

Anatomy of the Female Pelvic Organs

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References: 437 Lectures And Notes , 436 teamwork

Color code: 437 Notes , 436 Notes | Important | Extra | Kaplan

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Objectives:

1. Describe anatomy of female bony pelvis & Diameters.
2. Discuss the important landmarks in the female pelvis.
3. To know the types of pelvis.
4. Comprehend the normal organs with their blood, venous, lymphatic drainage and innervation.
5. Explain the relationship between pelvic organs.
6. Understand the relationship between the female pelvis (Bones & Soft Tissue) and fetal skull, in order to understand the mechanism of labour.
7. Understand the major variant in the fetal circulation than that of the adult.
8. Know the significance of ductus venosus ductus arteriosus and the first breath.
9. Explain the changes that occur after birth.
10. Familiarize yourself with the placental structure.
11. Know the significance of placental and umbilical cord inspection after birth.
12. Differentiate between the different types of placental abnormalities and their significance.

Female Genitalia

Female External Genitalia (vulva): For any woman, regardless of her age, you should inspect the vulva area

*Doctor only mention the Bartholin gland

- **Mons veneris**¹ fatty tissue covered by skin, lays over the symphysis pubis
- **Labia majora**² 2 large fatty folds extend from Mons pubis to the perineum, the outer surface hairy and has sweat gland, the inner surfaces smooth and contain sebaceous gland, so they are likely to be inflamed for boils or cysts, abscesses
- **Labia minora** 2 smaller folds, contains glands. Labia divides into 2 folds anteriorly forming the clitoral hood and the frenulum of the clitoris. posterior ends of the labia minora terminate as they become linked together by a skin fold called the frenulum or fourchette
- **The clitoris**³ is formed from two corpora cavernosa and a glans of spongy erectile tissue
- **The vestibule**⁴ → is the area between the labia minora and the hymen it has six openings:

Urethral meatus, opening of two skene's ducts runs parallel to the urethral orifice for 6mm and open at the external urethral orifice, Vaginal orifice, and opening of two Bartholin ducts.

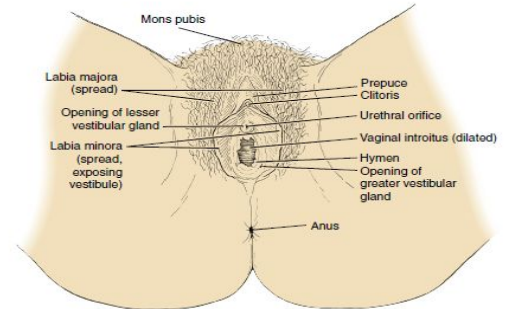


FIGURE 2.12 The female external genitalia, or vulva.

Bartholin glands “greater vestibular glands”

- lies on each side of the vagina, in the posterior lower third 1/3 of the introitus.
- Secrete mucus –alkaline

- **Bartholin cyst:** when the orifice of the Bartholin duct becomes obstructed, mucous produced by the gland accumulates, leading to cystic dilation proximal to the obstruction. Obstruction is often caused by local or diffuse vulvar edema. Bartholin cysts are usually sterile.
Management: is conservative unless pressure symptoms occur due to size. **Then we treated by “marsupialization”**
- **Bartholin abscess:** it may occur due to infection (mostly caused by E. coli and anaerobic Bacteroidesspecies, and seldom due to gonococcus). **Management:** Outpatient treatment is I&D with placement of a Word catheter under local anesthesia. The balloon is inflated and left in place for a month to allow a drainage tract to form. Antibiotic treatment is usually not needed.

Procedures of the vulva during labor: “ you need to know these procedures and their clinical indications”

- Catheterization
- Episiotomy
- Anaesthetic infiltration

¹cushion of fatty tissue, covered by skin and pubic hair, lies over the pubic symphysis

²male homologous = scrotum

³male homologous = glans of penis

⁴The cavity between the labia minora

Internal reproductive Organs

1/ Vagina

- A Canal/tube extends from the vulva to the uterus.
- Runs upwards and backwards
- Walls lie in close contact, easily separated. lay in transient folds and turns smooth in women who delivered vaginally Anterior vaginal wall is in direct relationship with the bladder and urethra, when there is a relaxation of the vaginal wall from repeated childbirth or having big babies previously or an increase in abdominal pressure you get vaginal prolapse. The **anterior vaginal wall** (the upper part) which is related to the bladder you get **cystocele** or **urethrocele**, while **posterior vaginal wall** you get **rectocele**.

Speculum examination inspection of the vagina with the aid of a bivalve speculum (Cusco's speculum)

- The posterior vaginal wall "11.5 cm (4.5 in)" is longer than the anterior wall "7.5 cm" in **Retroverted vagina, the anterior is longer than the posterior**
- Cervix enters the vagina at a right angle.
- Four fornices: Anterior, posterior **largest**, and 2 lateral
- In vagina only know the epithelium and acidity.
 - The covering epithelium of vagina is **non-keratinized squamous epithelium**, it's tough which lead to the acidity
 - The vagina is **acidic**. It has low PH= 4.5, so it's very difficult to get bacterial infections. This acidity is buffered by **menstrual cycle** so vagina becomes alkaline which makes it **prone to infections**.

