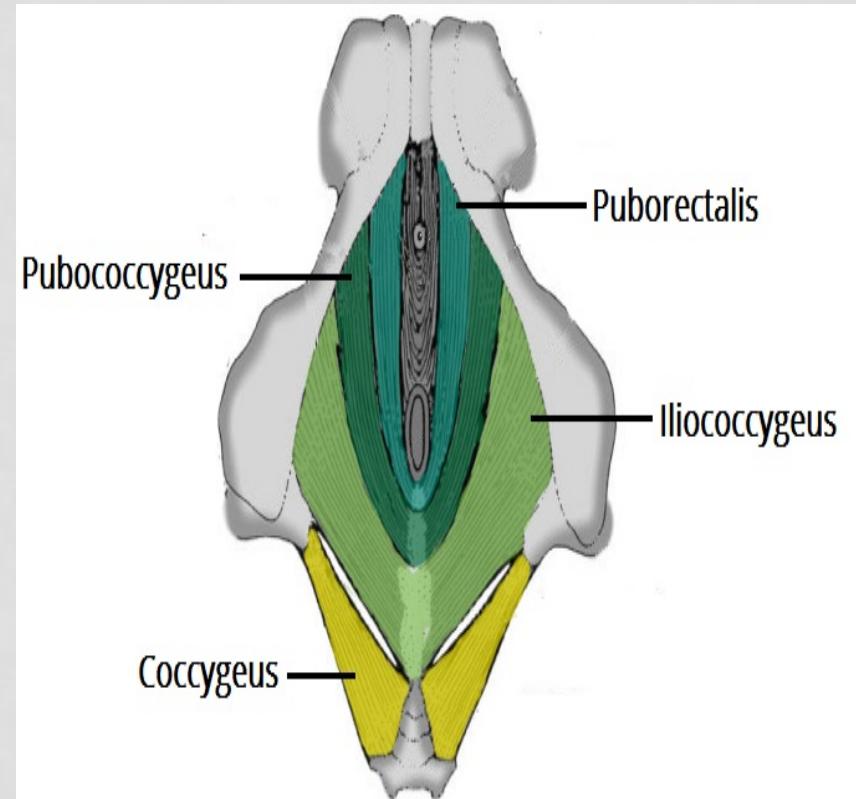
- many pelvis are not pure but are of mixed types.
- For example, a gynecoid pelvis with an android tendency means that the posterior pelvis is gynecoid and the anterior pelvis is android shaped.

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# SOFT PARTS OF THE PELVIS

- Pelvic floor: muscular partition that separates pelvic cavity from perineum
- 3 sets of muscles
  1. Pubococcygeus (pubovisceral)
  2. Iliococcygeus
  3. puborectalis

→ Collectively known as **LEVATOR ANI**



- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
- Sampaio WW, Ocampo-Andres IS, Blanco-Capito LR, Diamante An, Gamilla ZN. (eds). Textbook of Obstetrics 3<sup>rd</sup> edition. Chapter 23 The Passages

