

In the middle of every difficulty lies opportunity.
— Albert Einstein

Musculoskeletal Block
ANATOMY
team 435



C O L O R C O D E S

- IMPORTANT NOTES
- EXTRA NOTES
- DEFINITION

Objectives:

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

- Describe the bony structures of the pelvis.
- Describe in detail the hip bone, the sacrum, and the coccyx.
- Describe the boundaries of the pelvic inlet and outlet.
- Identify the articulations of the bony pelvis.
- List the major differences between the male and female pelvis.
- List the different types of female pelvis.



Bony Pelvis

Bony pelvis=skeleton of pelvis

- The pelvis is a region of the trunk that lies below the **abdomen**.
- Bony pelvis is the bowl shaped bony structure that forms the skeleton of that region.
- The skeleton of the pelvis is a **basin-shaped** ring of bones (حلقة من العظام تماثل شكل الحوض) with holes in its walls connecting the vertebral column (Axial skeleton) to both **femora** (lower Appendicular skeleton).
- Compared to the shoulder girdle, the pelvic girdle is ***stronger** and **heavier**

*Stronger because it gives attachment for **anti-gravity muscles (carries large weight)

The bones are:

- **Two Hip Bones**: These form the **lateral and anterior** walls of the bony pelvis.
- **Sacrum**: It forms most of the posterior wall.
- **Coccyx**: Consists of four vertebrae fused together forming a single **Triangular piece**

** mainly extensors of the knees, hips, and back, that by their tone resist the constant pull of gravity in the maintenance of normal posture.



Functions of the Bony Pelvis

Primary Functions

Secondary Functions

1- **bear** the weight of the upper body when sitting and standing.

2- **transfer** that weight from the axial skeleton to the lower appendicular skeleton when standing and walking.

3- **provide** *attachments and withstands the forces of the powerful muscles of locomotion and posture.

1. **contain and protect** the pelvic and abdomino-pelvic viscera.(inferior parts of the urinary tracts ,internal reproductive organs)

2. **provide attachment** for external reproductive organs and associated muscles and membranes.

*Attachment (origin or insertion) for muscles responsible for locomotion and posture (anti-gravity muscles)



Pelvic girdles:

Composed of Two Hip (Coxal) Bones (large irregular bone)

-Hip bone:

1. Ilium (upper)
2. Pubis (Anterior)
3. Ischium (Posteroinferior)

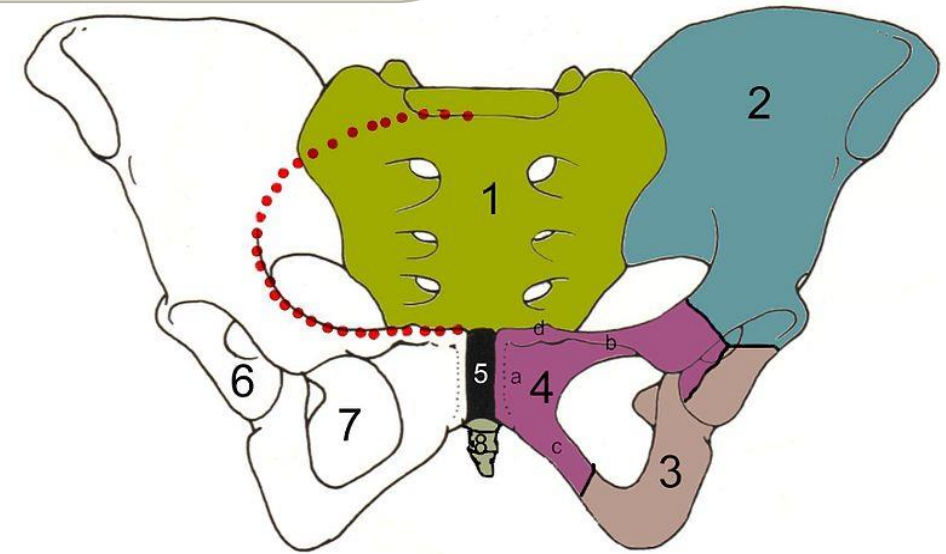
Hip bones are joined at a deep socket (the Acetabulum)

- During childhood, these sections are separate bones, joined by Y shaped cartilage.
- During puberty, they fuse together to form a single bone.

Pelvic girdle: 2 hip bones only
Pelvis bony: 2 hip bones + sacrum + coccyx

1. Sacrum
2. Ilium
3. Ischium is thick to bear the body weight.
4. Pubic bone
5. Pubic symphysis
6. Acetabulum
7. Obturator foramen
8. Coccyx

Red line: Terminal line/pelvic brim



Ilium

- The Ilium is the **Upper Flattened Part** of the Hip bone .
- It has **Iliac Crest** : which is
 - 1- An important anatomical landmark .
 - 2- Located below the waist .
- It extends between :
 - Anterior superior iliac spine (شوكة)** & **Posterior superior iliac spine (شوكة)**
- And below them :
 - Anterior inferior iliac spine** & **Posterior inferior iliac spine**

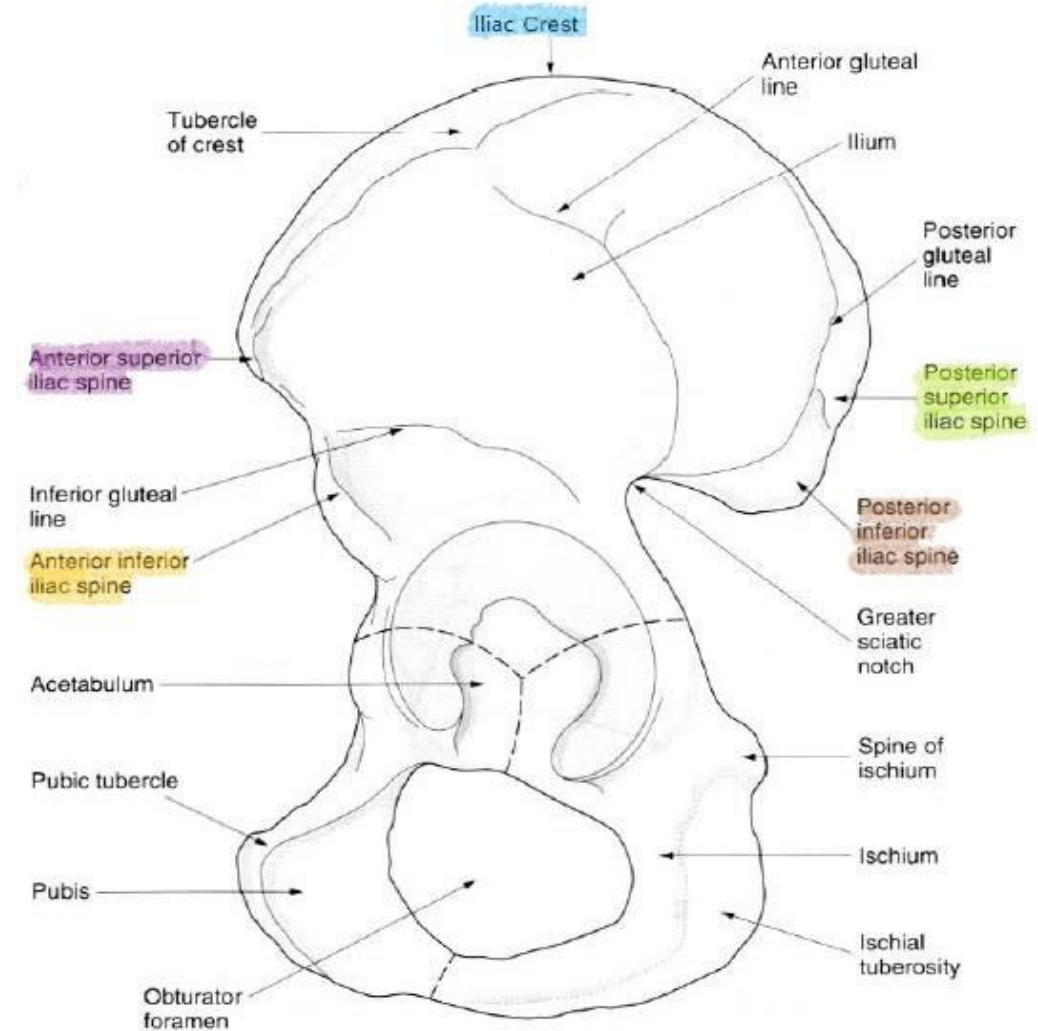


Fig. 4.7 Left innominate, lateral view.