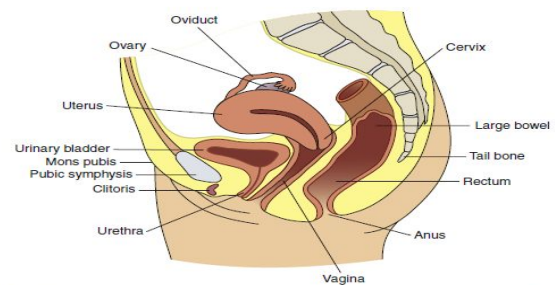
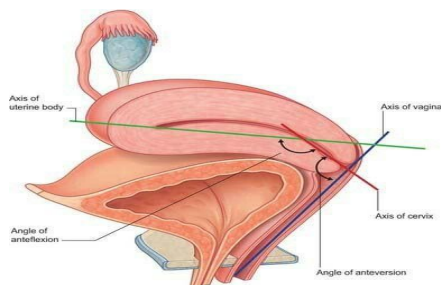


FIGURE 2.1 Side view of the female pelvic region showing some major components of the reproductive system.

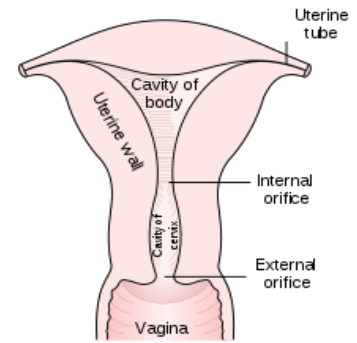
Relations:

Anterior	Posterior	Lateral
<ul style="list-style-type: none"> • Upper ½ of vagina: base of the bladder cystocele • Lower ½ of vagina: Urethra 	<ul style="list-style-type: none"> • The upper ⅓ is related to Pouch of Douglas • The middle ⅓ to Rectum rectocele • The lower ⅓ to Perineal body 	<ul style="list-style-type: none"> • Ureters • Uterine arteries




2/ Cervix

- Forms the lower 1/3 of the uterus.
- Enters the vagina at a right angle.
- Barrel shape.
- 2.5 cm (1 in) long
- Two parts: Supra vagina **above and outside the vagina** & Intra vaginal. **within the vagina**
- Cervical os: **Internal os** & **External os** **it is circular in a woman who has never given birth (nulliparous), transverse in multiparous female.**
- Cervical canal between the internal and external os.
- cervix is closed during pregnancy, if it opens abortion could happen
- STD in female genital tract could ascend to the cervix so pap smear screening test is done
- Transformation zone **vs** squamous-columnar junction. transformation zone is the common site of cervical malignancy so **when taking pap smear** you have to include it
- Cervical **Ectropion** **Overgrowth of the columnar epithelium on the squamous part (looks red because it is a single layer), it is a physiological phenomenon in reproductive aged women and women using OCP**



*doctor focused in the explanation

The cervix:

In pregnancy:	Late in pregnancy	In labor:
<ul style="list-style-type: none"> • Rich blood supply – bluish coloration • Soft • Cervical glands – mucus plug “operculum⁵” helps prevent infection 	<ul style="list-style-type: none"> • softer and starts to dilate 	<ul style="list-style-type: none"> • The longitudinal fibres of the uterus contract and retract pulling upward thus reducing the length of the cervix. • Cervical bishop score asses readiness or the ripeness of the cervix to see whether induction of labor will be required. The cervix is made up of fibrous and elastic tissue • Full dilatation of internal cervical os and shorten (effacement) marks the end of the first stage of labour.

3/ Uterus *doctor skip it

- The uterus lies in the true pelvis.
- Mostly Anteverted⁶ (A/V) and anteflexed⁷ (A/F) in position. **20% of women have retroverted uterus (tilted backwards) and it is not a problem.**
- The body of the uterus lies above the bladder.

⁵ a plug that fills and seals the cervical canal during pregnancy

⁶ angle between vagina and cervical canal

⁷ angle b/w junction of cervix and body of uterus

- Size:

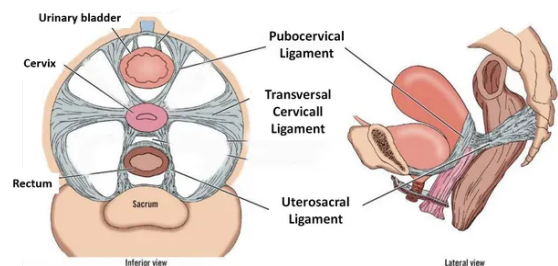
Length	Width	Thickness	Weight
7.5 cm	5 cm	2.5 cm	50 - 70 gm

