

Objectives

At the end of the lecture, students should be able to:

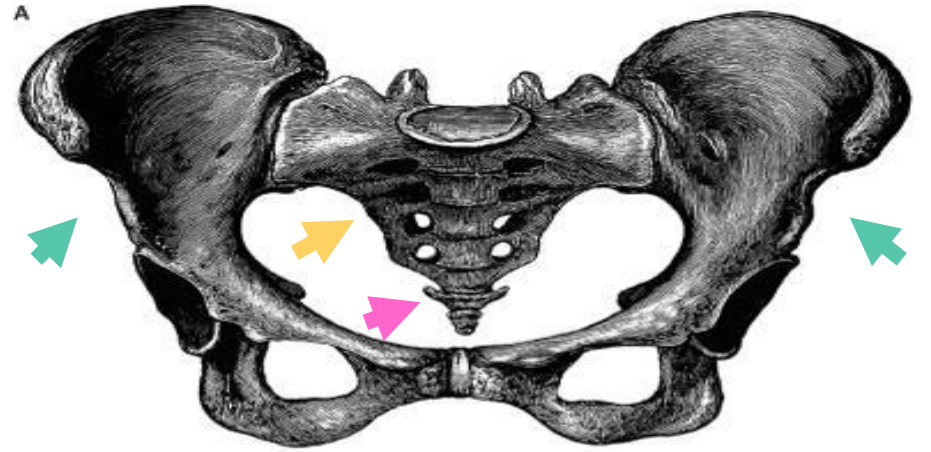
- ✓ Describe the anatomy of the pelvic wall, bones, joints & muscles.
- ✓ Describe the boundaries and subdivisions of the pelvis.
- ✓ Differentiate the different types of the female pelvis.
- ✓ Describe the pelvic walls & floor.
- ✓ Describe the components & function of the pelvic diaphragm.
- ✓ List the arterial & nerve supply
- ✓ List the lymph & venous drainage of the pelvis.

ملاحظة: لما نكتب *In females* او *In males* نقصد موجود فقط في جسم النساء او الرجال
بينما اذا كتبنا *Girls' slides* او *Boys' slides* نقصد اختلاف في سلايدز المحاضرة بين الدكتور والدكتورة

Introduction

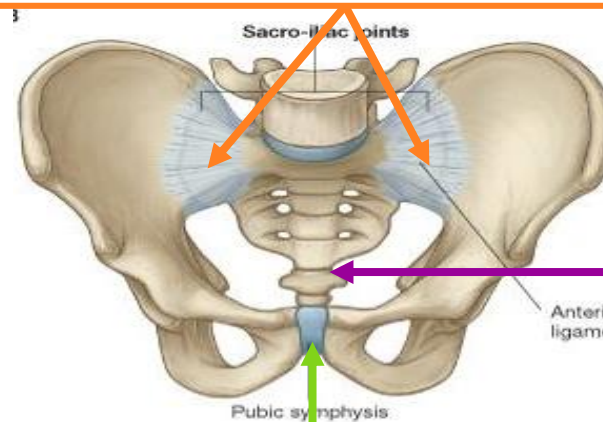
- The **bony pelvis** is composed of four bones:
 - Two hip bones, which form the **anterior** and **lateral** walls.
 - Sacrum and coccyx, which form the **posterior** wall.

- These 4 bones are connected by 4 joints and lined by 4 muscles.
- The bony pelvis with its joints and muscles form a strong **basin-shaped** (حوض) structure (with multiple foramina),
- The pelvis **contains** and **protects** the:
 - (1) lower parts of the alimentary &
 - (2) urinary tracts &
 - (3) internal organs of reproduction.



The four joints are:

2- **Two** Sacroiliac joints. (Synovial joints)
Posteriolateraly



3- Sacrococcygeal joint
(2ry Cartilaginous joint)
Posteriorly
Between sacrum & coccyx

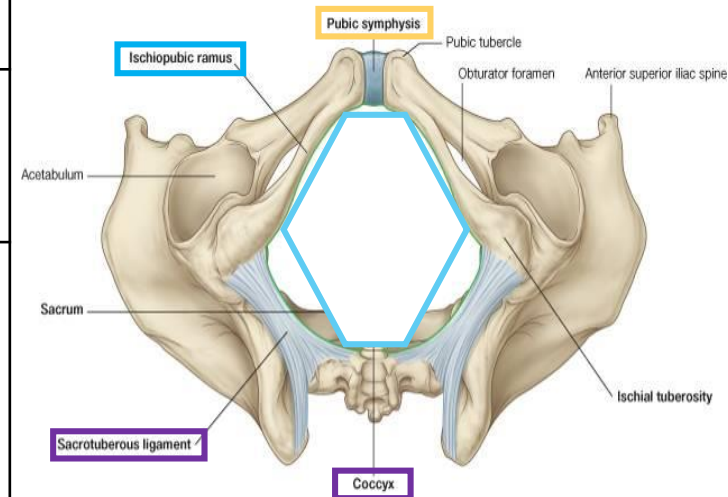
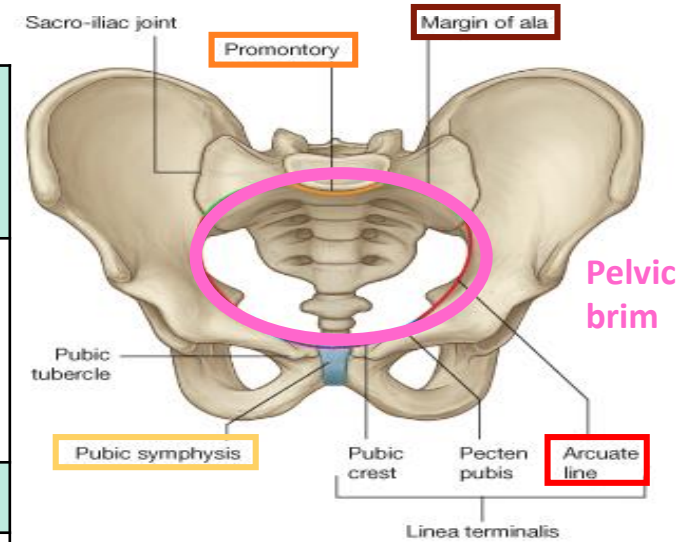
1- Symphysis pubis (2ry Cartilaginous joint)
Anteriorly

Pelvis

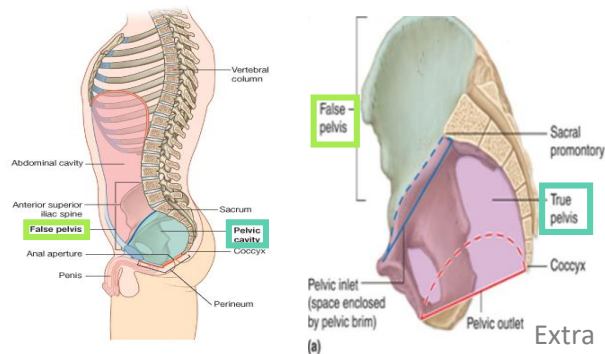
The pelvis is divided into two parts by the pelvic brim or inlet:

False pelvis
Inlet
True pelvis
Outlet
Perineum ← بالترتيب يكون

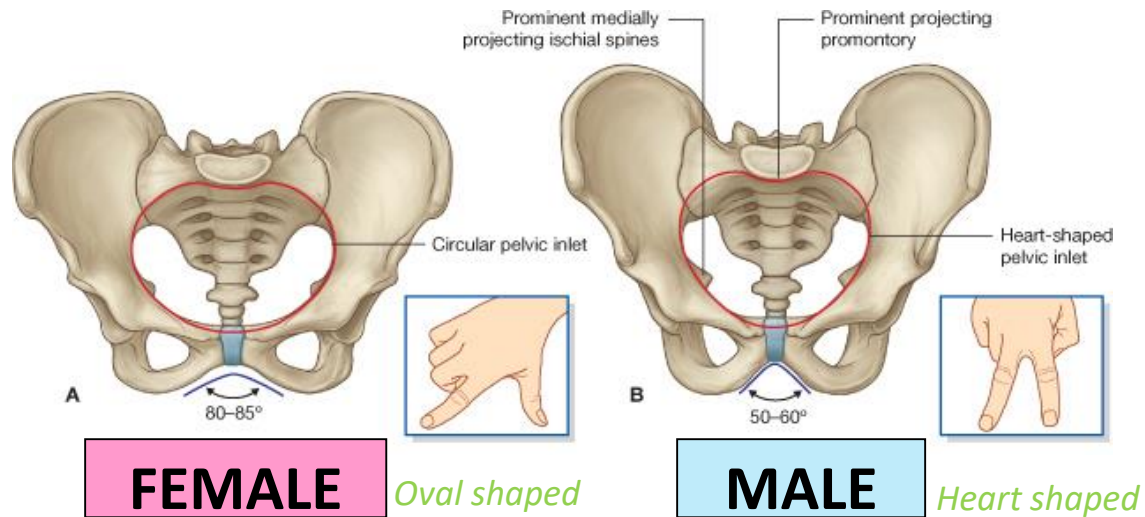
<p>False or greater pelvis <u>Above</u> the brim (part of the abdominal cavity)</p>	<p>True or lesser pelvis <u>Below</u> the brim. Has 3 parts:</p>	
<p>Bounded by:</p> <p><u>Posteriorly:</u> Lumbar vertebrae.</p> <p><u>Laterally:</u> Iliac fossae and the iliacus muscle.</p> <p><u>Anteriorly:</u> Lower part of the anterior abdominal wall.</p> <p>It supports the abdominal contents</p>	<p>1. A Cavity: The cavity is a short, curved canal, with a shallow anterior wall and a deeper posterior wall. It lies between the inlet and the outlet.</p>	<p>3. Outlet* (Diamond shape)</p>
	<p>2. Inlet (oval shape)</p>	<p>Anteriorly: <u>Symphysis pubis</u> (upper border)</p>
	<p>Posteriorly: <u>Promontory of sacrum, ala of sacrum.</u></p>	<p>Anteriorly: <u>Symphysis pubis</u> (lower border)</p> <p>Posteriorly : Tip of <u>Coccyx</u>.</p>
	<p>Laterally: (both sides) <u>Ileopectineal (arcuate) lines.</u> (Ileo = illum \ pectineal = pubis)</p>	<p>Anterolaterally: <u>ischiopubic ramus.</u></p> <p>Posterolaterally: <u>Sacrospinous ligament & ischial tuberosities.</u></p>



*recall these are the same boundaries as the perineum



Pelvis Female vs. Male



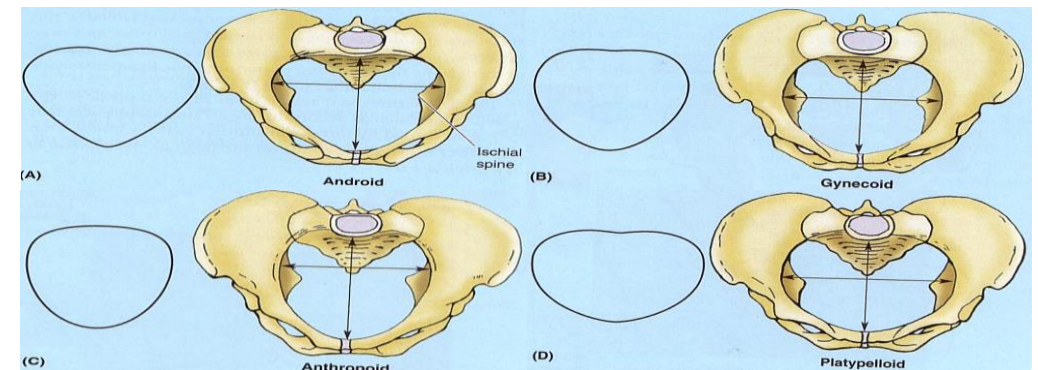
What is the main differences between male and female pelvis?