The ilium has two surfaces:

A. Outer surface : →

ناحية الـ
acetabulum

- Rough

- Has three **Gluteal Lines** :

1- Anterior Gluteal Line

2- posterior Gluteal Line

3- inferior Gluteal Line

Give
attachment for
muscles in the
gluteal region

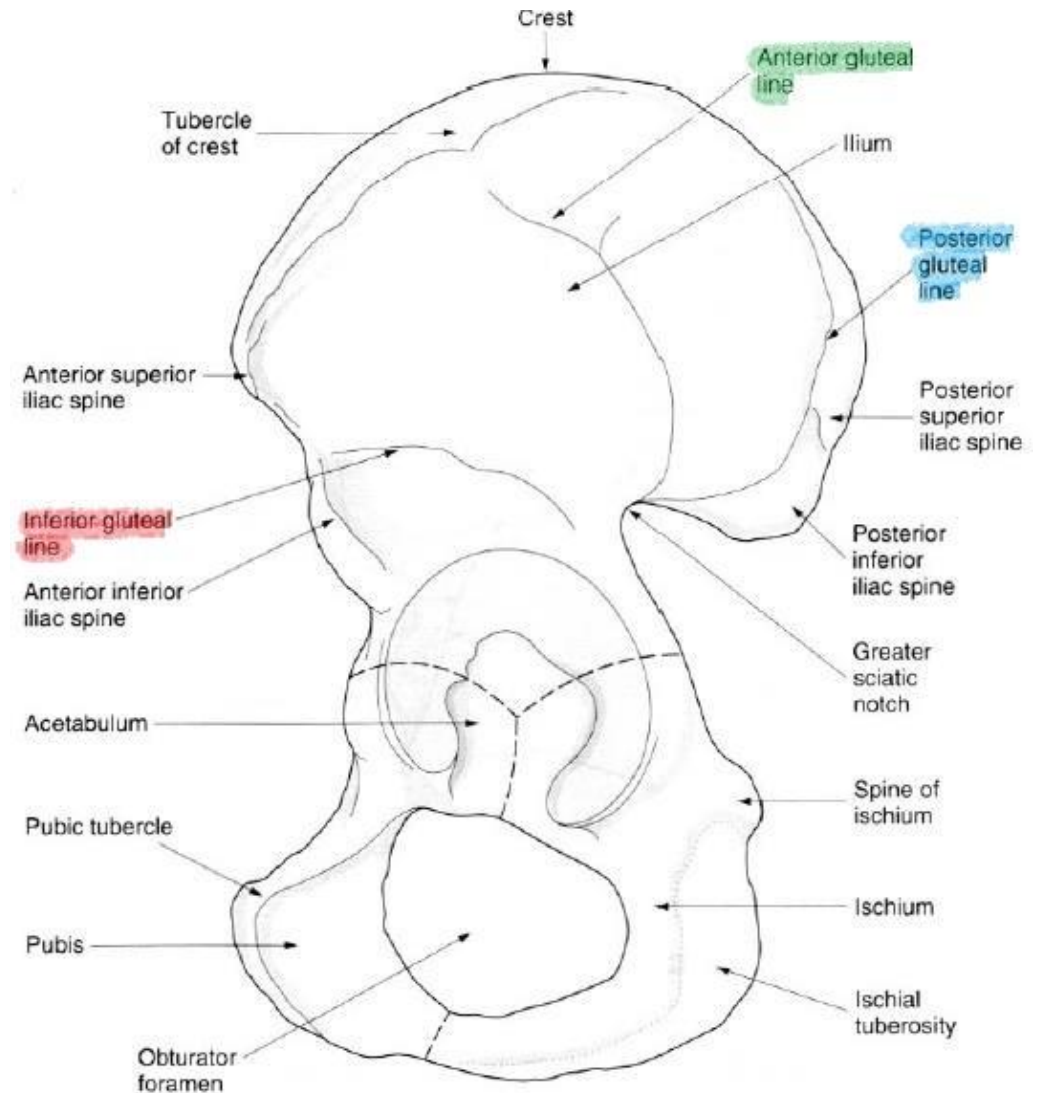


Fig. 4.7 Left innominate, lateral view.

B. Inner surface :

Smooth
And most of the inner
surface is iliac fossa

Has :

1- Iliac Fossa → forms false pelvis

2- Auricular surface → for articulation
with the sacrum

Rough region
resembles the ear

3- Iliopectinial (Arcuate) Line →

يشبه القوس
Extends from
illum to pupis

- Runs downwards & forwards.

- It separates between **the false** and **the true** pelvis .

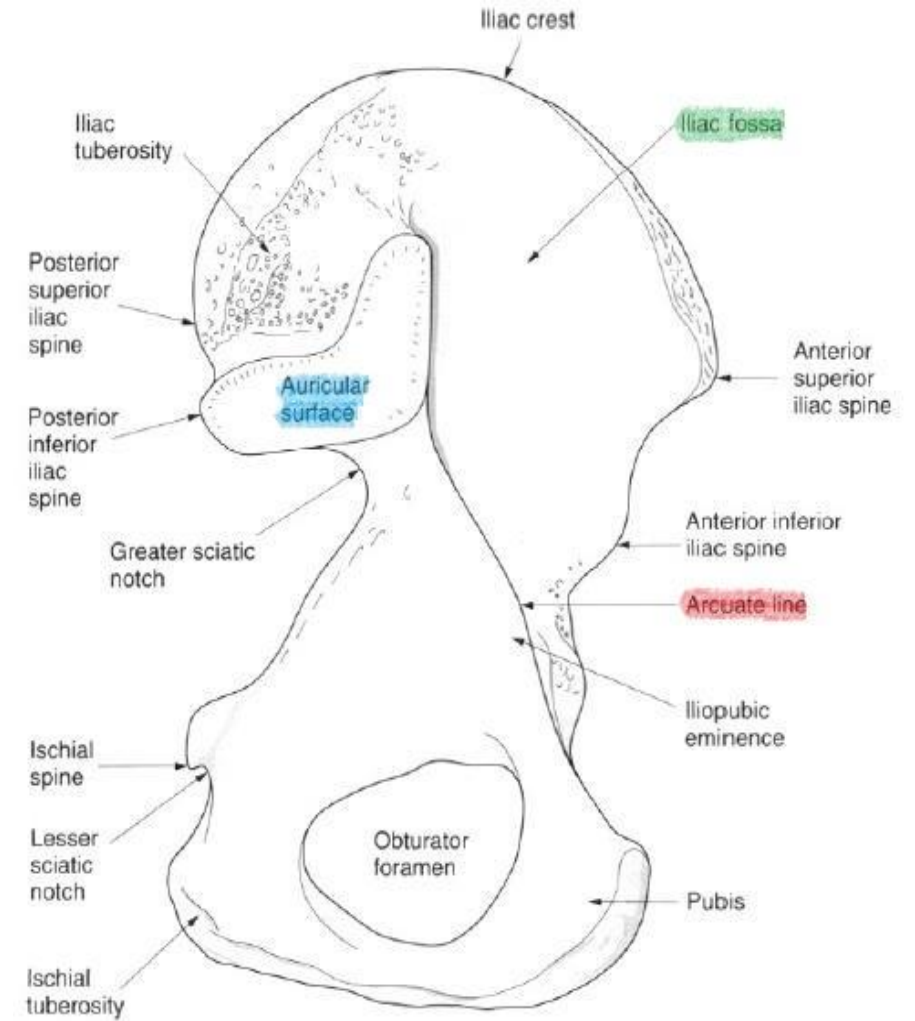


Fig. 4.8 Left innominate, medial view.

Pubis

- The Pubis forms the **Anterior & Inferior part** .
- It is composed of :
 - 1- **Body** → **Pubic Crest**
→ **Pubic Tubercle**
 - 2- **Superior pubic Rami** & **Inferior pubic Rami**
 - 3- **Obturator Foramen** → closed partially by the **obturator membrane**.