- Layers: Endometrium mucous membrane, shed during menstrual cycle up to the basal layer- Myometrium divided into 3 layers (outer longitudinal, middle oblique, inner circular)- Perimetrium - peritoneum cover the entire uterus except the cervix
 - Adherent, where? Lateral uterine wall Loose??? Anterior isthmus allows loose cardinal ligament (allows c-section incision)
- Gross structures:
 - The cervix lower 1/3
 - The isthmus the internal os is the isthmus, which is 7 mm long. It enlarges during pregnancy to form the lower uterine segment and it is made up of fibrous tissue. In the time caesarean section we make a transverse incision in the LUS (lower segment Caesarean section). If the Caesarean section done prior 30 weeks there is naturally no LUS so we make an incision upper part of the uterus (hysterotomy)
 - cavity
 - The corpus
 - The cornua.
 - The fundus
- **The relationship between the ureter and uterine artery:** Uterine artery runs behind the peritoneum, cross transverse cervical ligament (Cardinal ligament) then it passes anterior to and above the ureter 1.5cm from lateral vaginal wall fornix. **Water under the bridge, important landmark** During surgeries (hysterectomy for example) the surgeon while ligation of uterine artery damages the ureter without knowing and that leads to hydronephrosis, progress to renal failure
- The patient is starting to have uterine contractions during pregnancy in the second trimester these contractions known as **braxton hicks contractions**. They usually occur infrequently and not painful

Supports of cervix and uterus:

1. Cardinal ligaments: if this ligament is effected then it will lead to uterine prolapse
2. Pubocervical ligaments
3. Uterosacral ligaments

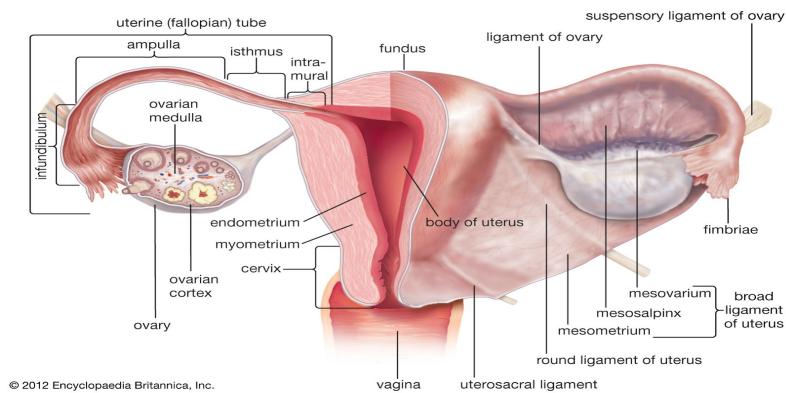
Only these 3 ligaments which support the uterus



4/ Fallopian Tube fallopian tumors are rare but tubal ligation has shown decrease in the incidence of ovarian tumors

- Extend from the cornua of the uterus, travels towards the sidewalls of the pelvis → then turns downwards and backwards.
- The tube lies in the upper margin of the broad ligaments
- Length 10 cm (4 in): 3 mm thick
- Communicate: superiorly with the uterine cavity and inferiorly with the perineal cavity
Tubal patency checked by different means

- 4 Parts: ✓ Isthmus ✓ Ampulla **fertilization zone** ✓ Infundibulum ✓ Fimbriae



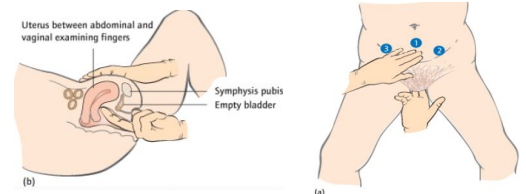
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5/ Ovaries not mentioned by the doctor

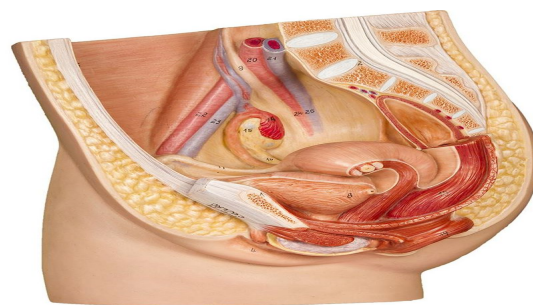
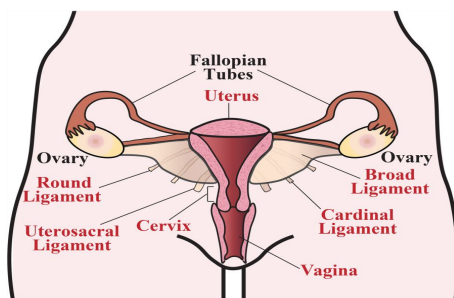
- Lie in the posterior wall of the broad ligament at the fimbrial end of the fallopian tubes at the level of the pelvic brim.
- Size: almond like = 3 x 2 x 1 cm
- Dull white colour, Corrugated surface
- Structure varies with woman's age.
- They lie in a fossa.