1. In female the **Sacrum** is usually wider and shorter, while in male is long and curved.
2. Also, the **Angle of the pubic arch** is wider.
3. The **promontory** and the **ischial spines** are less projecting, while the male is inverted.

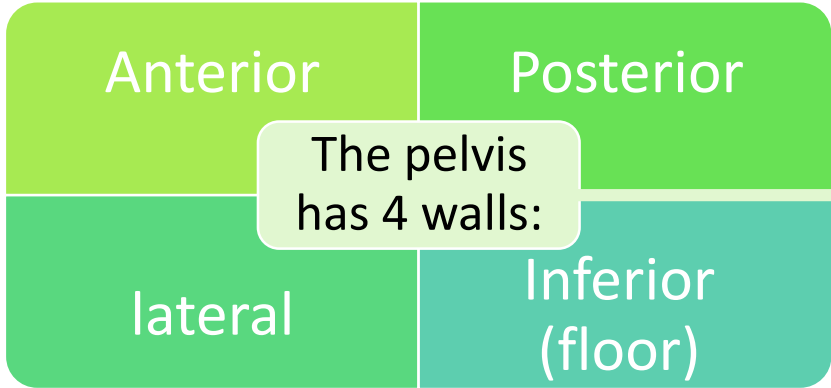
Types of Female Bony Pelvis

- Information of the shape and dimensions of the female pelvis is of **great importance for obstetrics**.
- **Why?** because it is the bony canal through which the child passes during birth.
- There are 4 types:
 - A. Android (*resembles male pelvis*)
 - B. Gynecoid (*typical female type*)
 - C. Anthropoid (*has both male and female characteristics*)
 - D. Platypelloid (*least common*)

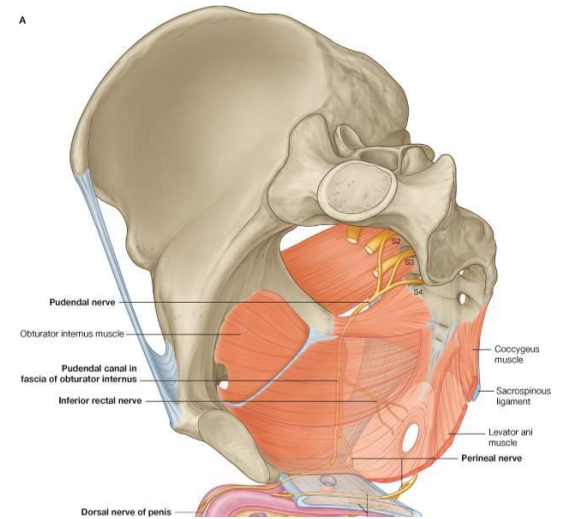
****Gynecoid** is the only type that can give normal birth, the other three types can't.



Pelvic Walls

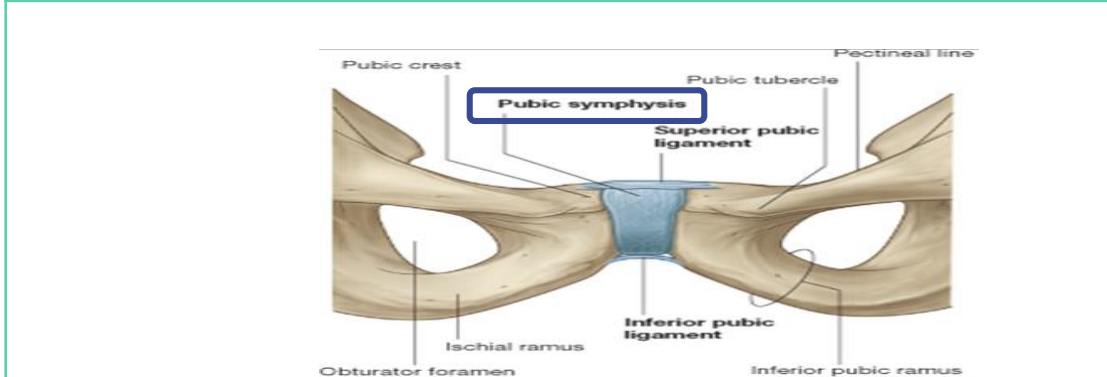


The walls are formed by bones and ligaments that are lined with muscles covered with fascia and parietal peritoneum.



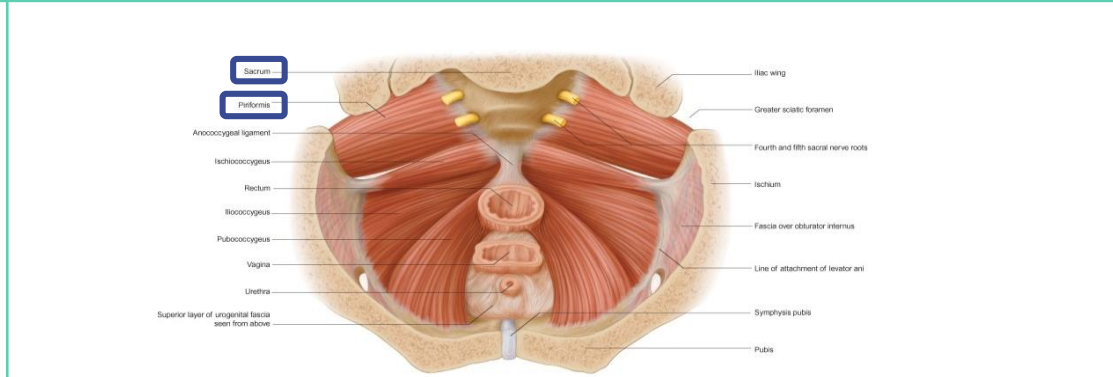
1. Anterior pelvic wall

It is the shallowest wall and is formed by **only bones**:
 (1) the posterior surfaces of the bodies of the **pubic bones**,
 (2) the 2 **pubic rami**, and (3) the **symphysis pubis**.



2. Posterior pelvic wall

It is large and deeper. Formed by:
 (1) **sacrum**, (2) **coccyx**, (3) **piriformis** muscles (right and left)
 and (4) their covering of parietal pelvic fascia.

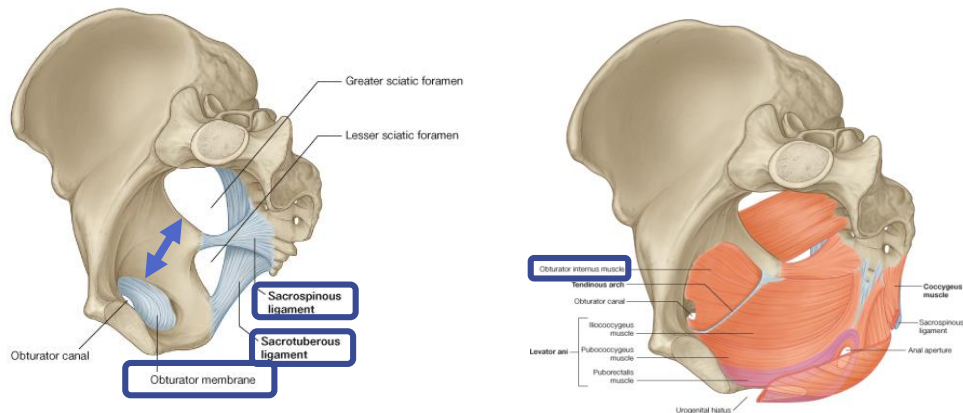


Pelvic Walls

3. Lateral pelvic wall

It is formed by:

1. Part of the **hip bone** below the pelvic inlet (the arrow),
2. **Obturator internus** and its covering fascia, the **obturator fascia**.
3. **Sacrospinous** ligament.
4. **Sacrospinous** ligament.

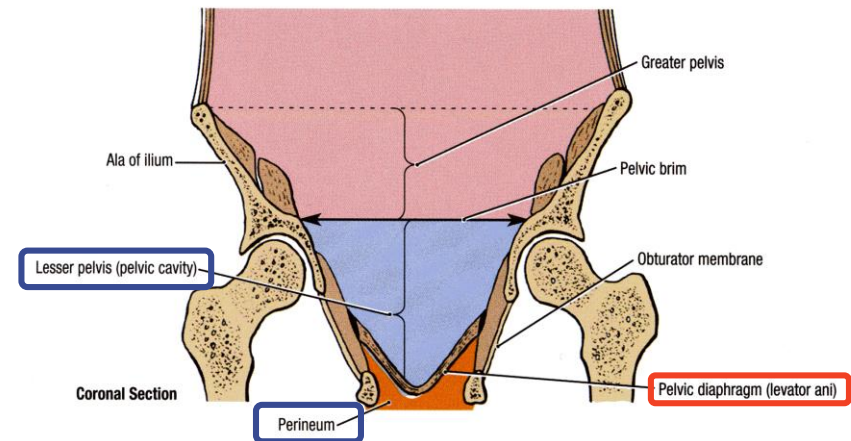


4. Inferior pelvic wall (floor)

Basin-like structure which supports the pelvic viscera and is formed by the **pelvic diaphragm**.

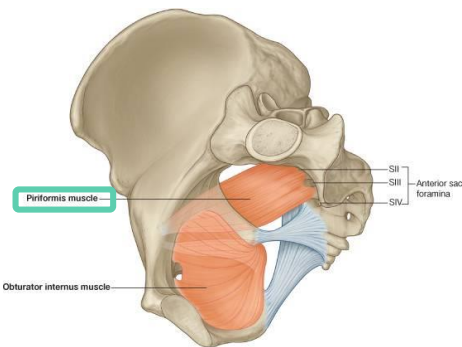
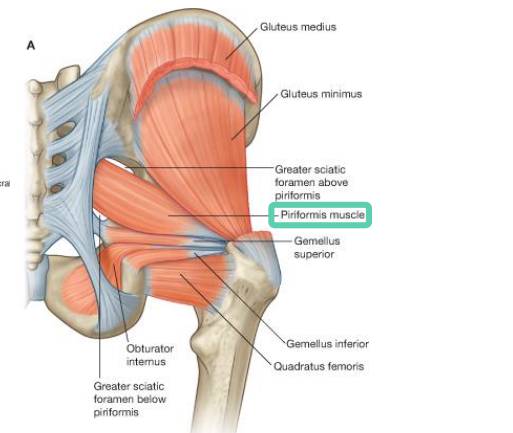
It stretches *across the lower part of the true pelvis* and divides it into:

1. **Main (true) pelvic cavity** above, which contains the pelvic viscera
2. **Perineum** below which carries the external genital organs.