# SOFT PARTS OF THE PELVIS

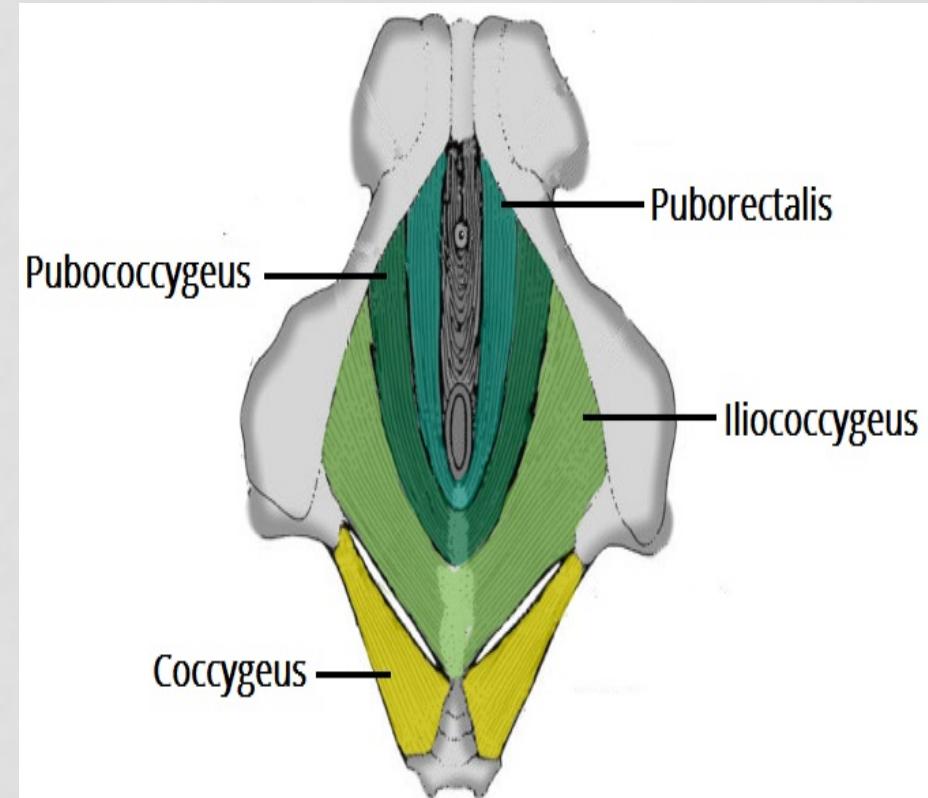
- Vaginal birth conveys significant risk for damage to the levator ani or to its innervation
- Of these muscles, the **pubococcygeus muscle** is more commonly damaged
- Evidence supports that these injuries may predispose women to greater risk of pelvic organ prolapse or urinary incontinence

- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). William's Obstetrics 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# SOFT PARTS OF THE PELVIS