Support of ovaries:

- Attached to the **broad ligament⁸** (mesovarium)
- The mesosalpinx is the broad ligament that extend between the fallopian tube and the ovary.
- The Fallopian tubes, ovaries and broad ligaments are called Adnexa **Bimanual examination**



Ligaments



1. **Round ligaments:**
 - a. Maintain uterus in Anteverted A/V + anteflexed A/F position
 - b. From the cornua of the uterus – pass downwards and insert in the tissue of the labia majora.
2. **Broad ligaments:**

⁸ The broad ligament may be divided into 3 subcomponents: mesometrium, mesosalpinx, and mesovarium

- a. Not true ligament but folds of peritoneum extend laterally from the uterus to the pelvic side walls.
 - 3. **Cardinal** ligaments (transverse cervical ligament)
 - 4. **Pubocervical** ligament: Inserted into the lateral portion of the cervix and vagina.
 - 5. **Uterosacral** ligament: from posterior surface of pubis → cervix of uterus
- Round and broad ligaments don't support the uterus**

	⁹ Blood Supply	Venous drainage	Lymphatic Drainage	Nerves
Vulva	Pudendal artery from the femoral artery	Corresponding vein	- Inguinal glands - External iliac glands	Branches of the pudendal nerve, perineal nerve (T12, L1-2, S2-4)
Vagina	- Vaginal artery, - uterine artery, - middle hemorrhoidal, - - inferior vesical, - pudendal branch of the internal iliac a.	Corresponding veins	- Inguinal, - Internal iliac, - Sacral glands	Sympathetic (hypogastric plexus) and parasympathetic (S2-S4)
Cervix	Uterine artery	-	- Internal iliac, - sacral glands	-
Uterus	Fundus: ovarian artery Body: uterine artery, directly from internal iliac artery	- Right ovarian vein → inferior vena cava - Left ovarian vein → renal vein	- Internal and external iliac gland - Inguinal /Sacral gland	
Fallopian Tubes	- Ovarian artery - Uterine artery	corresponding veins	-	-
Ovaries	Ovarian artery	Right ovarian vein drains to IVC Left ovarian vein drains to left renal	Lumbar glands	Ovarian plexus

Female Pelvis

Normal Female Pelvis

- The pelvis articulates with the fifth lumbar vertebra above and with the head of each femur in the right and left acetabulum.

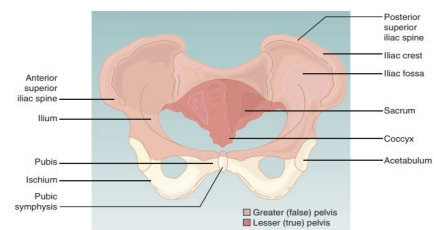


FIGURE 3-12 The bony pelvis.

⁹ Doctor skip the whole table except the ovaries

- The weight of the trunk is transmitted through the pelvis into the legs.
- Gives protection to the pelvic organs
- The pelvis is the largest bone in the body.
- **Gross structure: Consists of:**
 - 5 fused sacral vertebrae and coccyx
 - left & right innominate bones “hip bones”.
 - 4 pairs of holes (for passage of nerves, blood vessels/lymph)

Clinical pelvimetry : **Pelvimetry** assesses the size of a woman's pelvis aiming to predict whether she will be able to give birth vaginally or not. This can be **done** by **clinical** examination, or by conventional X-rays, computerised tomography (CT) scanning, or magnetic resonance imaging (MRI). we do not do x-ray instead of it we do **clinical** examination.

- we do vaginal examination we try to feel **The sacral promontory -> if you feel it she will not be able to give birth vaginally**
- feel the sacral curvature -> should be curve if it is flat **she will not** be able to give birth vaginally or diff
- on sides feel ischial spines and sacrospinous ligament -> should be soft and relax , you should not feel ischial spines
- feel pubic arch superiorly -> should accommodate 2 finger
- make fist and check for ischial tuberosity
- <https://www.youtube.com/watch?v=1whFvJ3wCYE>

Pelvic bones		
The Sacrum	The Coccyx	Right & Left Innominate Bones
<ul style="list-style-type: none"> ● Triangular shape ● The hollow of the sacrum is smooth and concave ● The ala of the sacrum: give the appearance of wings ● The sacral promontory: is the centrer point of the upper border of the first sacral vertebrae. ● The sacral canal opens at the level of 5th sacral vertebra, a passage for spinal cord. ● At the level of the 2nd and 3rd sacral vertebrae, the nerves spread out to form the cauda equina. ● Anaesthesia in labour¹⁰. 	<ul style="list-style-type: none"> ● 4 Fused coccygeal vertebrae ● Triangular shape ● Articulate with the sacrum ● Muscles are attached to its tip. 	<p>Each made of 3 separate parts meet in the acetabulum.</p> <ul style="list-style-type: none"> ● Ilium: upper part is iliac crest (anterior and posterior, superior iliac crest) ● Ischium: ischial tuberosity , 2 cm above is the ischial spines. ● Pubis: both meet the pubic body fused by cartilage “symphysis pubis”

¹⁰ Pain relief from perineal distention in stage 2 of labor, involves sacral roots, S2 to S4