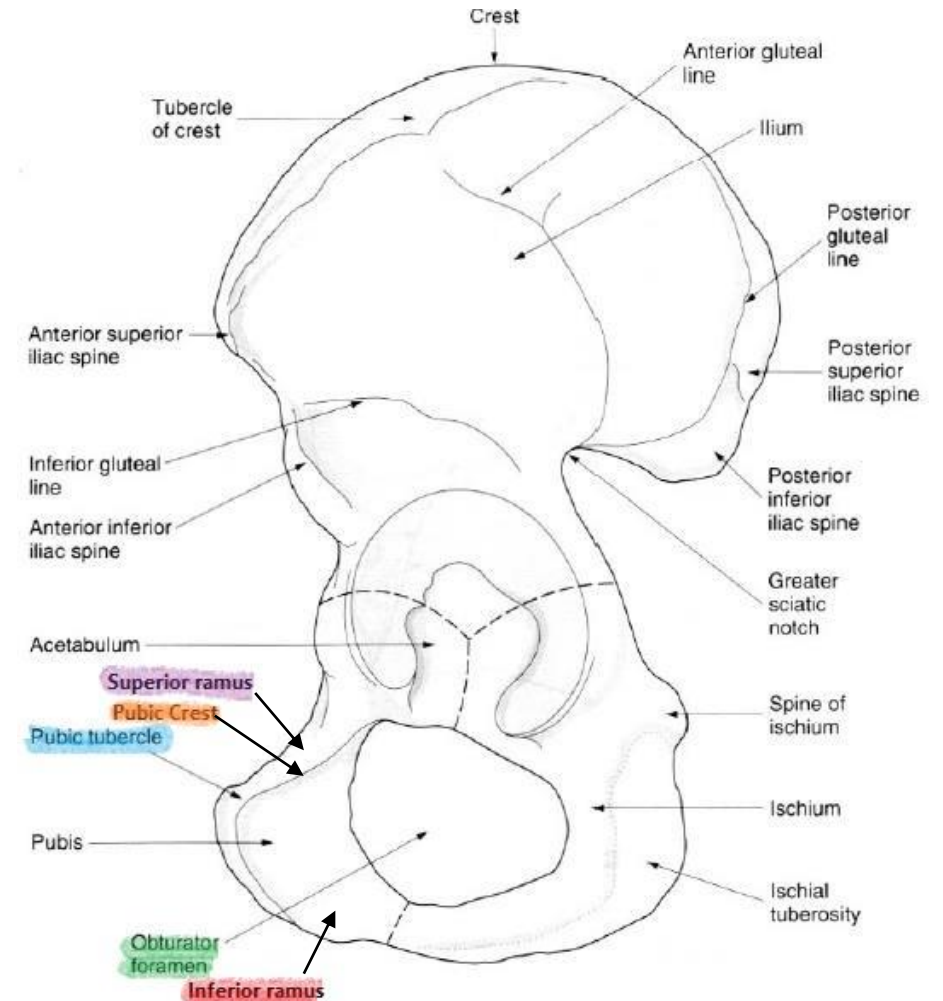


Fig. 4.7 Left innominate, lateral view.

Ischium

- The Pubis forms the **Posterior & Inferior part.**

- It is composed of :

- 1- **Ischial Tuberosity** :

- A roughened area .

- receives body weight in sitting.

- 2- **Ischial Spine*** :

- Superior to the tuberosity .

- it is important landmark in pregnant women.

- 3- **Greater sciatic notch.**

- 4- **Lesser sciatic notch.**

*-Important during labor, the doctor will decide whether there is possibility to deliver the baby normally or not.
-separates the notches

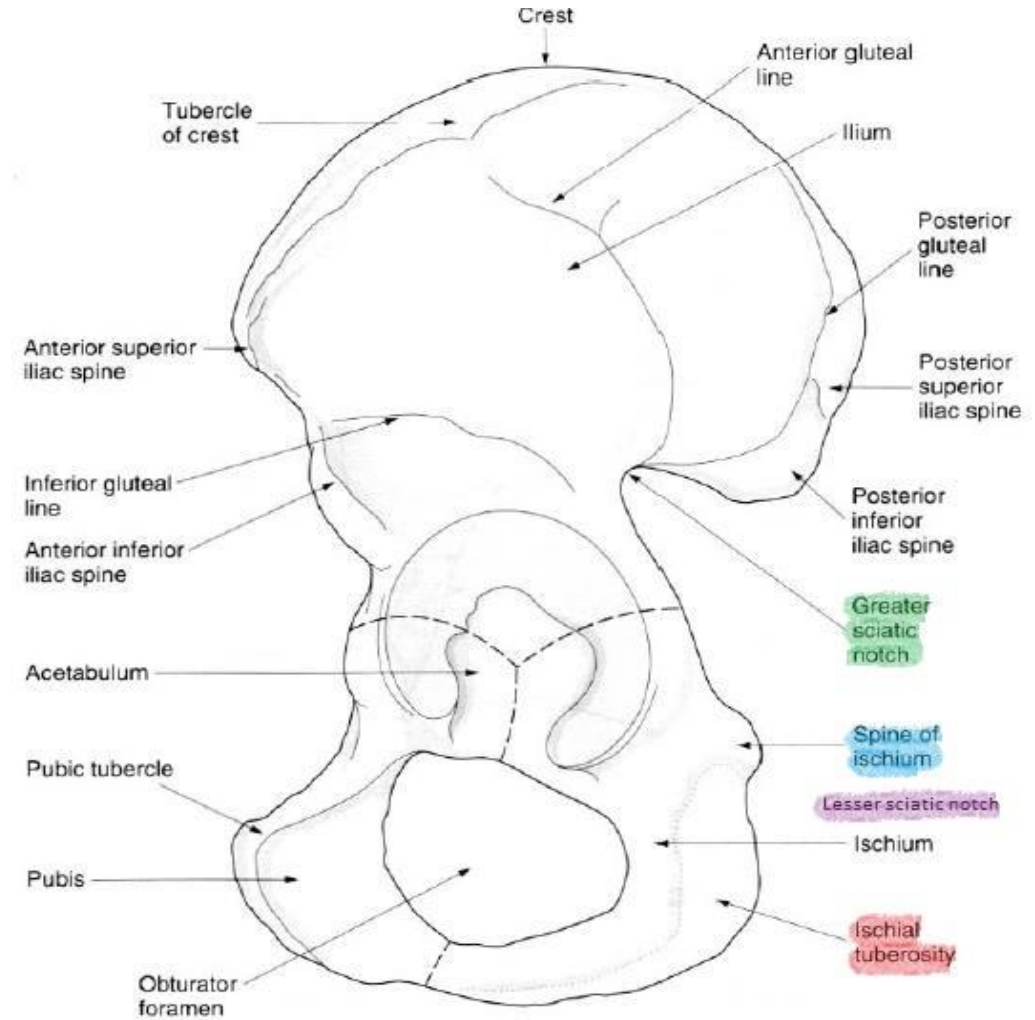


Fig. 4.7 Left innominate, lateral view.

Sacrum

The most posterior of the bony pelvis

❖ What is the SACRUM BONE?

It is a single wedge shaped bone (consists of **FIVE** rudimentary vertebrae **fused** together).

❖ Sacral Promontory**:

- The anterior and upper margin.
- It is tilted forward forming the **lumbosacral angle**.

❖ Four Sacral Foramina:

In the anterior and posterior surfaces (on each side)

❖ Sacral Canal:

Fused vertebral foramina.

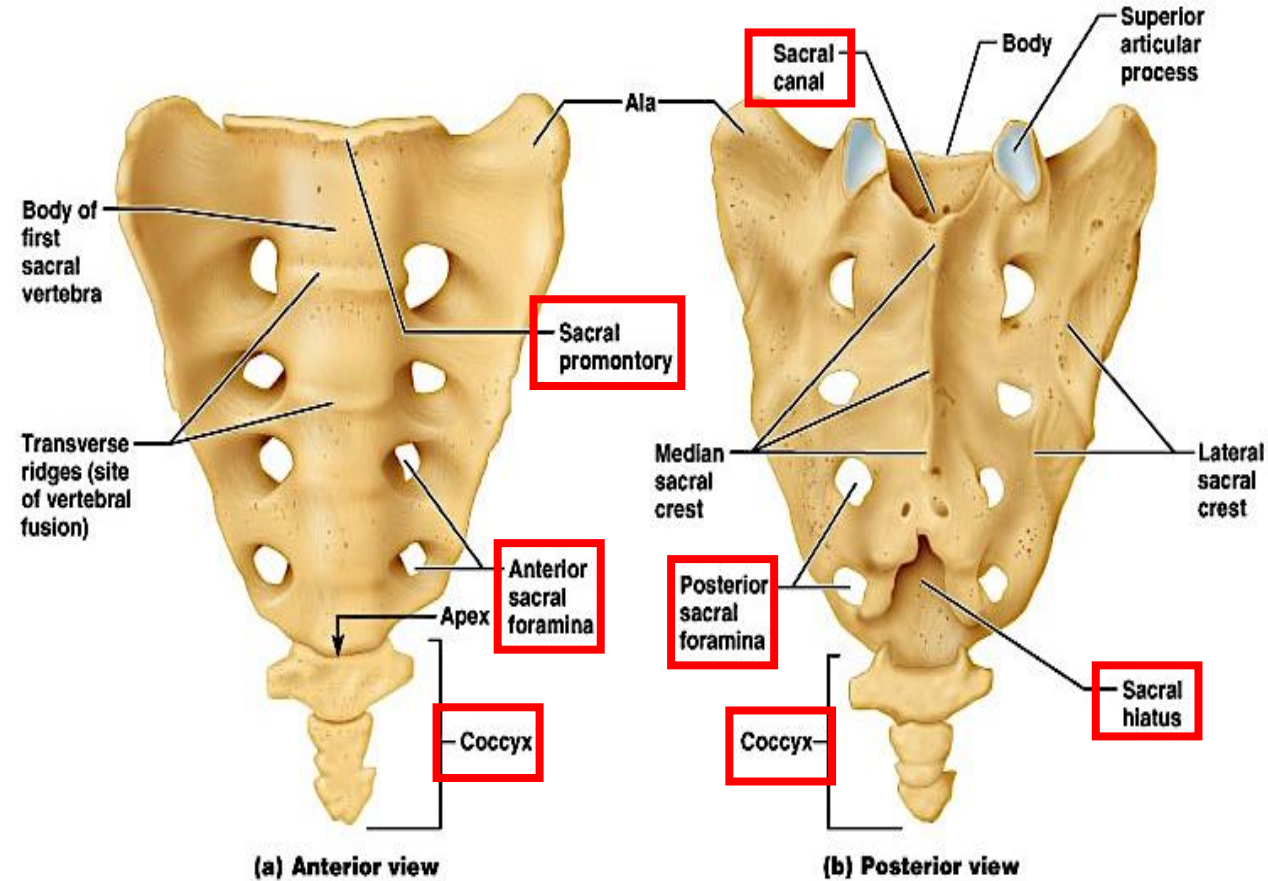
❖ Sacral Hiatus

Lower limit of the canal.