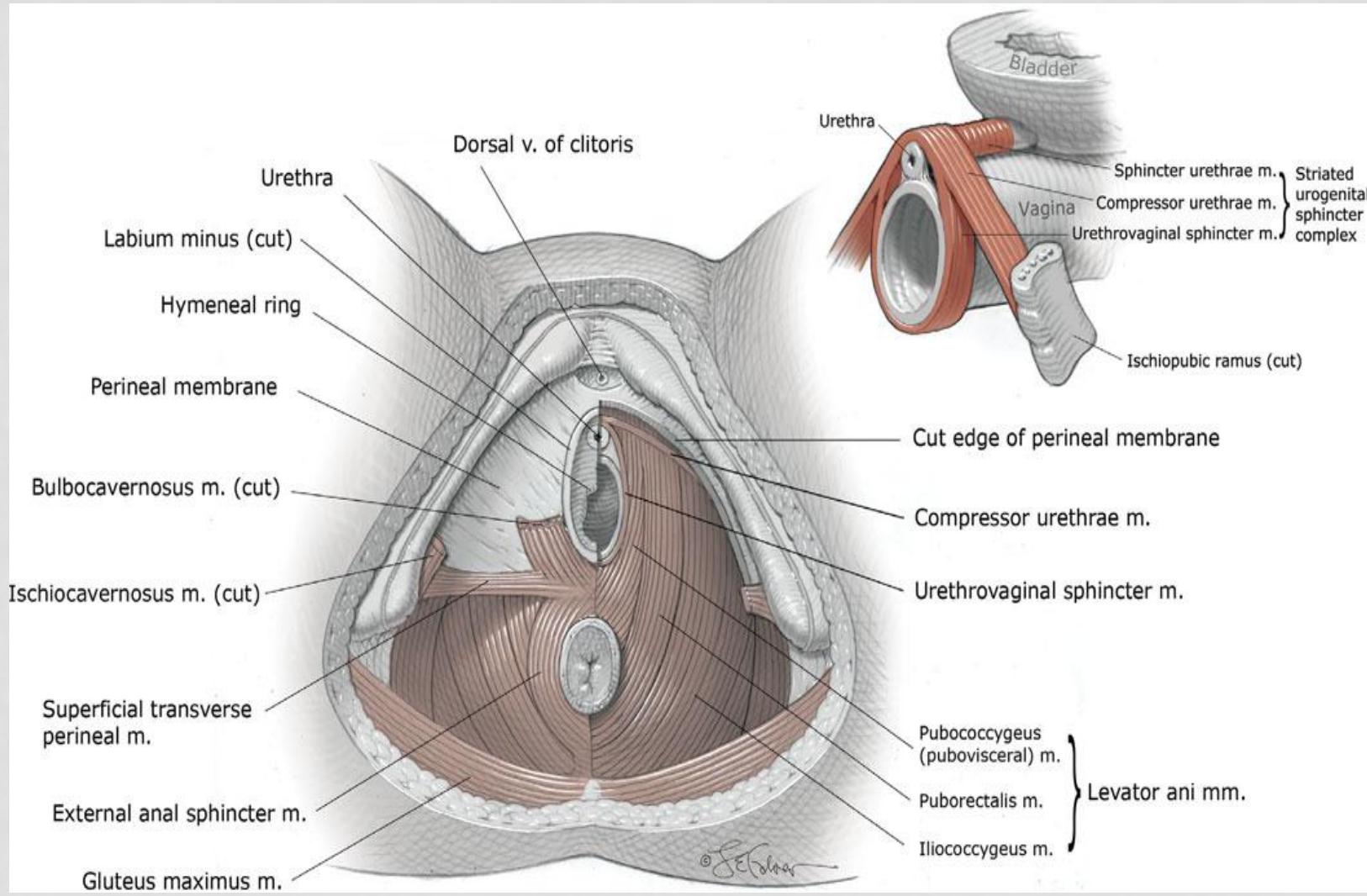
## Pelvic diaphragm

- Levator ani + coccygeus muscles + fascial covering



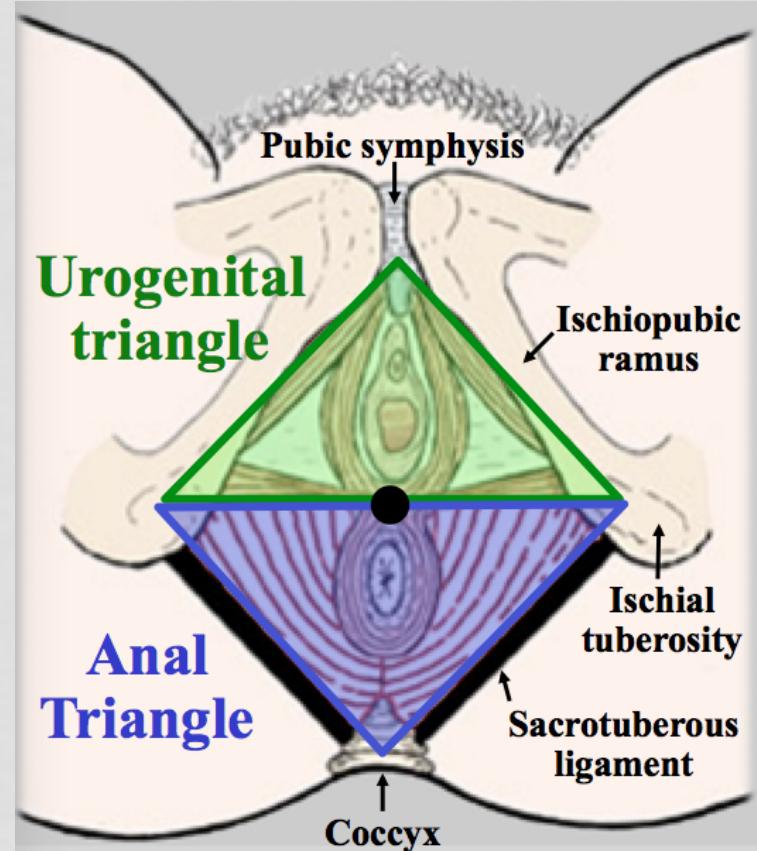
- Cunningham FG, Leveno KJ, Bloom SL, Spong CY, Dashe JS, Hoffman BL, Casey BM, Sheffield JS (eds). *William's Obstetrics* 24<sup>th</sup> edition (20140; chapter 2 Maternal anatomy
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# PELVIC DIAPHRAGM



# SOFT PARTS OF THE PELVIS

- Pelvic diaphragm: 2 parts
  1. Urogenital triangle (anterior)
  2. Anal triangle (posterior)
- Nerve supply: S4, inferior rectal nerve, perineal branch of the pudendal nerve
- Supports pelvic organs
- Control of external anal sphincter
- Stabilize sacroiliac and sacrococcygeal joints