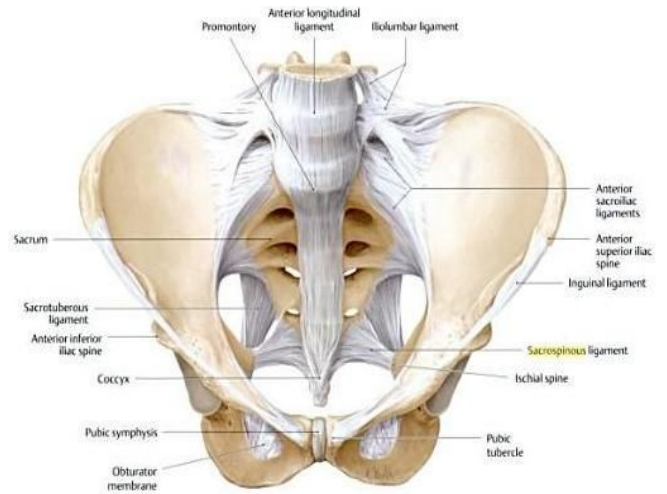
Pelvic Joints:

1. The two sacroiliac joints
2. The symphysis pubis
3. The sacrococcygeal joint

there are increase movement in joint due to progesterone secretion

Pelvic Ligaments:

1. Sacroiliac ligament = strongest in the body
2. Sacrotuberous ligament
3. Sacrospinous ligament
4. Inguinal ligament



Division of Pelvis

very important

- The pelvis has a brim (inlet), cavity, outlet, and forms the curved canal through which the fetus pass during labour.
- The brim divides the pelvis into the parts:

False	lies above the pelvic brim “not important in obstetrics”
True	what lies below the pelvic brim

1/ Pelvic Inlet:

- The inlet is Round in shape.
- Bounded: *anteriorly* by the pubis, *Laterally* by iliopectineal lines, *Posteriorly* by ala and sacral promontory.

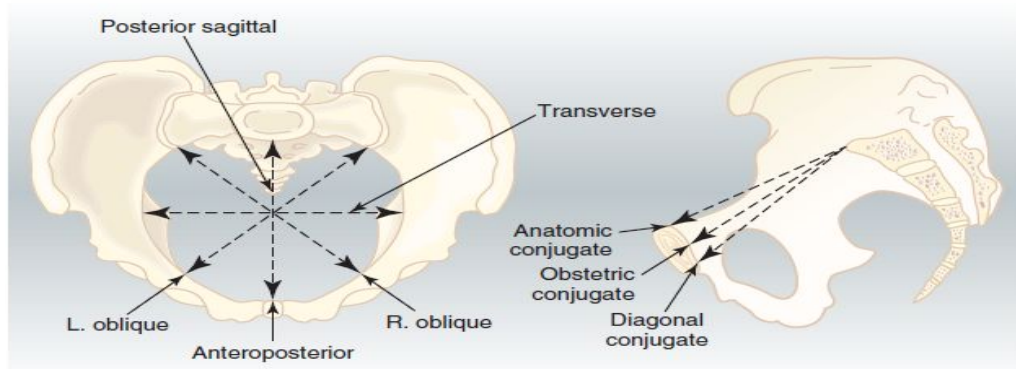


FIGURE 8-3 Pelvic inlet and its diameters.

- Pelvic Inlet has eight points, as demonstrated “figure 8-3”, formed by 5 important diameters:

1. The **anteroposterior diameter** is described by one of two measurements:
 - a. The true conjugate (**anatomic conjugate**) is the anatomic diameter and extends from the middle of the sacral promontory to the upper inner border of the pubic symphysis “11.5 cm”.
 - b. The **obstetric conjugate** represents the **actual space available** to the fetus and extends from the **middle of the sacral promontory** to the closest point on the convex **posterior surface of the symphysis pubis** “11 cm”.
 - c. The Diagonal Conjugate¹¹
2. The **transverse diameter** is the **widest diameter**. Measured by the widest distance **between the iliopectineal lines**.
3. Two **oblique diameters** (right or left) that extend from the sacroiliac joint to the opposite iliopectineal eminence.
4. The **posterior sagittal diameter** extends from the anteroposterior and transverse intersection to the middle of the sacral promontory.

2/ Pelvic Cavity (True Pelvis):

- Extends from the brim above to the pelvic outlet below .
- The **posterior wall** (11 cm): formed by hollow of the sacrum
- The **anterior wall** (3.8 cm): is formed by the symphysis pubis and obturator foramen
- The **lateral walls**: sacrosciatic ligament and ischial spines
- Interspinous Diameter is the diameter between the two ischial spines, considered the shortest diameter in the true pelvis.

3/ Pelvic Outlet:

Anatomical Outlet	Obstetrical Outlet
<p>The anatomical outlet is formed by fixed pointes useful landmarks for taking pelvic measurement.</p> <p>Bounded:</p> <ul style="list-style-type: none"> ● Anteriorly by pubic Arch ● Laterally by sacrosciatic ligaments & Ischial tuberosities ● Posteriorly by tip of Coccyx 	<p>The landmarks are:</p> <ul style="list-style-type: none"> ● The lower border of the symphysis pubis ● The ischial spines: this bony structure is used to determine whether the Fetal head is engaged during vaginal Examination ● The sacrospinous ligament ● The lower border of the sacrum.