Most inferior part of the posterior wall of bony pelvis

Coccyx

Consists of: **FOUR** vertebrae **fused** together forming → a **single Triangular piece**.



**Sacral promontory attached to 5th lumbar vertebra forming the lumbosacral angle
-Doesn't appear in the posterior surface



* They are the same

Articulations of:

Hip Bone

1. Symphysis Pubis

Secondary **cartilagenous** joint between the **two pubic bones**.

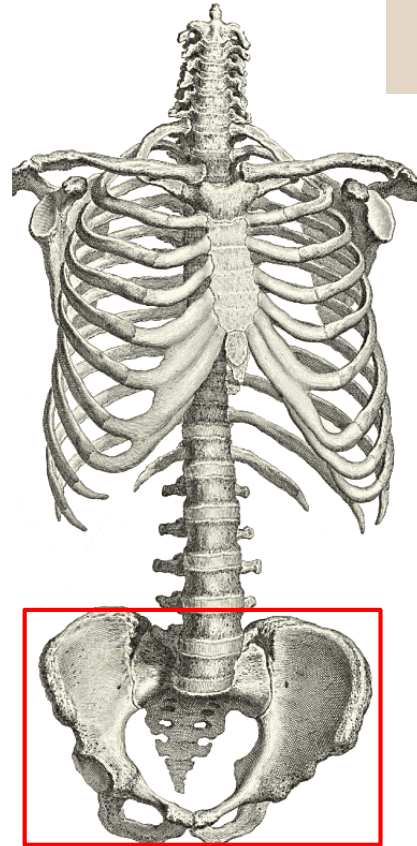
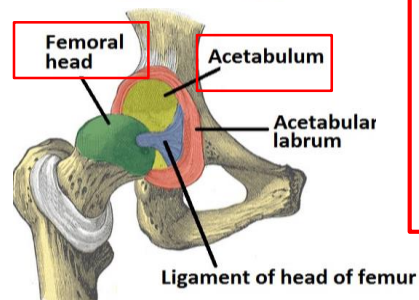
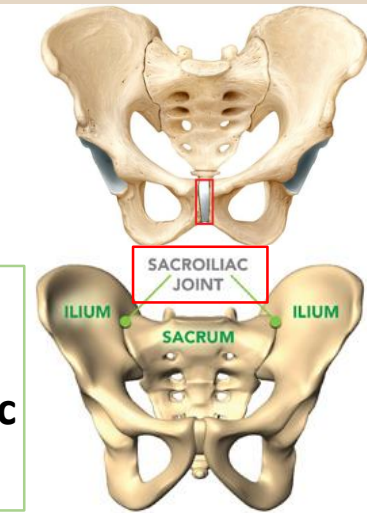
2. Sacroiliac Joints

Strong **synovial joints**, between the **auricular surfaces of both iliac bones and the sacrum**.*

3. Hip Joints

→ Synovial joint

The **acetabulum** articulates with the **head of the femur**.



Sacrum

1. Lumbosacral Joint

The **upper border of sacrum** articulates with the **5th Lumbar vertebra**.

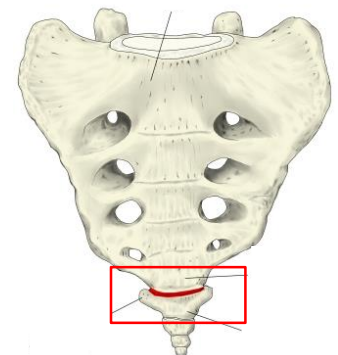
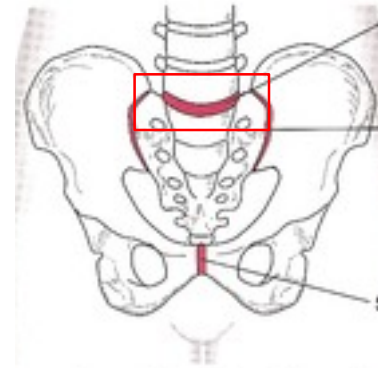
2. Sacroiliac Joints

Lateral articulation with the **both Hip bones**.*

3. Sacrococcygeal Joint

The **inferior part** articulates with the **Coccyx**.

Cartilagenous joint



Foramina in Bony Pelvis

Foramina : The holes of the basin.

Important foramina in the bony pelvis

Anterior sacral foramina.

Greater and lesser sciatic foramina.

Obturator foramen

***Sacro**tuberous: ligament between **sacrum** and **ischial tuberosity**.

****Sacro**spinous: ligament between **sacrum** and **ischial spine**.

- They are present on the **anterior** surface of the **sacrum** (which forms the posterior surface of the bony pelvis).
- Through these foramina pass the **anterior** rami of the **sacral** spinal nerves.

- They are the major foramina of the pelvis.
- In the bony pelvis, they are present as **greater and lesser sciatic notches** but by the attachment of ***sacro**tuberous and ****sacro**spinous ligaments, these notches are converted to, greater and lesser sciatic foramina.
- Through these foramina various structures enter and leave the pelvis.

- Each lateral wall of the pelvis has a large hole, called the **obturator foramen**.
- In living subjects, this hole is closed by the **obturator** membrane except for a small opening, which represents the **obturator** canal .
- **Obturator** nerve passes through this small opening

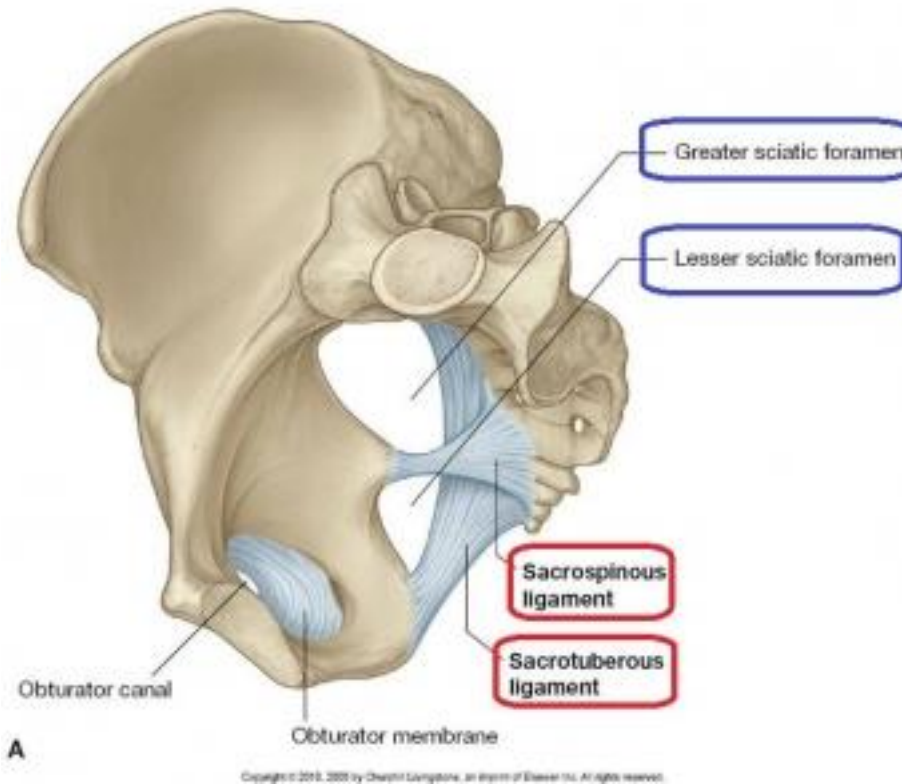


Foramina in Bony Pelvis

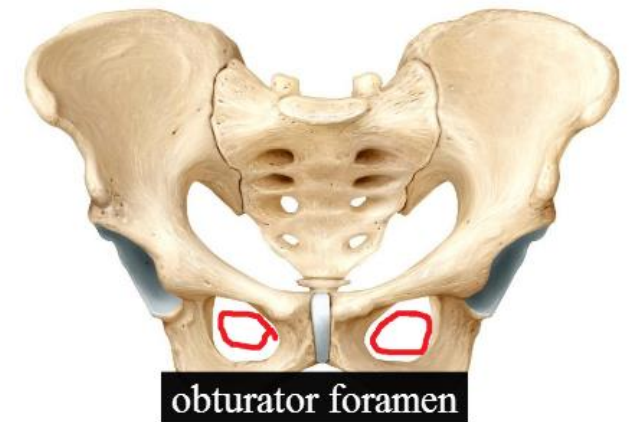
Anterior sacral foramina.