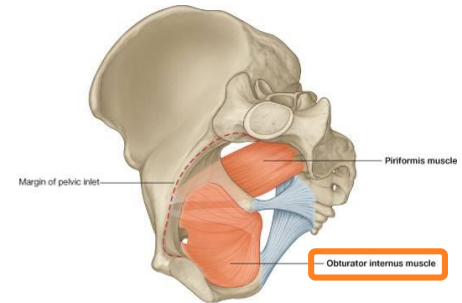
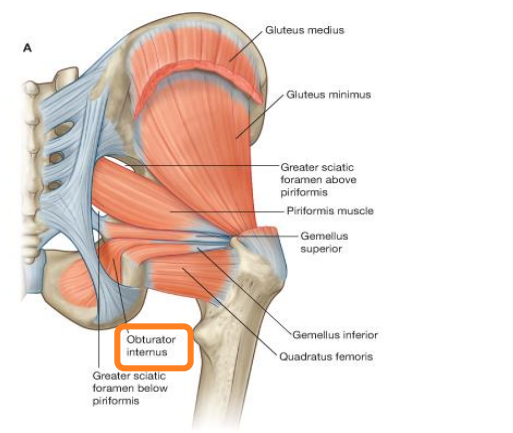


Pelvic Walls

Piriformis muscle (part of posterior pelvic wall)	
<i>Origin</i>	Pelvic surface (in front of) the middle 3 sacral vertebrae. It leaves the pelvis through the greater sciatic foramen .
<i>Insertion</i>	Greater trochanter of the femur.
<i>Action</i>	Lateral rotator of the femur at the hip joint.
<i>Innervation</i>	Sacral plexus (lies in front of the muscles).

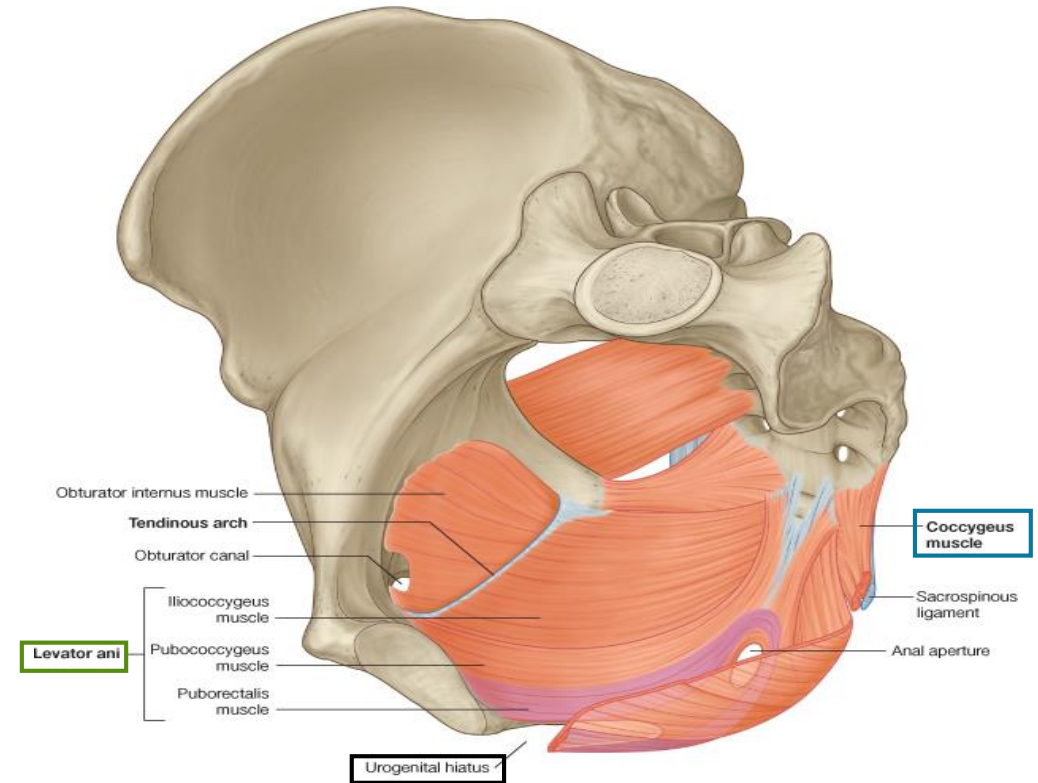
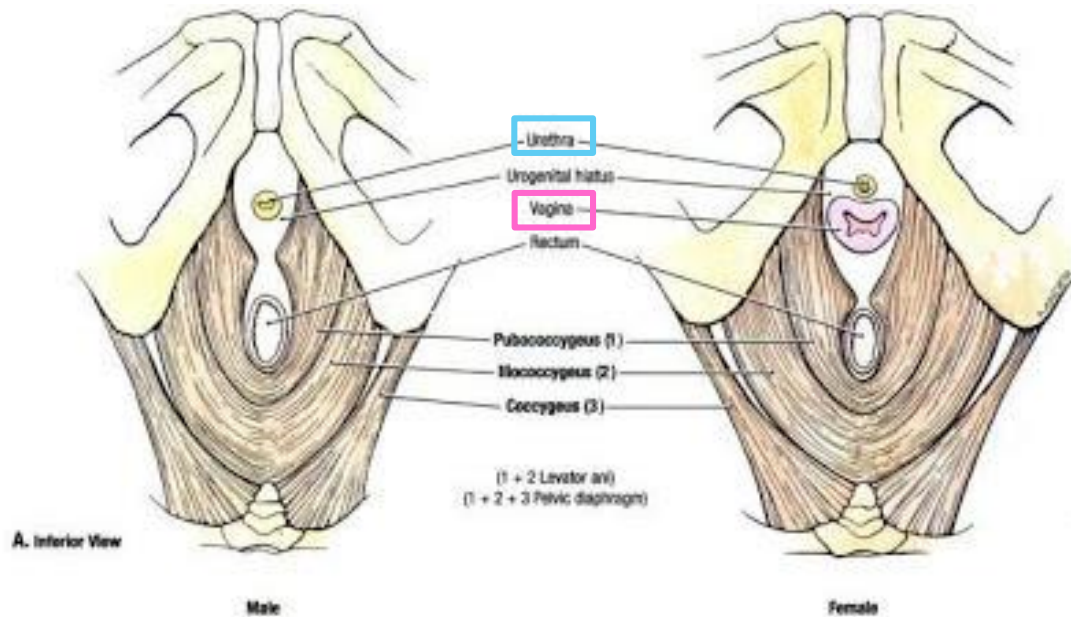



Obturator internus muscle (part of lateral pelvic wall)	
<i>Origin</i>	Inner surface of the obturator membrane and the hip bone. It leaves the pelvis through the lesser sciatic foramen
<i>Insertion</i>	Greater trochanter of the femur.
<i>Action</i>	Lateral rotator of the femur at the hip joint.
<i>Innervation</i>	Nerve to obturator internus (from sacral plexus).

Pelvic Diaphragm

- It is formed by the **levator ani** and the **coccygeus muscles** and their covering fasciae.
- It is incomplete **anteriorly** to allow passage of:
 - the **urethra** in **males** and
 - **urethra** and **vagina** in **females**.
- **Posteriorly** the muscles of each side meet together.