¹¹ the anteroposterior dimension of the inlet that measures the clinical distance from the promontory of the sacrum to the inferior margin of the pubic symphysis, **measured manually per vagina or by ultrasonography**



Average measurements of pelvis:

	Brim	Cavity	Outlet
Anteroposterior or true conjugate	11.5 cm	12.0 cm	12.5 cm
Transverse	13.0 cm	10.5 cm	11.0 cm

Pelvis Shapes:

Gynecoid	Android	Anthropoid	Platypelloid
50%	25%	20%	5%

Pelvic Floor:

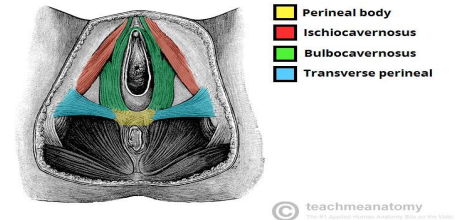
- The outlet of the pelvis is filled with a soft tissue that **supports** the pelvic and abdominal organs.
- It forms as a gutter-shaped structure highest anteriorly than posteriorly.
- Three canals with external orifices run through the tissue:
 1. The urethra
 2. The vagina
 3. The rectum

Perineum

- There are six layers of tissue:
 1. An outer covering of skin
 2. Subcutaneous fat
 3. Superficial muscles enclosed in fascia:
 - I. Transverse perinei
 - II. Bulbocavernosus (bulbospongiosus)
 - III. Ischiocavernosus
 4. Deep muscles enclosed in fascia:
 - Three pairs of muscles all have their insertion around the coccyx.
 - Their anatomical name is levator ani muscles (5 mm thick):
 - 1) Ilio-coccygeus
 - 2) ischiococcygeus
 - 3) pubo-coccygeus
 5. Pelvic fascia, thickened to form pelvic ligaments:
 6. Peritoneum

Perineal Body:

- Lies between the vaginal and rectal canals
- Triangular, the base is the skin and the apex pointing upward each side is 3.8 cm in length
- Perineal body attaches three layers of tissue:
 - outer covering of skin
 - superficial pelvic floor: a- bulbo-cavernous. b- transverse perinei
 - deep pelvic floor muscle



Episiotomy (types + indications):

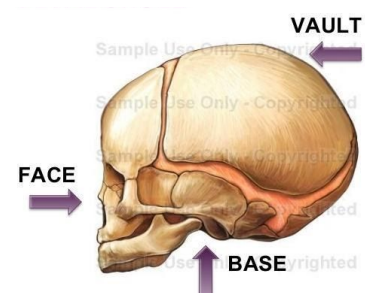
	Midline episiotomy	Mediolateral episiotomy
Procedure	incision is made in the middle of the vaginal opening, straight down toward the anus	incision begins in the middle of the vaginal opening and extends down toward the buttocks at a 45-degree angle
Advantage	easy repair and improved healing	risk for anal muscle tears is much lower
Disadvantages	increased risk for tears that extend through the anal muscles	more severe pain and difficult repair

Indications:

- ★ fetal weight greater than 4kg
- ★ operative delivery
- ★ shoulder dystocia
- ★ **Crowning of fetal head** (this will be explained in later lectures)

Fetal Skull

- Skull is divided into regions
 - The **vault**: formed from membrane and not cartilage.
 - The **face**
 - The **base**





- There are 5 points – ossification centres. Calcification begins as early as 5 weeks after conception. If a premature baby is born, there is a risk of intracranial damage!!!
- Bones:
 - Two frontal bones,
 - Two parietal bones,
 - **One occipital bone.**
- Bones are separated by? Sutures
- Suture, an area of membrane which has not ossified:
 - **Lambdoidal suture**
 - **Sagittal suture**
 - **Coronal suture**
 - **Frontal suture.**
- Fontanelles very important landmarks where two or more sutures meet.
 - Anterior fontanelle: diamond in shape where sagittal, frontal and coronal sutures meet. It looks like Mercedes logo **close after 18 months**

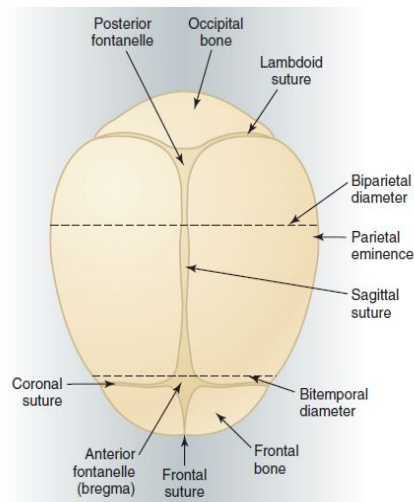


FIGURE 8-1 Superior view of the fetal skull showing the sutures, fontanelles, and transverse diameters.

if you feel anterior fontanelle that means head is not flex and delivery will be difficult

- Posterior fontanelle: Y or T shaped where lambdoidal and sagittal sutures meet. **posterior fontanelle tell us how baby lie if it is felt that mean the head is flexed it close after 6 wks**