Greater and lesser sciatic foramina.



Obturator foramen



Obturator foramen is covered by obturator membrane except for the **upper part**. why? Because of the passage of **obturator nerve** that gives supply to the upper limbs.



Orientation of the Pelvis

What is *Orientation of the Pelvis*?

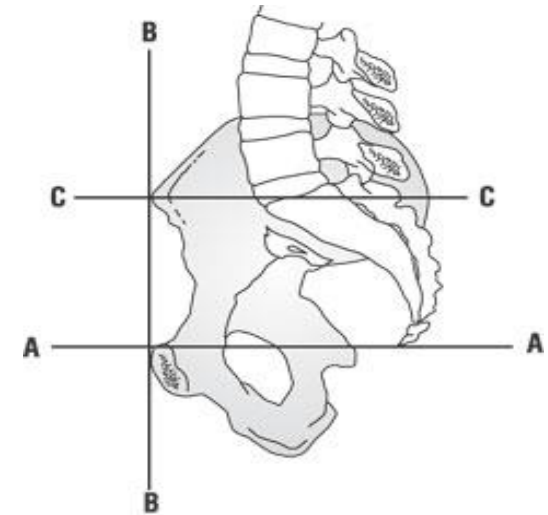
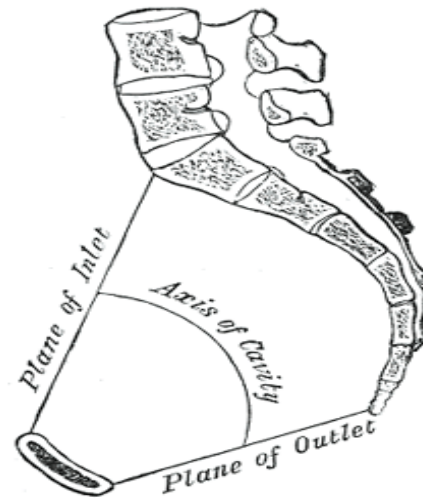
-It is the Correct Position of the bony pelvis relative to the trunk (**in the anatomical position**).

the anatomical position:

1. The anterior-superior iliac spine and the pubic tubercles are in the same **Vertical plane**

2. The coccyx is in the same **Horizontal plane** as the upper margin of the pubic symphysis.

3. The **axis of the pelvic cavity** running through the central point of the inlet (مدخل) and the outlet (مخرج) almost parallels the curvature of the sacrum.



In this position:* The anterior surface of the **Sacrum is directed **forward** and **downward** while the **pelvic surface of symphysis pubis** faces **upward** and **backward**



Fractures of the Bony Pelvis

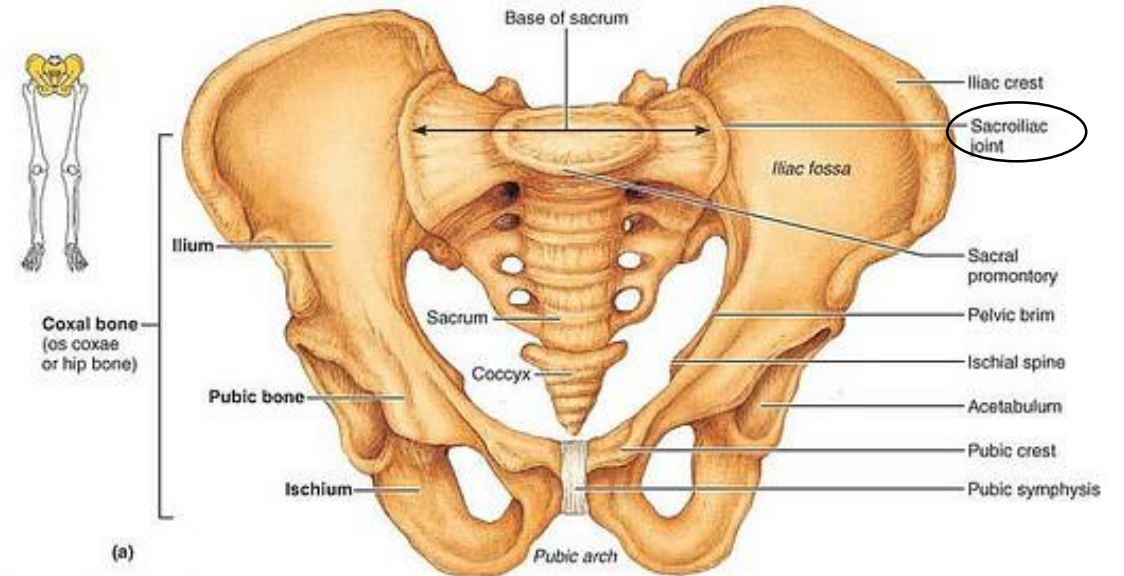
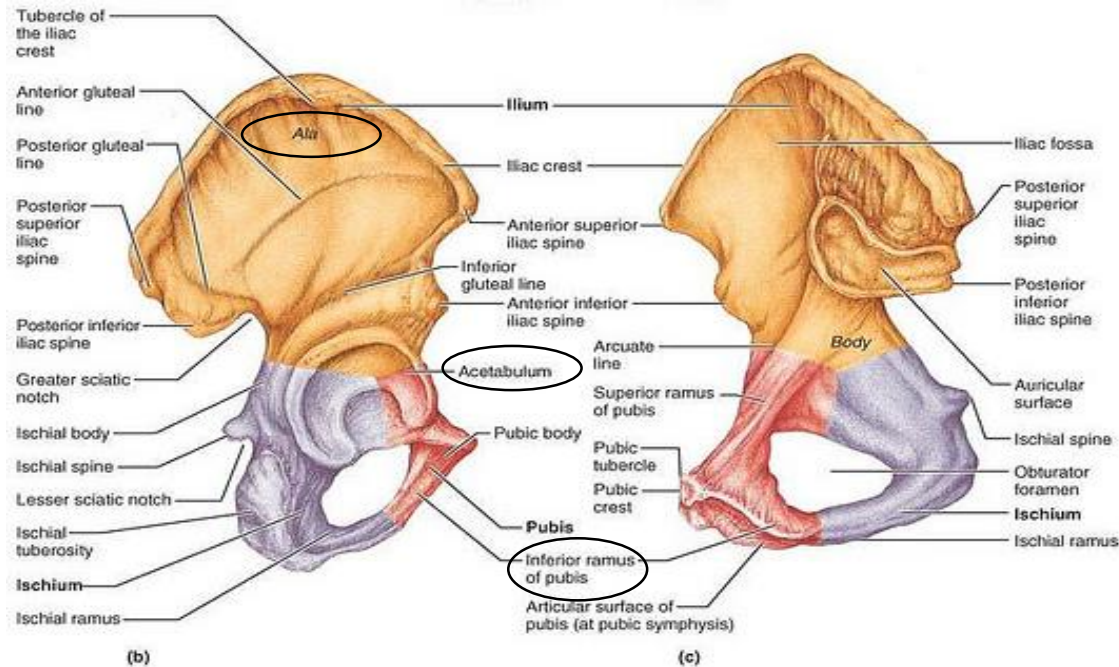
The weakest parts of the bony pelvis are:

- Pubic rami.
- Acetabula.
- Region of sacroiliac joint.
- Alae of the ilium.

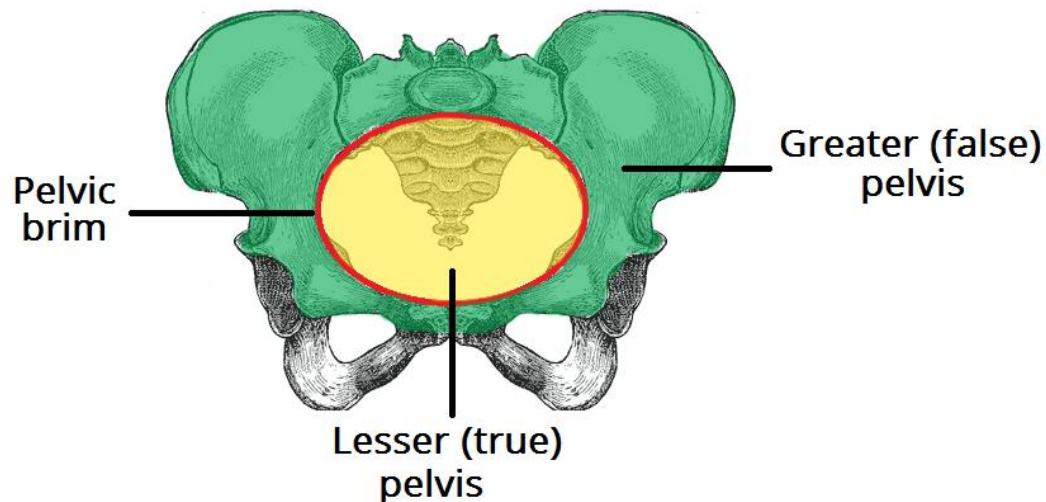
*Pelvic Fractures can result from **direct trauma** to the pelvic bones as occurs in *car accidents* or **by forces transmitted** to these bones from the lower limbs during falls on the feet.