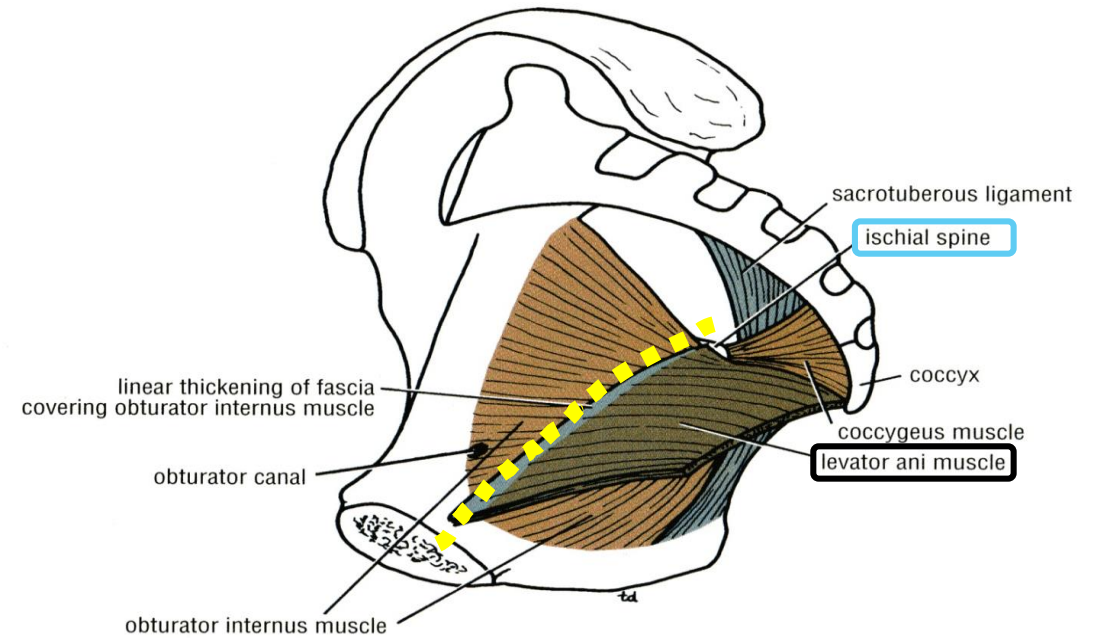


Pelvic Diaphragm

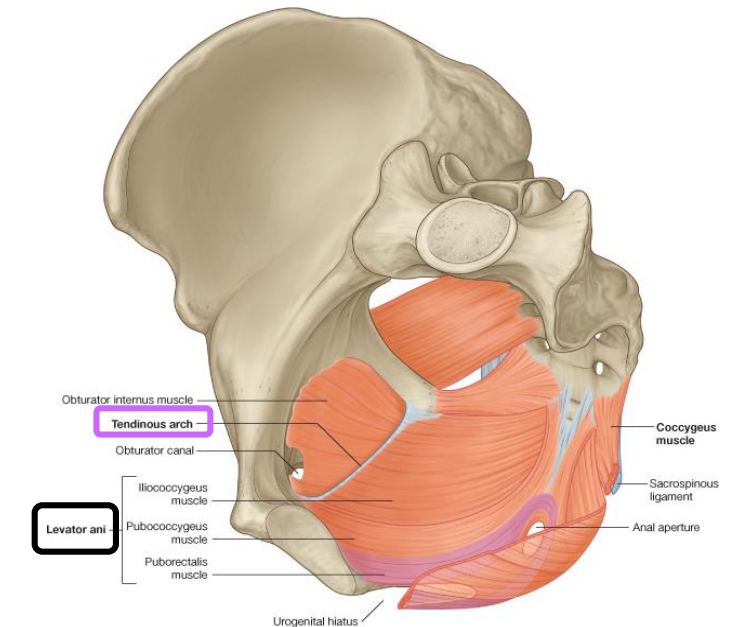
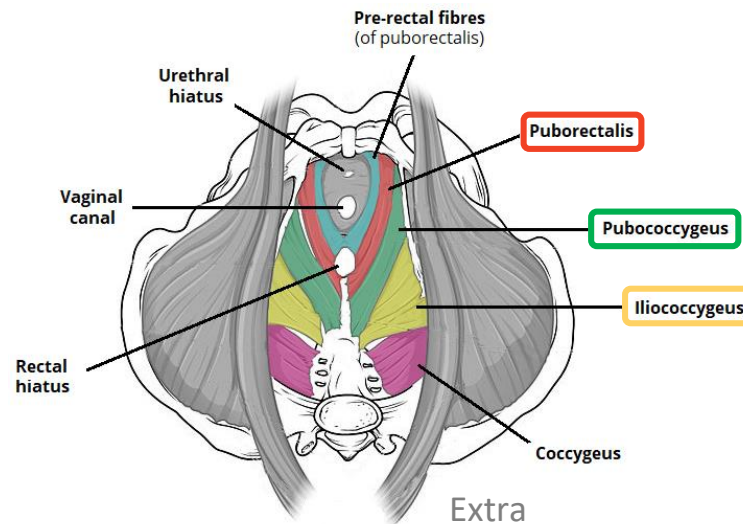
Levatores Ani Muscles



- It is a wide thin sheet-like muscle that has a linear origin .
- ORIGIN: (look at the dotted yellow line)
 1. Back of the body of the pubis
 2. Tendinous arch of the obturator fascia
 3. Spine of the ischium (ischial spine).



- Its fibers are divided into 3 parts:
 1. Pubococcygeus
 2. Puborectalis
 3. Iliococcygeus (Ischiococcygeus)



Levatores Ani Muscles Anterior Fibers

1. Pubococcygeus

- Origin: originates from the posterior surface of the body of the pubis and passes downward & medially
- Insertion: inserted into the perineal body, anococcygeal body and coccyx.
- Action:
 - forms a sling around the prostate or the vagina*:

In males

Levator prostatae:

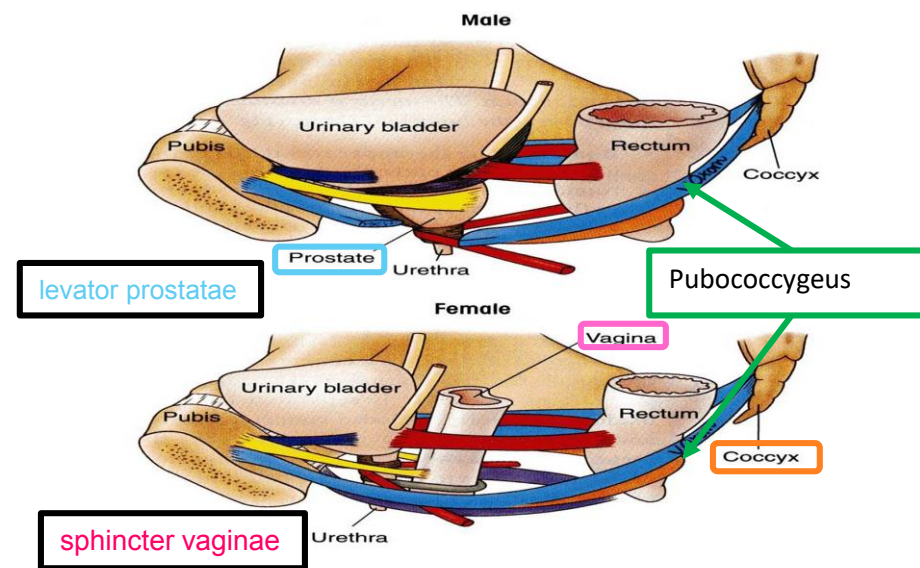
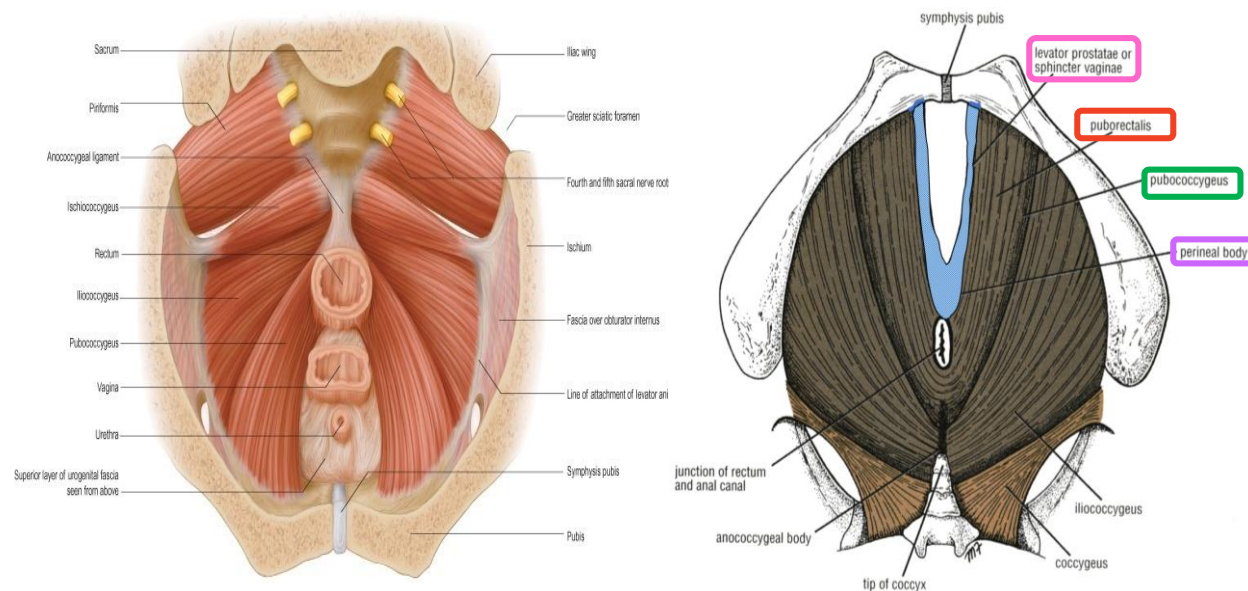
1. Supports prostate
2. Stabilizes perineal body

In females

Sphincter vaginae:

1. Supports vagina
2. Stabilizes perineal body

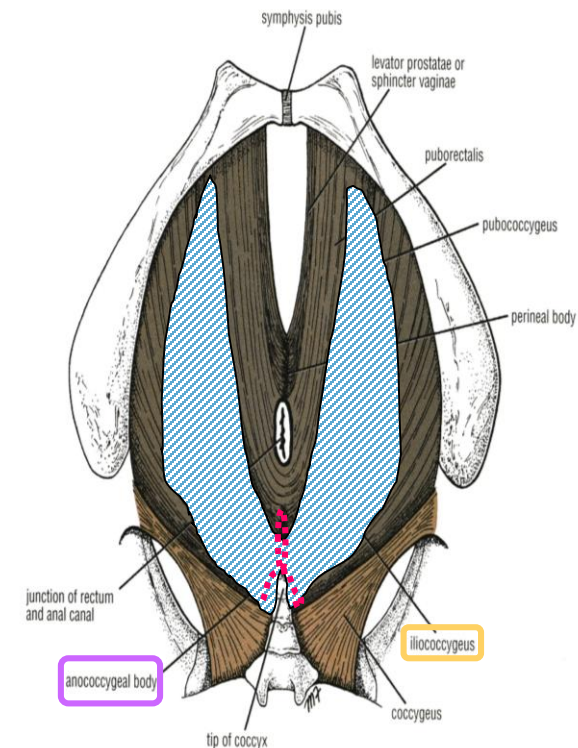
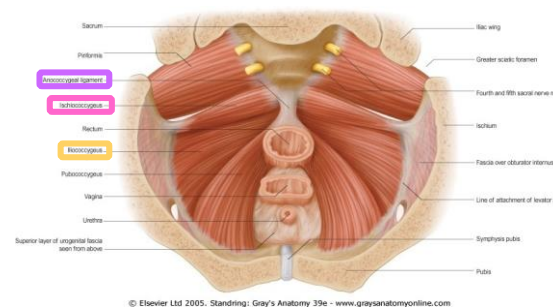
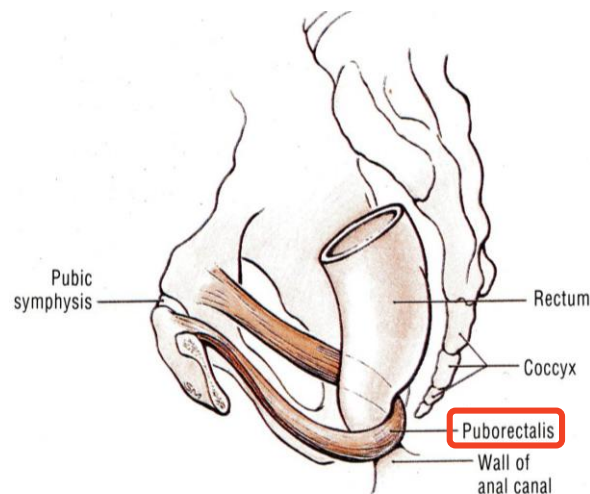
*While the muscle goes from origin to insertion it surrounds these 2 organs (prostate or vagina) and supports them.



Levatores Ani Muscles Intermediate Fibers

2. Puborectalis (شكلها زي اللجام بتاع الخيل)

- forms a sling around the recto-anal Junction.
- It has a very important role in maintaining **fecal continence**.
- Its tone is important to maintain the angle between rectum & anal canal. When it relaxes, the angle is gone and defecation can occur



Posterior Fibers

3. Iliococcygeus

- Origin: Inserted into the anococcygeal body and the coccyx

4. Ischiococcygeus* (only on the girls' slides)

- Origin: Arises from the ischial spine
- Insertion: inserted into the anococcygeal body & coccyx.