When the baby is delivered the posterior fontanelle is already closed, while the anterior fontanelle will close later

Areas of the Skull:

1. Glabella: the bridge of the nose
2. Sinciput: the forehead
3. Bregma: the anterior fontanelle
4. Vertex
5. Lambda: the posterior fontanelle
6. Occiput
7. Suboccipital area
8. Mentum: the chin

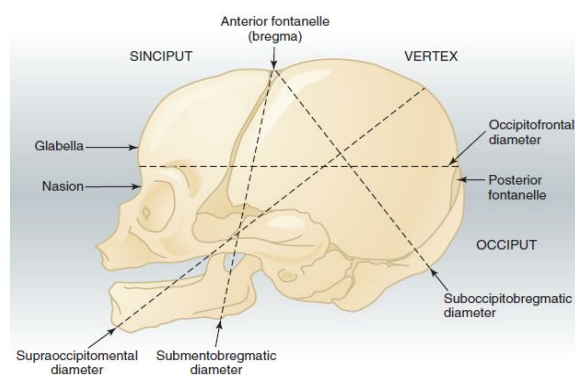


FIGURE 8-2 Lateral view of the fetal skull showing the prominent landmarks and the anteroposterior diameters.

Circumferences of the Fetal Skull:

- The engaging diameter in a **well flexed head**:
 - Suboccipito-bregmatic + Biparietal

Presentation	Attitude	Engaging diameter (cm)	Denominator
Vertex	Complete flexion	Suboccipitobregmatic (9-5)	Occiput
Occipitoposterior	Deflexion	Occipitofrontal (11-1)	Occiput
Brow	Partial extension	Verticomenal (13-5)	Frontum
Face	Complete extension	Submentobregmatic (9-5)	Mentum

- In Vertex presentation
- The engaging diameter in a **deflexed head** (partly extended)
larger diameter -> hard delivery
 - OccipitoFrontal + Biparietal
 - In Occipito posterior Position

Definitions

- Malposition: Abnormal position of fetal head in relation to maternal pelvis
- Malpresentation: Any presentation other than vertex
- Engagement of the head: passage of widest diameters of fetal head through the inlet of the pelvis/ brim.
- **Palpation of the head** (Cephalic presentation) by the abdomen, 5/5 palpable to 0/5, When it is $\frac{2}{5}$? the head is engaged

Diameters of Fetal Skull:

- Suboccipital-bregmatic
- Occipito frontal
- Mentoverical or Supraoccipitomenal
- Submento-bregmatic
- Biparietal **Largest transverse head diameter**
- **The normal position at delivery is occipito-anterior .**
- **What's the landmark in vertex ? Occipital bone**
- What's the engaging diameter in vertex ? Suboccipito-bregmatic. **How long is it? 9.5 cm**
- What's the landmark in face presentation? Mentum
- What's the engaging diameter in face presentation? Submento-bregmatic. How long is it? 9.5 cm.
- What's the engaging diameter in brow presentation? Mento-vertival. How long? 13.5 cm

Effect of Labour and Delivery:

- Molding

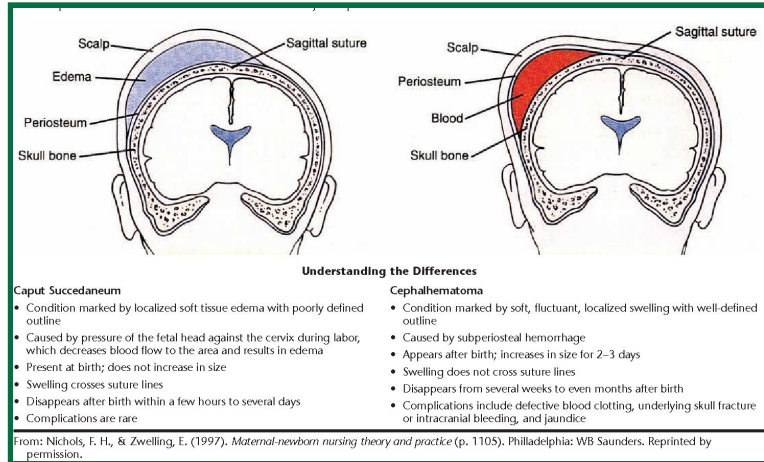
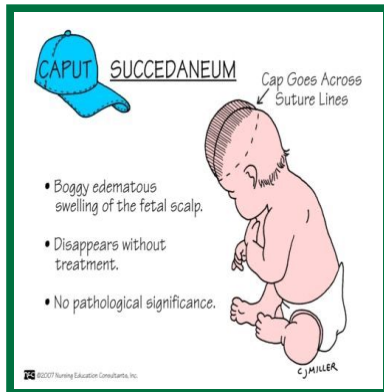
The five separate bones of the fetal skull are joined together by sutures, which are quite flexible during the birth, and there are also two larger soft areas called fontanelles . Movement in the sutures and fontanelles allows the skull bones to overlap each other to some extent as the head is forced down the birth canal by the contractions of the uterus. The extent of overlapping of fetal skull bones is called moulding grades :

0 Bones are separated and the sutures can be felt easily.

+1 Bones are just touching each other.