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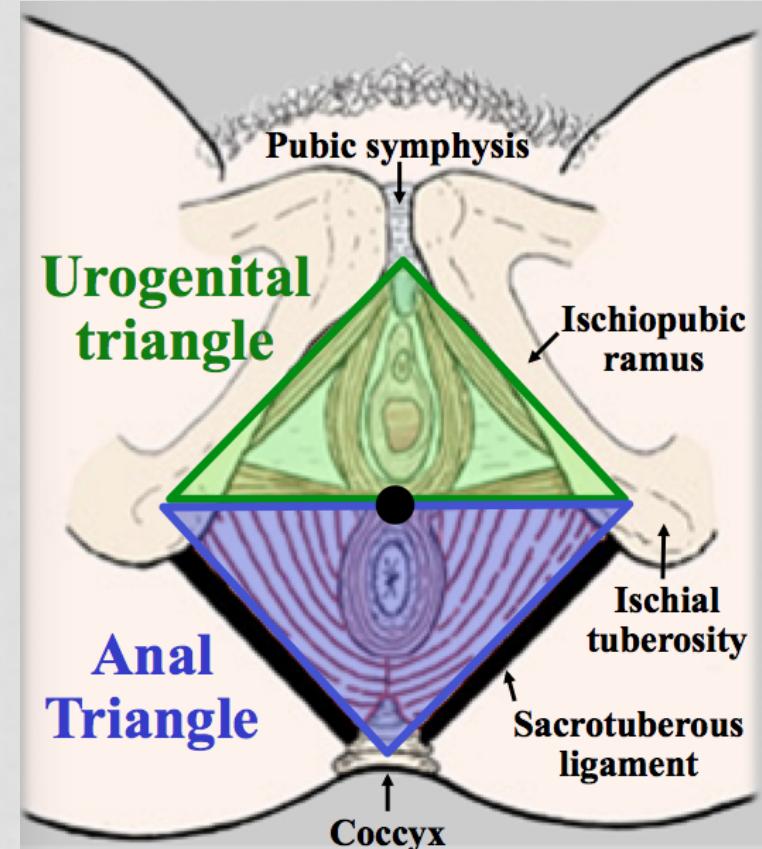
# ANTERIOR TRIANGLE

- Contains portions of **urethra and vagina**, certain portions of internal pudendal artery branches, and the compressor urethrae and urethrovaginal sphincter muscles, which comprise part of the striated urogenital sphincter complex.

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# ANAL/ POSTERIOR TRIANGLE

- This triangle contains the ischioanal fossae, **anal canal, and anal sphincter complex**, which consists of the internal anal sphincter, external anal sphincter, and puborectalis muscle.
- Branches of the pudendal nerve and internal pudendal vessels are also found within this triangle.



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# PUDENDAL NERVE

- formed from the anterior rami of S2–4 spinal nerves.
- It courses between the piriformis and coccygeus muscles and exits through the greater sciatic foramen at a location posterior to the sacrospinous ligament and just medial to the ischial spine
- thus, when injecting local anesthetic for a **pudendal nerve block**, the **ischial spine** serves as an identifiable landmark

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# ANAL SPHINCTER COMPLEX: IAS

- Two sphincters surround the anal canal to provide fecal continence—the **external and internal anal sphincters**.
- Both lie proximate to the vagina, and one or both may be torn during vaginal delivery.
- **Internal Anal Sphincter (IAS)** is a distal continuation of the rectal circular smooth muscle layer. It receives predominantly parasympathetic fibers, which pass through the pelvic splanchnic nerves.
  - this sphincter is supplied by the superior, middle, and inferior **rectal arteries**.
  - IAS contributes the bulk of anal canal resting pressure for fecal continence and relaxes prior to defecation.

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# ANAL SPHINCTER COMPLEX: EAS

- **External Anal Sphincter (EAS)** is a striated muscle ring that anteriorly attaches to the perineal body and that posteriorly connects to the coccyx via the anococcygeal ligament.
- EAS maintains a constant resting contraction to aid continence, provides additional squeeze pressure when continence is threatened, yet relaxes for defecation.
- Receives blood supply from the inferior rectal artery, which is a branch of the internal pudendal artery.

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# SUMMARY/REVIEW

1. Composition of the bony pelvis
2. Pelvic anatomy
  - true pelvis
  - false pelvis
3. Planes of the bony pelvis
  - inlet
  - midpelvis
  - outlet
4. Pelvic shapes
  - gynecoid, android, anthropoid, platypelloid
5. Soft parts of the pelvis
  - levator ani
  - pelvic diaphragm