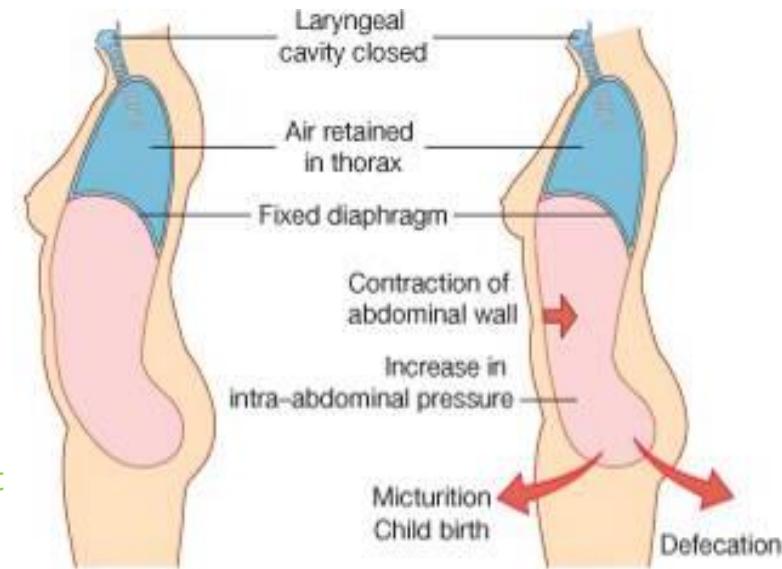
*الدكاتره اختلفوا في هذه العضلة د.ابوالمكارم قال انها في اسم ثاني لـ iliococcygeus موجوده في بعض الكتب .ود.جميلة تقول في اختلاف في الاراء بحيث البعض يعتبرها جزء من coccygeus ریحوا بالكلم وانسوا عنها .اهم شئى ركزوا على الثلاثة الاولى لانها هي الاساسية

Levatores Ani Muscles Supply & Action

Nerve supply to levator ani:

1. perineal branch of the **fourth sacral nerve (S4)** → upper surface.
2. perineal branch of the **pudendal nerve** → lower surface.

The importance of the different supplies is if one of these nerves is affected, the other is still intact



Actions of levator ani:

1. The muscles of the two sides form an efficient muscular sling that **supports and maintains the pelvic viscera** in position. (so if it is injured rectal or vaginal prolapse may occur)
2. They **resist the rise in intra pelvic pressure** during the straining and expulsive efforts of the abdominal muscles (as in coughing).
3. They have a very important role in **maintaining fecal continence** (puborectalis) by acting as a sphincter at the anorectal junction .
4. They serve as a **vaginal sphincter** in the female. (The most important muscle in labour is levator ani: should be relaxed so the vaginal sphincter isn't closed)

This table is a summary of the slides before.

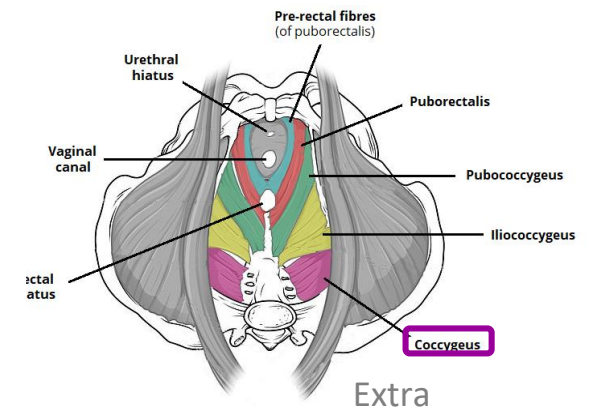
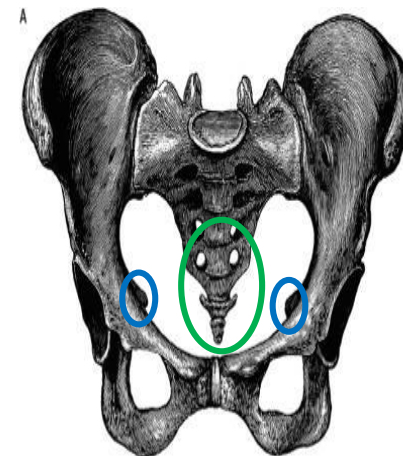
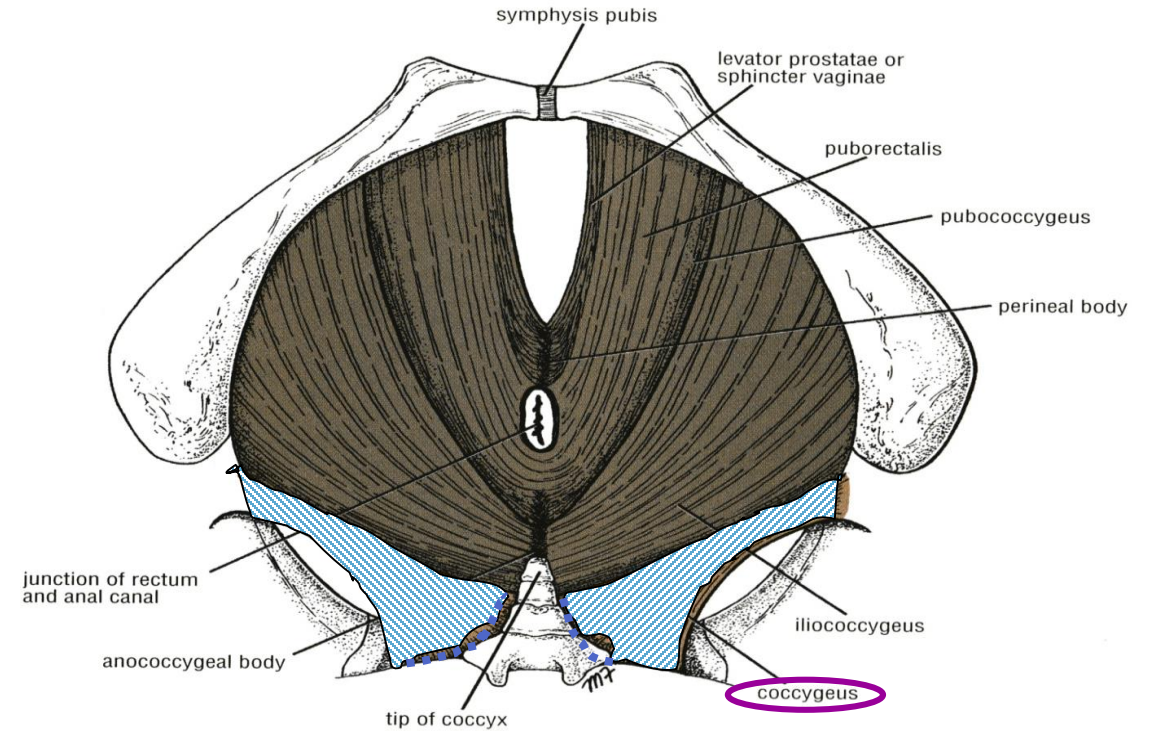
Muscle		Origin	Insertion	Action	Innervation
Levator Ani Muscle	Pubococcygeus	<ol style="list-style-type: none"> Back of the body of the pubis Tendinous arch of the obturator fascia Spine of the ischium. 	<ol style="list-style-type: none"> perineal body anococcygeal body coccyx <p>(forms a sling around the prostate or the vagina)</p>	<ol style="list-style-type: none"> Support and maintain the pelvic viscera in position. They resist the rise in intra pelvic pressure during the straining and expulsive efforts of the abdominal muscles (as in coughing). Maintaining fecal continence. They serve as a vaginal sphincter in the female. 	<ol style="list-style-type: none"> perineal branch of the fourth sacral nerve perineal branch of the pudendal nerve.
	Puborectalis		forms a sling around the recto-anal Junction. It has a very important role in maintaining fecal continence .		
	Iliococcygeus		<ol style="list-style-type: none"> anococcygeal body coccyx 		
	Ischiococcygeus		<ol style="list-style-type: none"> anococcygeal body coccyx 		

Pelvic Diaphragm

Coccygeus Muscle

This muscle is bigger in animals because they have tails.

Coccygeus: small triangular muscle.		
<i>Origin</i>	<u>Ischial spine</u>	Coccygeus muscle has the same attachment as the sacrospinous ligament!
<i>Insertion</i>	Lower end of <u>sacrum</u> and <u>coccyx</u>	
<i>Action</i>	Assist the levator ani in supporting the pelvic viscera	
<i>Innervation</i>	branches of the 4 th and 5 th sacral nerves (S4 & S5).	



Arteries of the Pelvis

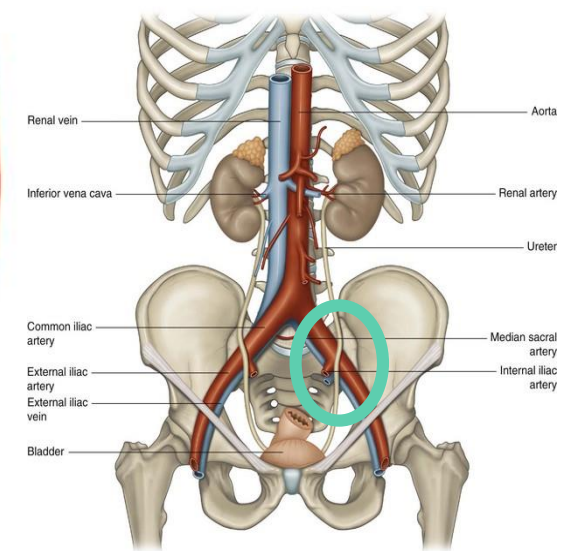
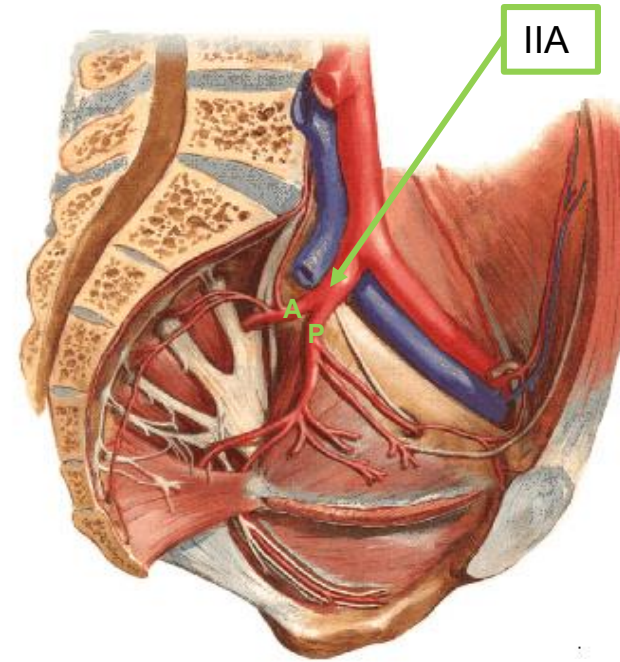


I) Internal iliac artery (IIA)

- One of the 2 terminal branch of the **Common iliac artery**.
- Course:
 1. Arises in front of the sacroiliac joint
 2. It descends downward & backwards over the pelvic inlet.
 3. It divides at the upper border of the **greater sciatic foramen** into: Anterior & Posterior divisions.