Pelvic fractures may cause injury to:

*the pelvic soft tissues. *blood vessels. *nerves and organs.



SUBDIVISION OF THE BONY PELVIS



The bony pelvis is divided into two parts by the **Pelvic Brim**.

The brim is formed from:

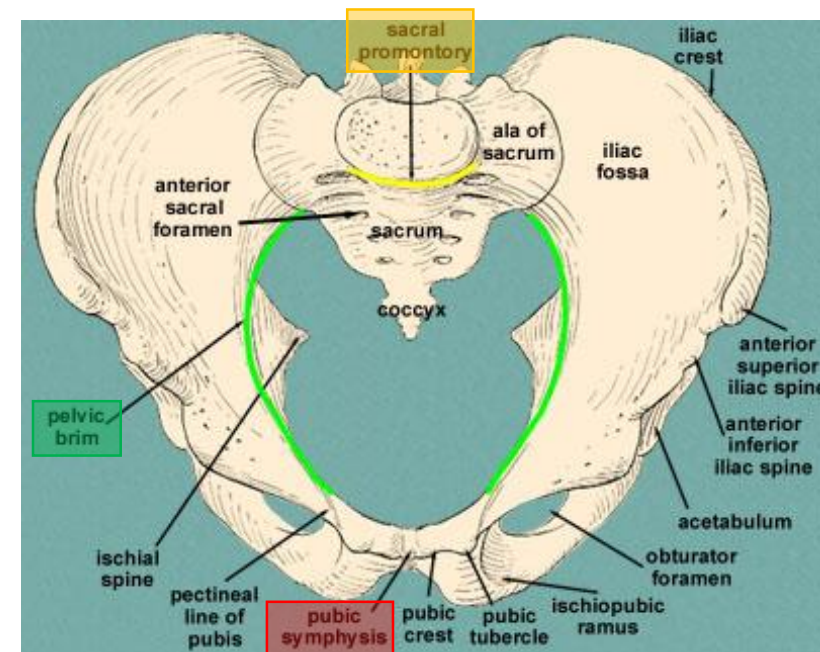
Posteriorly: Sacral Promontory.

Laterally: Iliopectineal line.

Anteriorly: Symphysis pubis.

- Above the pelvic brim lies the **False Pelvis**, which is not of much clinical importance.
- Below the brim is the **True Pelvis**

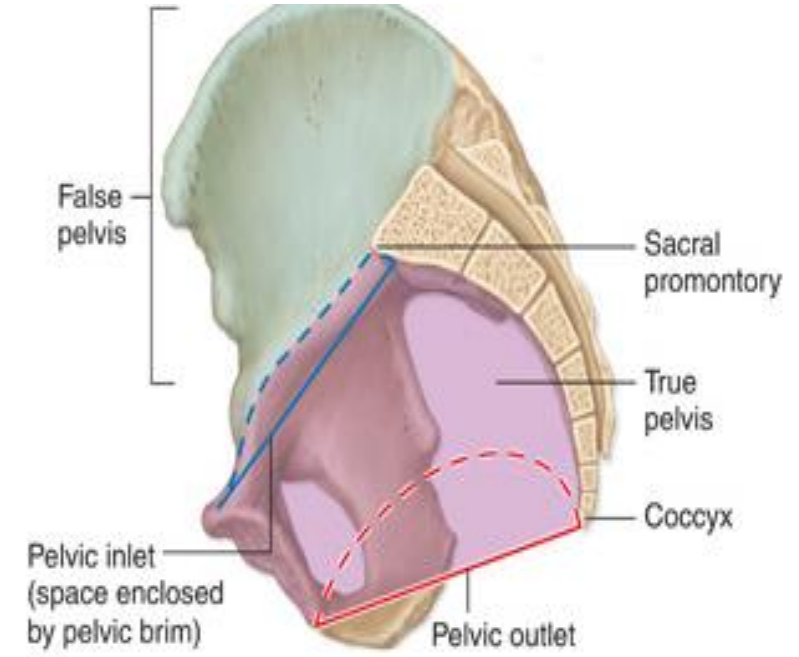
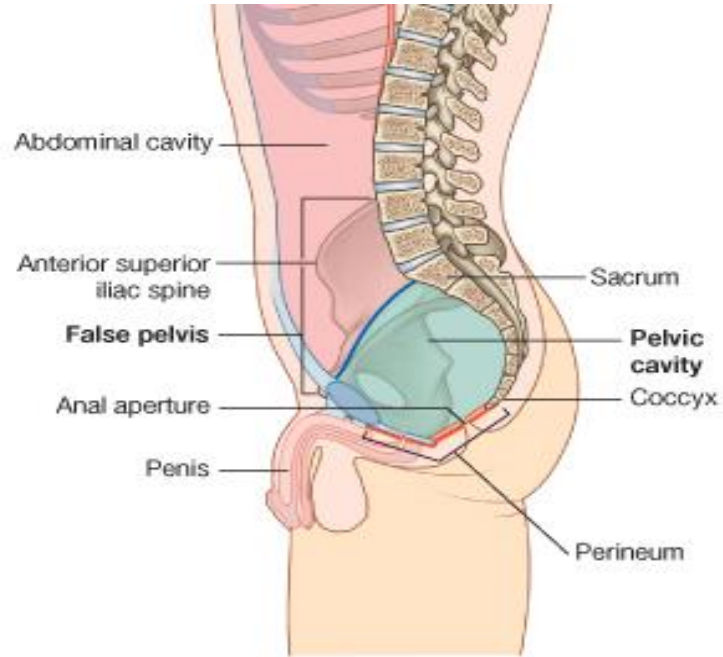
Other name for pelvic brim → pelvic inlet



بإختصار شديد مانطول عليكم دكاترتنا عظمة الحوض مقسمة إلى حوض كاذب في الأعلى و حوض حقيقي في الأسفل
ايش الحدود الي نقدر نقسم فيها الحوض لأعلى و أسفل؟

- **Symphysis pubis (من الأمام)**
- **Iliopectineal line (من الجوانب)**
- **Sacral promontory (من الخلف)**

The pelvis is divided into



-The False pelvis is also known as greater pelvis
-the true pelvis is also known as lesser pelvis

*False pelvis

- Lies superior to the pelvic brim.
- Enclosed by the Fossae of the iliac bones
- Forms the inferior region of the abdominal cavity.
- Houses the Inferior abdominal organs

*Considered to be a part of the abdomen (occupied by abdominal viscera)
-Surrounded posteriorly by vertebral column (S1 vertebra) and laterally (on each side) by iliac fossa

**True pelvis

- Lies inferior to the pelvic brim.
- Encloses the pelvic cavity.
- Contains the pelvic organs.
- It has : Inlet, Outlet, Pelvic walls.

**Contains the organs of the pelvis
-Between the pelvic inlet and the pelvic outlet



Pelvic Inlet (Pelvic Brim)

Huh? What is that

We can say it is the upper limit of the true pelvis

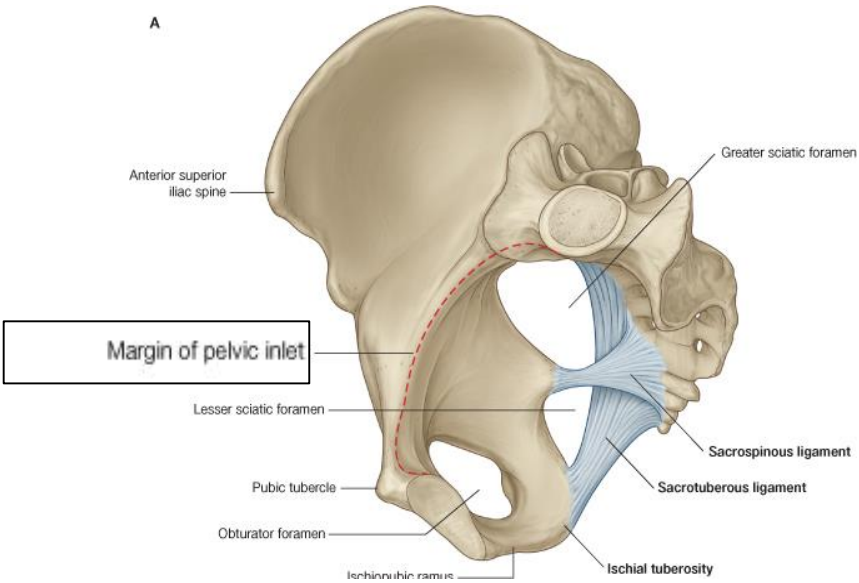
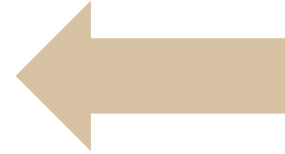
Or the cranial opening of the true pelvis