II) Ovarian artery (in female):

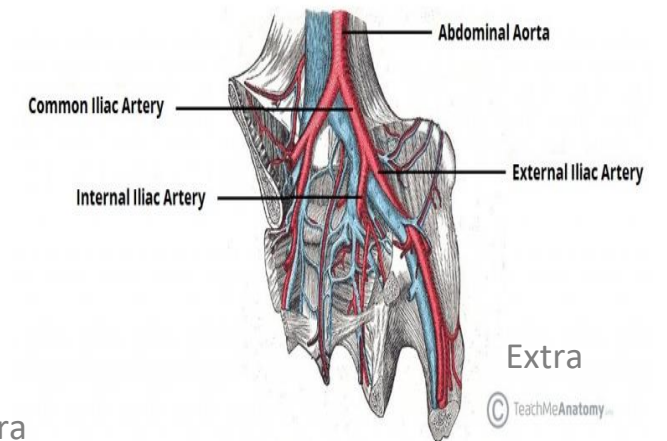
- Arises from the **abdominal aorta**.



Extra



Extra



Extra

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The abdominal aorta divides into 2 common iliac arteries. Then at the sacroiliac joint the common iliac divides into external and internal iliac arteries. The external iliac continues as the femoral artery, while the internal iliac supplies the pelvis and perineum. Then at the greater sciatic foramen the internal iliac divides into anterior and posterior divisions.

Arteries of the Pelvis

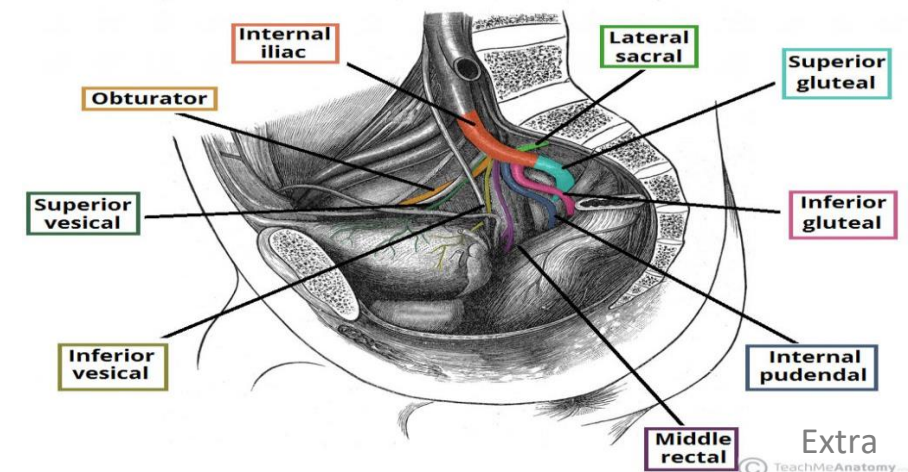
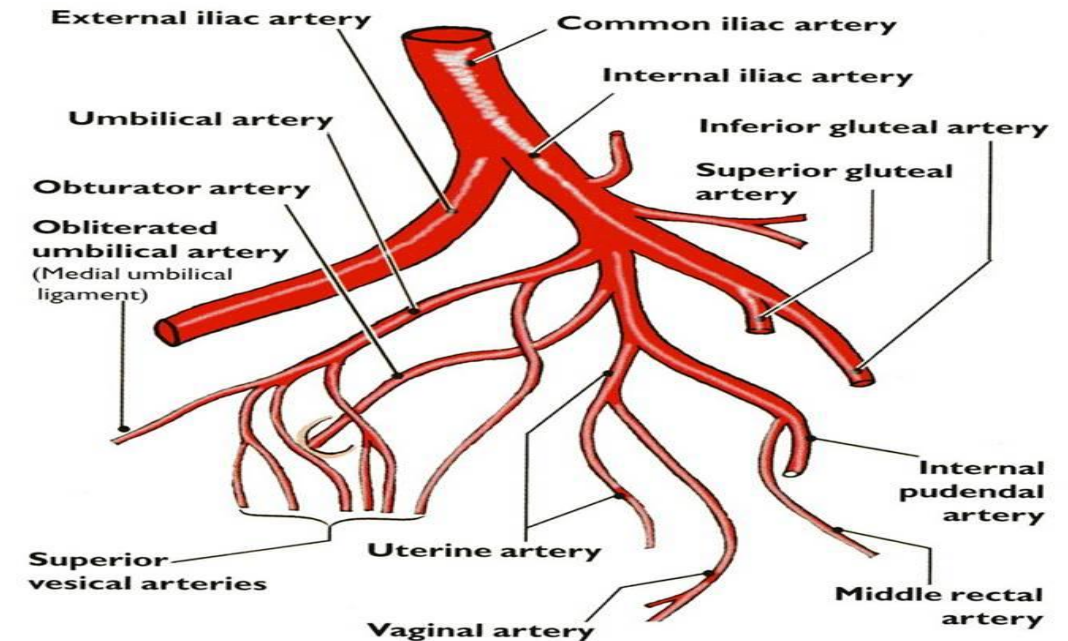
Internal Iliac Artery

- Posterior division Supplies: (supplies only walls)

1. Posterior abdominal wall.
2. Posterior pelvic wall.
3. Gluteal region.

- Anterior division supplies: (supplies wall & viscera)

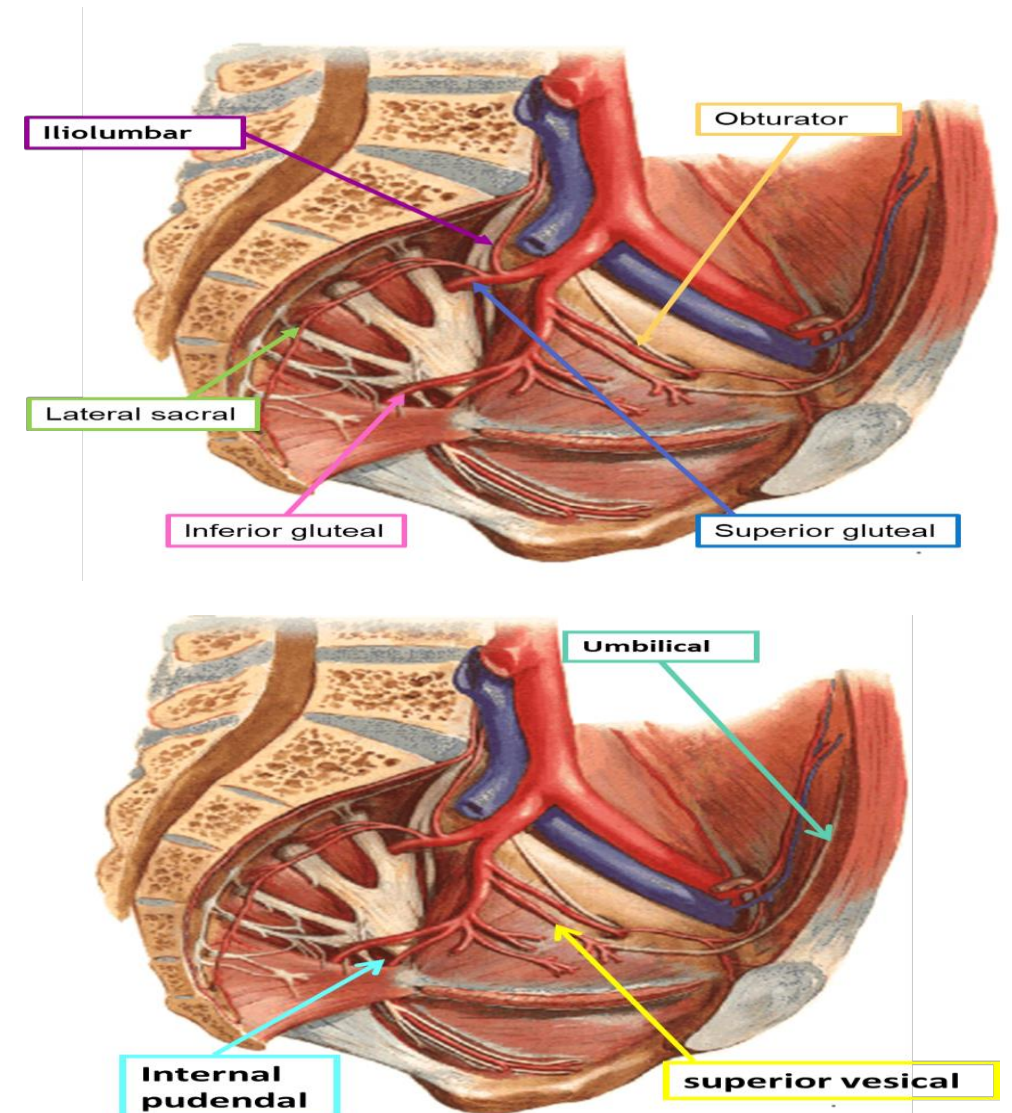
1. Gluteal region.
2. Perineum.
3. Pelvic viscera.
4. Medial (adductor) region of thigh (by obturator artery).
5. The fetus (through the umbilical arteries).



Arteries of the Pelvis

Internal Iliac Artery

<i>Parietal Branches</i>	
From posterior division	From anterior division:
<ol style="list-style-type: none"> 1. <u>Iliolumbar</u> artery. 2. <u>Lateral sacral</u> arteries (2 branches.) 3. <u>Superior gluteal</u> artery. 	<ol style="list-style-type: none"> 4. <u>Obturator</u> artery. 5. <u>Inferior Gluteal</u> artery.
<i>Visceral Branches</i>	
<i>(all from anterior division only)</i>	
<ol style="list-style-type: none"> 1. <u>Umbilical</u> artery :Gives the <u>superior vesical</u>* artery: The distal part of this artery fibrosed and forms the Medial Umbilical Ligament. 2. Inferior Vesical artery in male or vaginal in female: In the male it supplies, the Prostate and the Seminal Vesicles. It also gives the artery of the Vas Deferens. 3. Middle rectal artery 4. <u>Internal pudendal</u> artery It is the main arterial supply to the perineum. 	