يعني تقريباً كأنني أقولك الحد العلوي للحوض (الحقيقي)

Bounded by:

- Sacral promontory
- Iliopectineal lines
- Symphysis pubis

نلاحظ نفس الي كان يفصل
الحوض العلوي (الكاذب) و
السفلي (الحقيقي) لأنه يمثل
الحد الأعلى للحوض الحقيقي
بما إن الحقيقي يبدأ من تحته



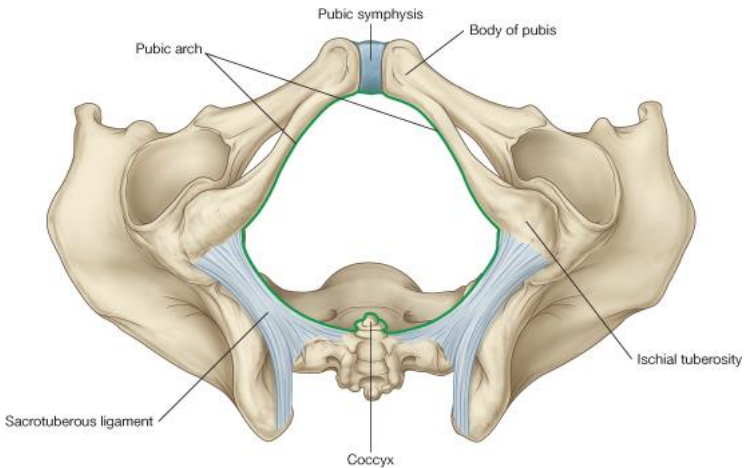
Pelvic Outlet

-the lower opening of the true pelvis

-the caudal opening of the pelvis

Bounded by:

- Coccyx
- Ischial tuberosities
- Pubic arches



Forensic Medicine & Bony Pelvis

For **identification** of human skeletal remains, the **bony pelvis** is of prime focus of attention because **sexual differences** are clearly **visible**. Even parts of the pelvis are useful in making a **diagnosis of sex**.

We can know the sex from skull, hip bone and the sacrum

يستطيع الطب الشرعي التمييز بين هيكل الأنثى والذكر من خلال
Bony Pelvis




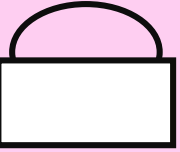

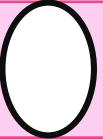
وعمومًا، حوض الأنثى أعرض من حوض الذكر
على أساس هذا المبدأ نقيس الفروقات بينهما
في الشريحة القادمة



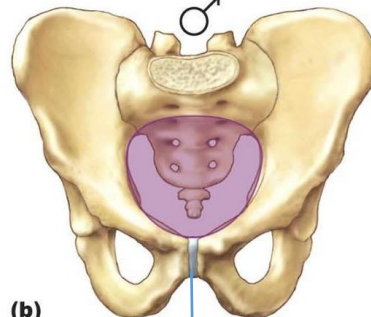
Male vs Female Pelvis

فيديو توضيحي ممكن تشوفونه قبل ما تنتقلون للشريحة
القادمة إلي فيها الفروقات



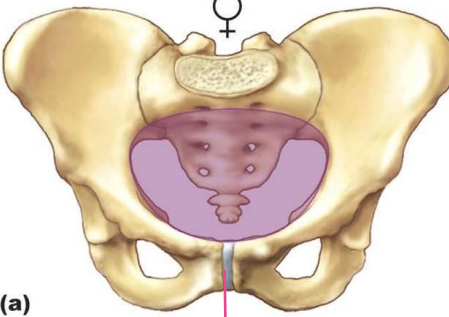
bony pelvis	Male	Female
1. General structure	Thick & heavy	Thin, Smaller, lighter
2. <u>False pelvis (major)</u>	Deep	Shallow
3. True pelvis (lesser)	Narrow & Deep	Wide & Shallow
4. Pelvic inlet	Heart shaped 	Oval or Rounded 
5. Acetabulum	Large	Small
6. Pubic arch & Subpubic angle	Narrow 	Wide 
7. Obturator foramen	Round	Oval
8. Pelvic outlet	Small 	Larger 

Male ♂






(b) زاوية حادة

Female ♀





(a) زاوية من قائمة إلى منفرجة



Pelvic cavity





Pelvic outlet is larger in female because of the everted ischial tuberosities

Sacrum	Longer Narrower More <u>curved</u>	Shorter Wider Less <u>curved</u>
		

Curved :
 تقوس إلى الأمام ويكون أقل عند الإناث لكي لا يشغل حيزاً فيسمح باتساع الحوض

When the iliac fossa is deep the false pelvis is deep also

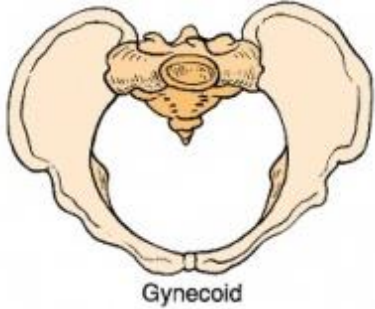
Heart shaped: Sacrum and the sacral promontory بارزات للأمام



Wide sacrum in females causes increased space between the 2 hip bones → wide pelvis

Types of Obstetrical Female Pelvis

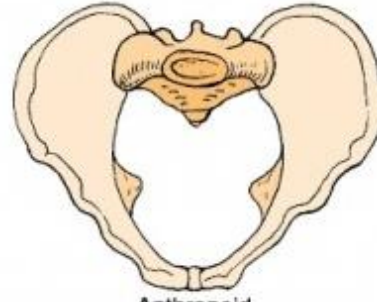
يختلف شكل الحوض من أنثى لأخرى وبالتالي تختلف طريقة الولادة.
فيما يلي الأنواع الأربعة لشكل الحوض عند الإناث.



Gynecoid

Typical female Type

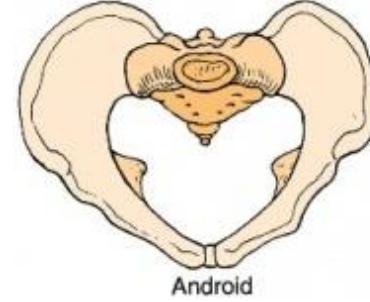
شائع عند أغلب النساء
تكون الولادة طبيعية بعد كل حمل



Anthropoid

Long, narrow
and oval shaped.

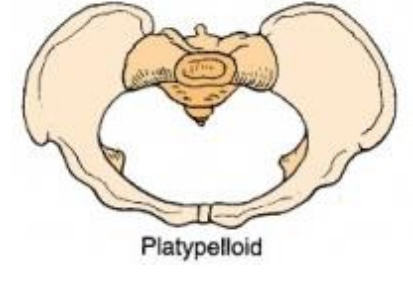
شبيه بالرجال



Android

Funnel shaped with
contracted outlet it
causes hazard خطورة
to normal vaginal
delivery

الولادة الطبيعية تشكل خطورة
في هذا النوع



Platypelloid

wide , flattened at
the brim
(with forward
promontory عند
صفة الرجال)

نادر

* summary

Bony pelvis (basin- shaped ring of bones)

1ry functions	2ry functions
<ol style="list-style-type: none"> 1. <u>Bears</u> the weight (standing/sitting) 2. <u>Transfer</u> weight to lower appendicular skeleton (standing/walking) 3. <u>Provides</u> attachments/withstands the forces of the muscles. 	<ol style="list-style-type: none"> 1. <u>Contains and Protects</u> the pelvic and abdominopelvic viscera 2. <u>Provides</u> attachment for reproductive organs and its muscles and membranes.

Pelvic girdle

- stronger and heavier than shoulder girdle (carries body weight and anti-gravity muscles)
- composed of Two Hip Bones
- each hip bone formed of 3 parts: (Ilium, Ischium, and Pubis). These 3 parts are joined at acetabulum.
- During childhood → separate bones, joined by “Y” shaped cartilage
- During puberty → fused together → single bone

Orientation of the pelvis = the correct position = anatomical position

Vertical plane	The anterior-superior iliac spine and the pubic tubercles are in the same plane
Horizontal plane	The coccyx and the upper margin of the pubic symphysis are in the same plane
Axis of the pelvic cavity	<ul style="list-style-type: none"> * runs through the central point of the inlet and the outlet * almost parallels the curvature of the sacrum
sacrum	directed forward and downward
Symphysis pubis	Directed upward and backward

Ilium

<u>Iliac Crest</u>	<ul style="list-style-type: none"> • Landmark below the waist. • It runs between the Anterior and Posterior <u>Superior Iliac Spines</u>
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Below, there are anterior and Posterior Inferior Iliac Spines

<u>Outer surface</u>	Rough and contains <u>3 gluteal lines</u>	
<u>Inner surface</u>	<u>Iliac fossa</u>	Encloses False pelvis
	<u>Auricular surface</u>	Ear-like, articulate with sacrum
	<u>Iliopectinial line</u>	Separates false and true pelvis

Ischium (posterior & inferior)

<u>Ischial Tuberosity</u>	Receive body weight in sitting (you can feel it if somebody sat in your lab)
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<u>Ischial spine</u>	superior to the tuberosity. it is important landmark in pregnant women
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Greater sciatic notch & Lesser sciatic notch

Pubis (anterior & inferior)

<u>Body</u>	<u>Pubic Crest</u>
	<u>Pubic Tubercle</u>
<u>Two pubic Rami</u>	superior & Inferior. they bound the <u>Obturator Foramen</u>
<u>Obturator Foramen</u>	closed partially by <u>obturator membrane</u>

Coccyx (4 vertebrae fused together forming a triangular piece)

Sacrum (wedge-shaped, 5 vertebrae fused together)

<u>Sacral Promontory</u>	anterior & upper margin
<u>4 Sacral Foramina</u>	anterior & posterior surfaces possess on each side.
<u>Sacral canal</u>	The fused vertebral foramina. its lower limit is the <u>Sacral Hiatus</u> .

Articulations of

Hip Bone	Symphysis Pubis	<ul style="list-style-type: none"> • Secondary cartilaginous joint • between the two pubic bones
	Hip Joints	<ul style="list-style-type: none"> • Synovia joint • between acetabulum and head of the femur
	Sacroiliac Joints	<ul style="list-style-type: none"> • Strong synovial joints. • between the auricular surfaces of both iliac bones and the sacrum.
Sacrum	Lumbosacral joint	<ul style="list-style-type: none"> • Between upper border of sacrum and L5
	Sacrococcygeal joint	<ul style="list-style-type: none"> • Between inferior part of sacrum and coccyx

Foramina in Bony Pelvis

Anterior sacral foramina (4)	<ul style="list-style-type: none"> • Present on the anterior surface of the sacrum • Through these foramina pass the anterior rami of the sacral spinal nerves
Greater and lesser sciatic foramina	greater and lesser sciatic notches + sacrotuberous and sacrospinous ligaments
Obturator foramen	<ul style="list-style-type: none"> • In living subjects, it is closed by obturator membrane except for a small opening, which represents the "<u>obturator canal</u>" • Obturator nerve passes Through this small opening

Fractures of the Bony Pelvis

weakest parts of the bony pelvis	Pubic rami, acetabula, region of sacroiliac joint, and alae of the ilium.
Result from	<ul style="list-style-type: none"> • Direct trauma " car accident" • forces transmitted to these bones from the lower limbs during falls on the feet.
It may lead to	injury to the pelvic soft tissues, blood vessels, nerves and organs

Subdivision of the Bony Pelvis by pelvic brim

True pelvis	<ul style="list-style-type: none"> • Lies <u>inferior</u> to the pelvic brim. • Encloses the <u>pelvic cavity</u>. • Contains the <u>pelvic organs</u>. 	<u>Pelvic Inlet = pelvic Brim</u> Bounded by: Sacral promontory, iliopectineal lines, and symphysis pubi
		<u>Pelvic outlet</u> Bounded by: Coccyx, ischial tuberosities, and pubic arches.
False pelvis	<ul style="list-style-type: none"> • Lies <u>superior</u> to the pelvic brim. • Enclosed by the <u>iliac fossa</u>. • Forms the <u>inferior region of the abdominal cavity</u>. • Houses the <u>Inferior abdominal organs</u>. 	

Bony pelvis

	In general	False pelvis	True pelvis	Pelvic inlet	Pelvic outlet	Subpubic angle	Obturator foramen	acetabulum
Male	Thick & heavy	Deep	Narrow & deep	Heart shaped	small	Narrow	round	large
Female	Thin & light	Shallow	Wide & shallow	Oval or rounded	Large	Wide	Oval	Small

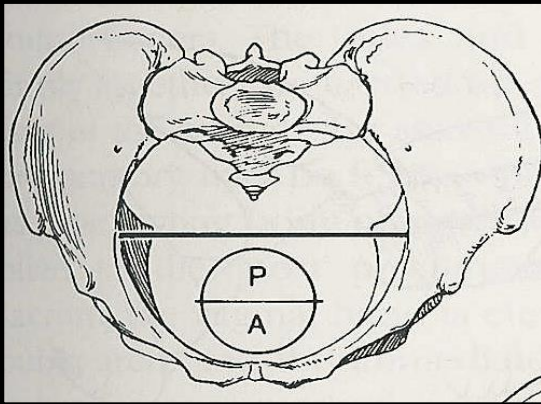
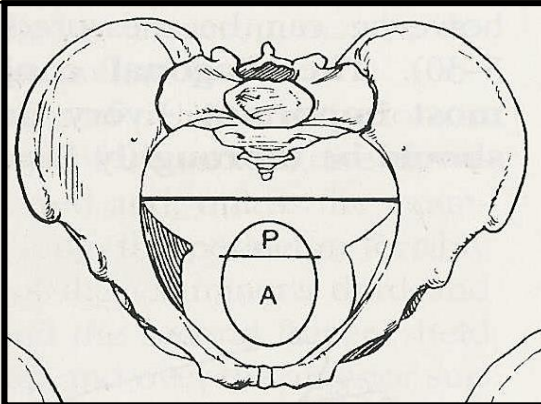
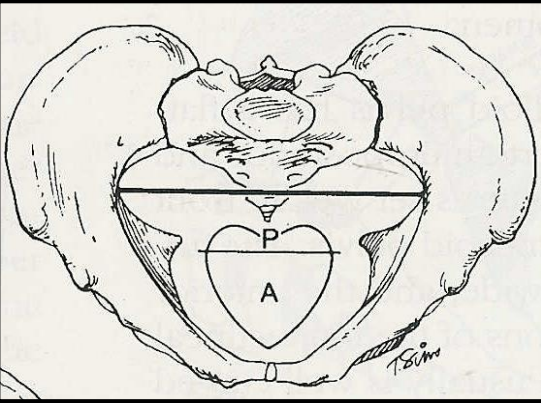
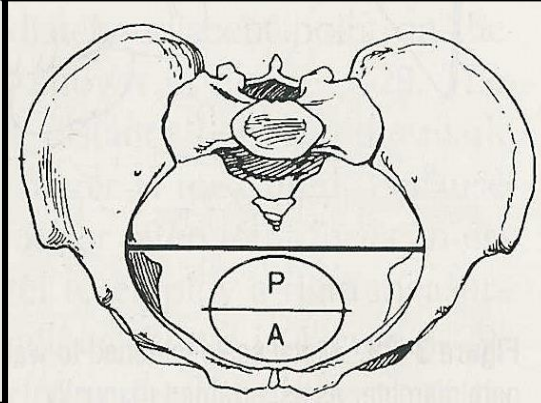
Sacrum

	Length	Breadth	curvature
Male	Longer	Narrower	More curved
Female	Shorter	Wider	Less curved

Forensic medicine & bony pelvis

the bony pelvis is of prime focus of attention because sexual differences are clearly visible. •
 parts of the pelvis are useful in making a diagnosis of sex. •

Types of Obstetrical Female Pelvis

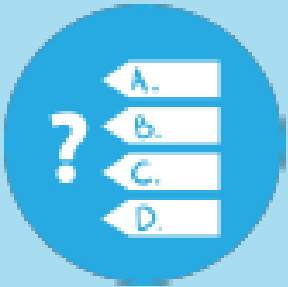
<p><u>Gynaecoid</u> The typical type</p>		<p><u>Anthropoid</u> Long Narrow oval shaped</p>		
<p><u>Android</u> Funnel shaped contracted outlet</p>		<p><i>Anatomy</i> TEAM 435</p>		<p><u>Platypelloid</u> Wide brim narrow outlet</p>



<http://youtu.be/0el6sINX0N8>

<https://www.youtube.com/watch?v=3v5AsAESg1Q>

<https://www.youtube.com/watch?v=a5NHHHW53kA>



<https://www.onlineexambuilder.com/pelvis-and-sacrum-2/exam-50484>

<https://www.onlineexambuilder.com/pelvis-and-sacrum-1/exam-50493>

هذا العمل إجتهد من طلاب و طالبات
إن أصبنا فمن الله وإن أخطأنا فمن أنفسنا و من الشيطان

TEAM MEMBERS:

Lamyia Alsaghan

Ola Alnuhayer

Johara Almalki

Nora AlRomaih

Lojain Alsiwat

Munira Alayuni

Sarah AlMutawa

Nouf Alabdulkarim

TEAM LEADERS:

Bodour Julaidan

Elham Alzahrani

Abdullah Alfuraih

- For questions and suggestions you can contact us on Anatomy435@gmail.com