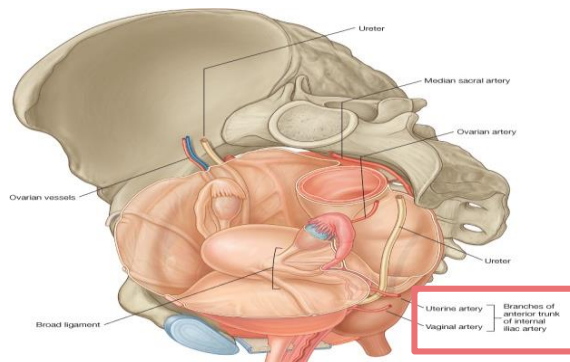
* Supplies urinary bladder:
In male (superior and inferior vesical arteries)
In female (superior vesical & vaginal artery)

Arteries of the Pelvis

Internal Iliac Artery

Visceral Branches (In Female)

- Vaginal artery:
Replaces the inferior vesical artery.
- Uterine artery: *has tortuous* course*
Crosses the Ureter superiorly and supplies the uterus & uterine tubes.
N.B. The ureter may be wrongly ligated (cut) in **hysterectomy** (removal of uterus)
- Ovarian artery from **abdominal aorta**

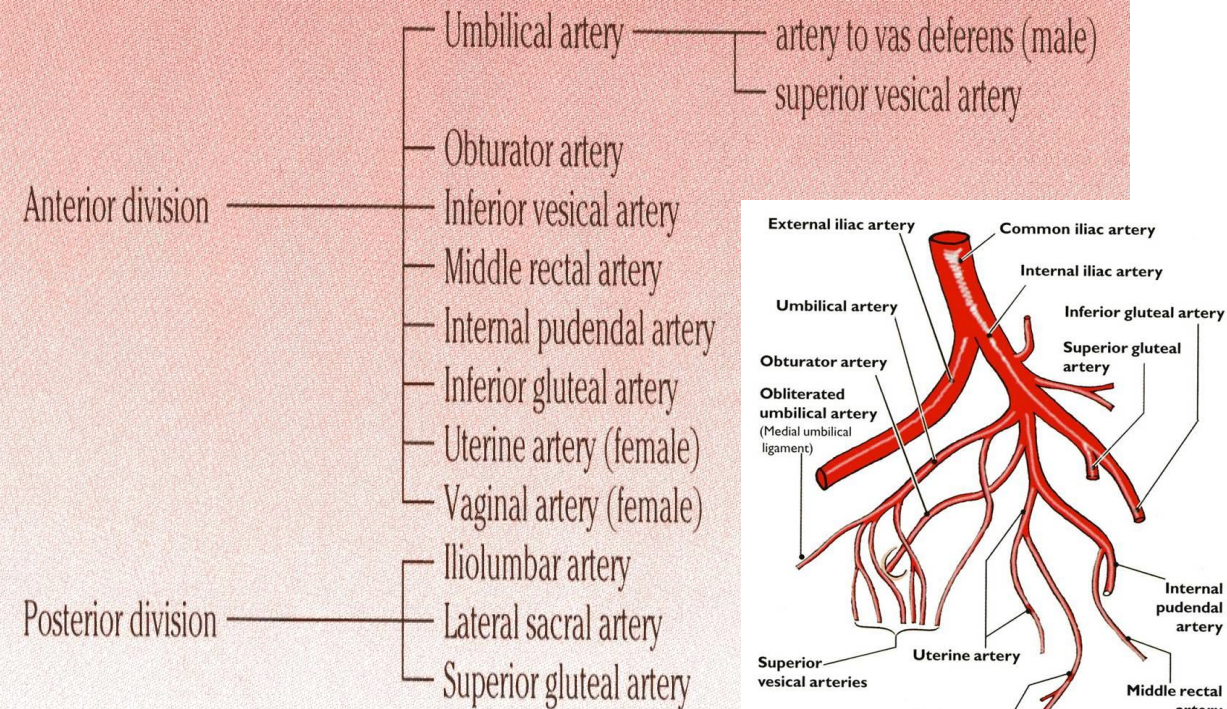


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- *recall the arteries that have tortuous course:*
1. Facial artery
 2. Splenic artery
 3. Uterine artery

Summary of the Branches (only on the *girls'* slides):

Diagram 6-1 Branches of the Internal Iliac Artery



Supply of the Pelvis

Venous Drainage

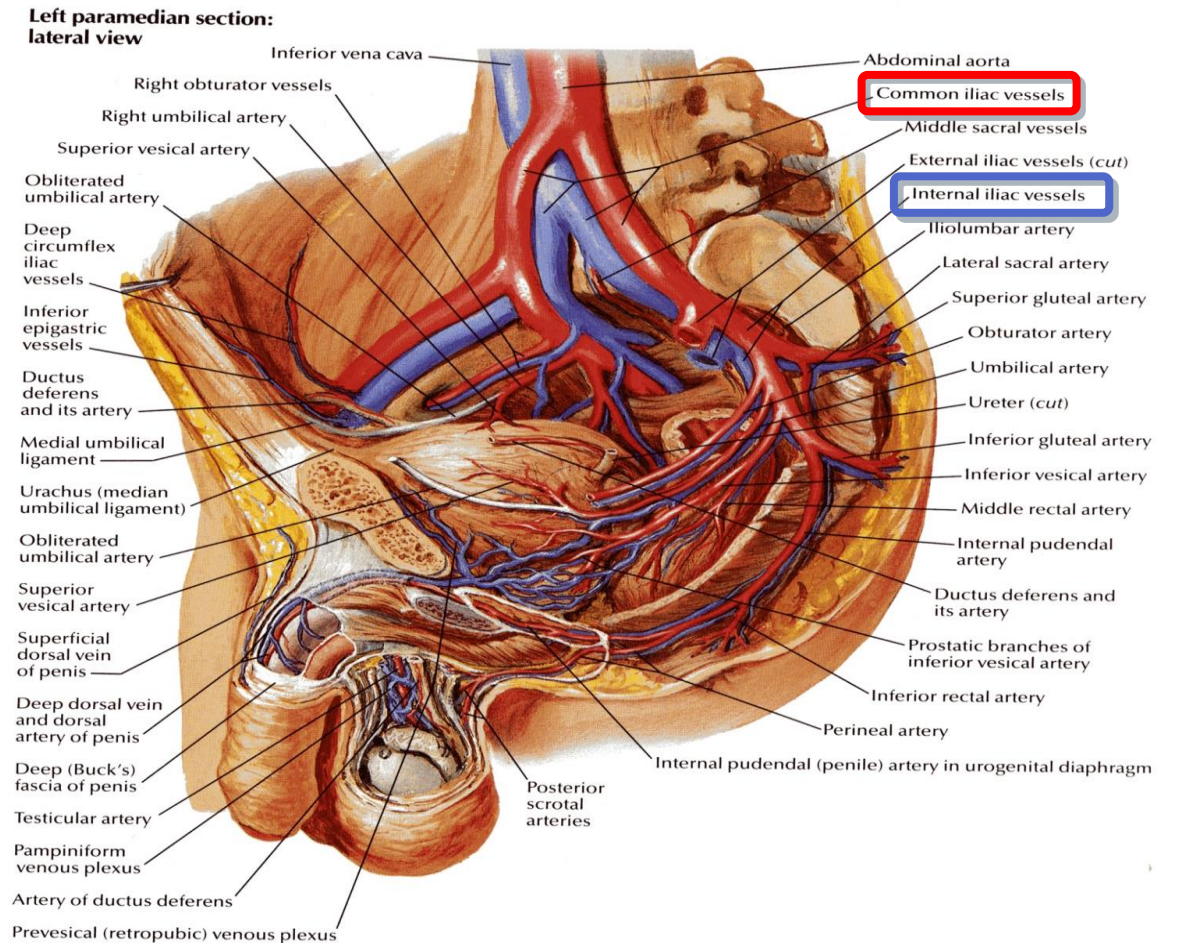
The veins correspond to the arteries.

1. Internal iliac veins:

- It collect tributaries corresponding to the branches of the internal iliac artery.
- joins the external iliac vein in front of the **sacroiliac joint** to form the **common iliac vein** (the common iliac veins join at the level of L5 to give the inferior vena cava).

2. Ovarian vein:

- Right vein drains into IVC.
- Left vein drains into left renal vein.



Clinical point: There are venous plexuses around uterus, bladder, rectum...

Their importance is that they can drain to vertebral venous plexuses

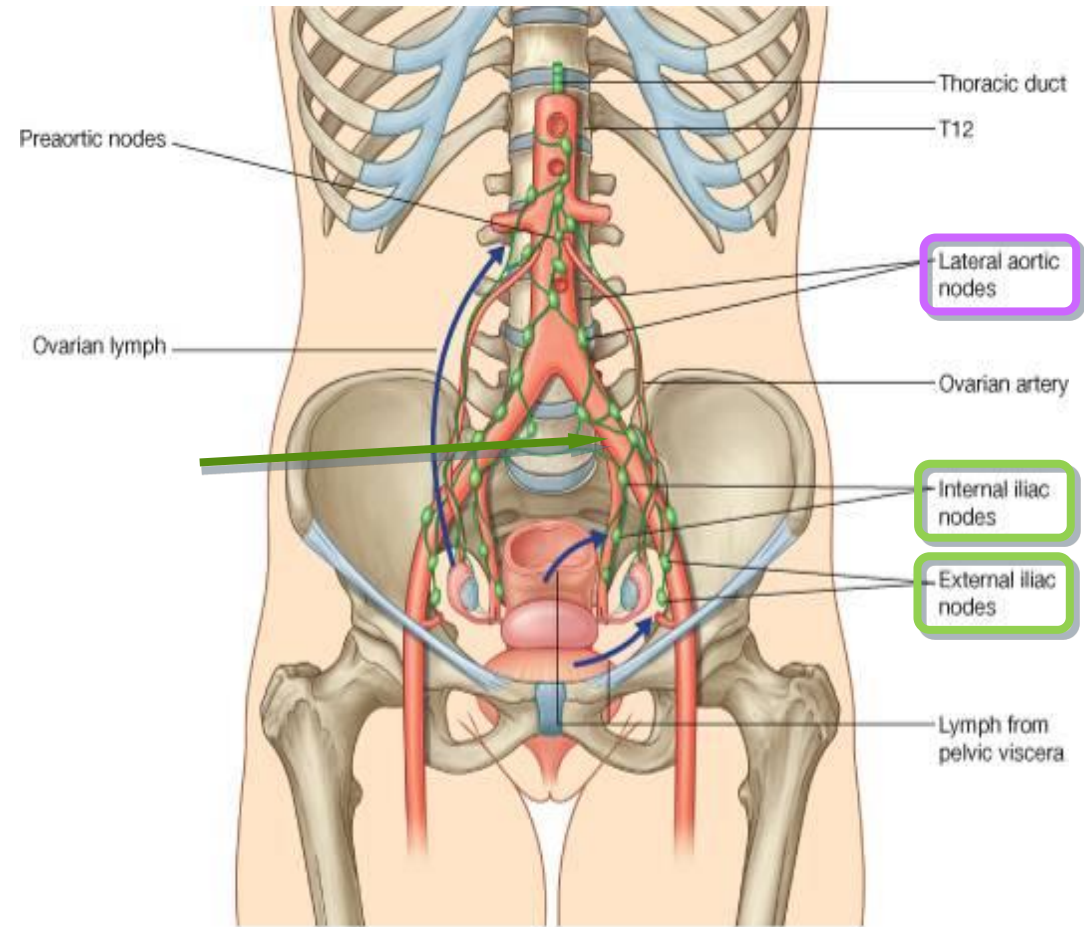
So venous blood can shift to vertebral venous plexuses ascend through foramen magnum then to occipital sinus in cranium

That means if there is cancer in either uterus, bladder, rectum the metastasis reaches the brain quickly (faster than other places)

Supply of the Pelvis

Lymphatic Drainage

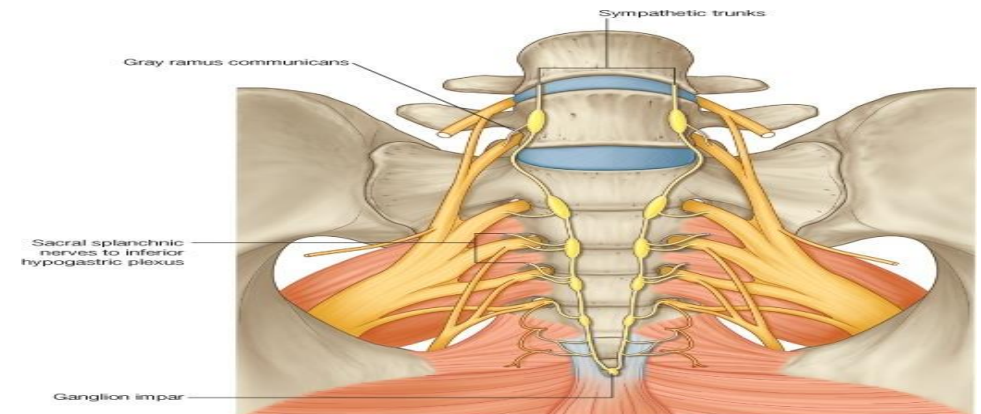
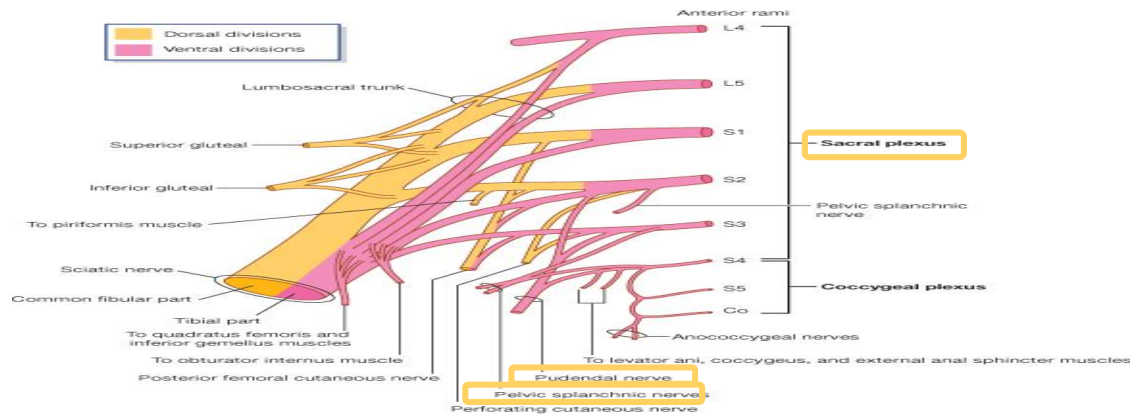
- The lymph nodes and vessels are arranged in a chain along the main blood vessels.
- Thus, there are **external iliac nodes**, **internal iliac nodes**, and **common iliac nodes**.
- Lymph from Common iliac nodes & the (Ovaries, uterine tubes & fundus of uterus) passes to **Lateral aortic (paraortic) nodes** which then passes to **cisterna chyli (thoracic duct)**



Supply of the Pelvis

Nerve Supply

Nerve Supply	
Somatic	Autonomic
<p>Sacral plexus:</p> <ul style="list-style-type: none"> from ventral (anterior rami) of L4 & L5 (lumbosacral trunk) + S1, S2, S3 and most of S4. It gives pudendal nerve to perineum. 	<p>Sympathetic:</p> <p>Pelvic part of sympathetic trunk:</p> <ul style="list-style-type: none"> It is the continuation of the abdominal part of sympathetic trunk. It descends in front of the ala of the sacrum. The 2 sympathetic trunks unite inferiorly in front of the coccyx and form a single ganglion (Ganglion Impar). Superior & Inferior Hypogastric plexuses <p>Parasympathetic:</p> <p>Pelvic splanchnic nerves (From S 2 , 3 & 4): preganglionic fibers to pelvic viscera & hindgut</p>



MCQs

1-The bony pelvis is composed of four bones :

- A-are connected by 3 joints and lined by 4 muscles.
- B-are connected by 4 joints and lined by 3 muscles.
- C-are connected by 4 joints and lined by 4 muscles.
- D-are connected by 2joints and lined by 8 muscles.

2-The Sacroiliac joints is :

- A- Anteriolateral cartilaginous join
- B-posteriomedial cartilaginous joint
- C- posteriolateral Synovial joint
- D- Anteriomedial Synovial joint

3- The False pelvis is bounded by :

- A- T11
- B-C6
- C-L1
- D-S2

4- Which of the following is true about the PELVIC INLET:

- A- Bounded Posteriorly by the Coccyx
- B- Bounded Anteriorly by the Ileopectineal (arcuate) lines.
- C- Bounded laterally by the Promontory of sacrum
- D-Bounded posteriorly by the ala of sacrum.

5-Which of the following is a female of the pubic arch angle:

- A- 45
- B- 65
- C-75
- D- 85

6- A 28 year old women ,school teacher from

Dublin had a positive pregnancy test. Her obstetrician informed her that it is impossible for her to deliver normally because of the type of her bony pelvis , which of the following types of pelvis can have normal vaginal delivery?

- A- Gynecoid Pelvis
- B- Android Pelvis
- C- Anthropoid Pelvis
- D- Platypelloid Pelvis

7-No muscles are found in :

- A- The anterior pelvic wall
- B- The posterior pelvic wall
- C- The lateral pelvic wall
- D- The medial pelvic wall

8-Which of the following is true about the piriformis muscle :

- A- Origin from the Inner surface of the obturator membrane and the hip bone.
- B- inserted in the pelvic surface of the middle 3 sacral vertebrae.
- C- Supplied by the lumbar plexus.
- D- leaves the pelvis through the greater sciatic foramen.

9-Which of the following is true about the PELVIC DIAPHRAGM :

- A- It is incomplete posteriorly to allow passage of the anal canal.
- B- it forms the INFERIOR PELVIC WALL.
- C- Main (true) pelvic cavity below it.
- D- formed by the levator ani and the coccygeus muscles without their covering fasciae.

Answers: 1-C, 2-C, 3-C, 4-D, 5-D, 6-A, 7-A, 8-D, 9-B.

MCQs

10. Which one the following fibers of Levatores Ani muscles considered as the intermediate part?

- A. Pubococcygeus
- B. Ischiococcygeus
- C. Iliococcygeus

11. The Nerve supply to the Coccygeus muscle:

- A. Branches of 4th and 5th sacral nerves
- B. Branches of pudendal nerve
- C. both

12: The medial umbilical ligament results from?

- A. Fibrosed umbilical vein
- B. Fibrosed umbilical artery
- C. Superior vesical artery

13. Which of the following arteries supply the urinary bladder in female :

- A. Uterine artery
- B. Inferior vesical artery
- C. Vaginal artery

14. The right ovarian vein drains into:

- A. Renal vein
- B. Common iliac vein
- C. Inferior vena cava

15. The relaxation of which of the following muscle fibers lead to defecation?

- A. Pubococcygeus
- B. Puborectalis
- C. Coccygeus

16. The ovarian artery originate from:

- A. Uterine artery
- B. Abdominal aorta
- C. Internal iliac artery

17. Woman is undergoing hysterectomy and during the ligation of uterine artery which of the following will be endanger:-

- A. Ureter
- B. Urinary bladder
- C. Ovarian artery

SAQs

Q1: A 14 years old patient was diagnosed with osteosarcoma in the distal femur 3 months after starting the treatment the doctor found that the tumor have metastasized to the right hip bone.

A-What forms the LATERAL PELVIC WALL

It is formed by:

- 1- Part of the hip bone below the pelvic inlet,
- 2- Obturator internus and its covering fascia & the obturator fascia.
- 3- Sacrotuberous ligament.
- 4- Sacrospinous ligament.

B- What is the action of the Obturator internus muscle:

Action: Lateral rotator of the femur at the hip joint.

Q2: What is the nerve supply of levator ani muscles?

1. perineal branch of the fourth sacral nerve.
2. perineal branch of the pudendal nerve.

Q3: The arterial supply of urinary bladder in male and female are:

- In male : superior vesical artery + inferior vesical artery
- In female : superior vesical artery + vaginal artery

Q4: Define the anterior divisions of Internal Iliac Artery :-

- Obturator Artery - Inferior Gluteal Artery - Vaginal Artery - Middle Rectal Artery - Internal Pudendal Artery - Uterine Artery - Inferior Vesical Artery - Umbilical Artery Gives: superior vesical artery and Artery of vas deferens.

Q5: Describe nerve supply of the pelvis :-

- Somatic > Sacral plexus
- Autonomic >
- Sympathetic: Pelvic part of sympathetic trunk
- Parasympathetic: Pelvic splanchnic nerves From S 2 , 3 & 4.

SUMMARY

Pelvis composed of 4 bones :	<ul style="list-style-type: none"> • 2hip bones • Sacrum & coccyx 				Arterial supply :	internal iliac artery divides to: <ol style="list-style-type: none"> 1. anterior (gives parietal & visceral branches) 2. Posterior (gives parietal branches)
Connected by 4 joints :	<ul style="list-style-type: none"> • Symphysis pubis (Ant.) } Cartilaginous • Sacrococcygeal (Post.) } • 2 sacroiliac joints (potserolateraly) synovial 					Venous drainage :
Divides into :	False pelvis which bounded by	True pelvis Which has : Pelvic inlet,outlet,and cavity			Lymphatic drainage :	external, internal and common iliac node
	Post. : lumbr vertebrae Ant. : lower part of abdominal wall Laterally : iliac fossa & iliacus ms.		Pelvic inlet	Pelvic outlet		
		Anteriorly	symphysis pubis			
		Posteriorly	<ol style="list-style-type: none"> 1. Promontry of sacrum 2. Ala of sacrum 	coccyx		
		Laterally	Arcuate lines	Anterolaterally : ischiopubic ramus Psterolaterally : sacrotuberous ligament		
Nerve supply :	<ul style="list-style-type: none"> • somatic : sacral plexus • Autonomic : <ol style="list-style-type: none"> 1. sympathetic(pelvic part of sympathetic trunk , Superior and inferior hypogastric plexus) 2.Parasympthatic : pelvic splanchnic nerve (S2,3&4) 					



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