+2 Bones are overlapping but can be separated easily with pressure by your finger.

+3 Bones are overlapping but cannot be separated easily with pressure by your finger. This is dangerous, it is increasing ICP

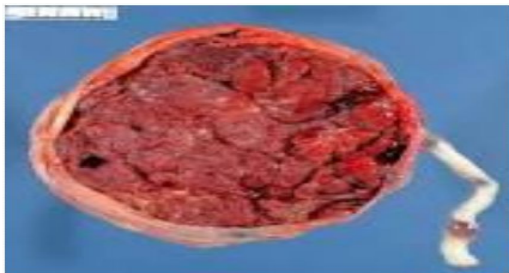


- Caput succedaneum
- Cephalhematoma

Placenta and Fetal Circulation

Structure of the Mature Placenta

- Flat, Roughly circular
- 22 cm in Diameter
- 2cm thick in the centre
- Weight: 1/6 of the baby's weight



Maternal Surface

- Lies next to the uterus on inspection
- Chorionic villi are arranged in lobes/cotyledons, their are 20 in number – 200 lobules.
- The groove separating the lobes are sulci
- Dark – red color, rough surface

Fetal Surface

- Faces the baby.
- Bluish gray colour, smooth, shiny surface.
- Umbilical cord inserted in the fetal surface usually in the centre. Blood vessels seen radiating from the cord
- The amniotic membranes covers the fetal surface.

Abnormalities of Placental Development:

- Placenta succenturiata
- Placenta bipartita
- Placenta circumvallata
- Placenta velamentosa
- Placenta succenturiata/ Placenta velamentosa and Vasa previa

Umbilical Cord

- At full term: 40-50 cm long, 1.5 cm in diameter
- Twisted in appearance.
- Two umbilical arteries and One umbilical vein.
- Wharton jelly¹²
- Abnormal insertion of the cord:
 - Battledore insertion
 - Velamentous insertion

Fetal Circulation

- How does the fetal circulatory system works?
- Two Major Events??

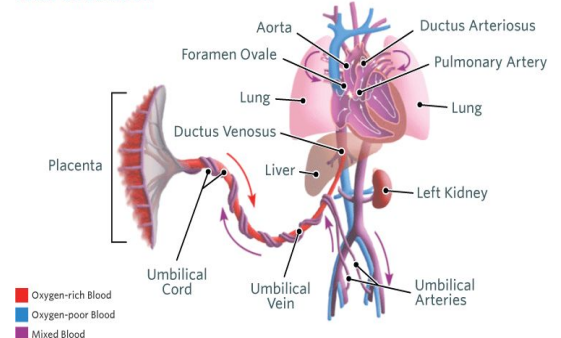
Recommended: [Fetal circulation right before birth](#) / [Baby circulation right after birth](#)

- The respiratory function of the placenta requires that oxygenated blood be returned via the umbilical vein and into the fetal circulation through this journey:

1- The umbilical vein, carrying oxygenated blood from the placenta (O₂ saturation 70-80%) to the fetal body, enters the portal system. A portion of this blood passes through the hepatic microcirculation, but the majority of the blood bypasses the liver through the ductus venosus, which directly enters the inferior vena cava. This mixes with returning non oxygenated blood from the lower limbs and kidney, liver. However, only partial mixing of the two streams.

2- Most of the oxygenated blood is directed to the crista dividens at the upper end of the inferior vena cava into the right atrium through the foramen ovale and thus into the left

Fetal Circulation



¹² A gelatinous substance made up of mucopolysaccharides (hyaluronic acid and chondroitin sulfate) that provides insulation and protection within the umbilical cord. Stem cells are present in Wharton's jelly, as well as in umbilical cord blood.

atrium and hence to the left ventricle and ascending aorta to be directed to the brain, heart and upper extremities. (SUMMARY: IVC → crista dividens → right atrium → foramen ovale → left atrium → left ventricle → ascending aorta → brain , heart and upper limbs)

3- The remainder of the blood from the superior vena cava mixes with that of IVC and passes directly to the right ventricle: 10% of it goes through the pulmonary artery to the lung, while most of this enters the systemic circulation via the ductus arteriosus and into the descending aorta beyond the vessels supplying the head. It supplies the viscera and lower limbs.

It then passes into the umbilical arteries (branches of left and right internal iliac arteries) (SUMMARY: SVC + IVC → right ventricle → ductus arteriosus → descending aorta → viscera and lower limbs)

- The fetal circulatory system uses three shunts:
 1. Ductus arteriosus: shunts mildly oxygenated blood from pulmonary artery to descending aorta
 2. Ductus venosus: shunts highly oxygenated blood from umbilical vein to the IVC , so this structure carries oxygen to fetal organs)
 3. Foramen ovale: shunts highly oxygenated blood from right atrium to left atrium
- Cardiovascular system major variants are explained by:
 - presence of umbilical-placental circulation and
 - absence of significant pulmonary circulation.
- What maintains patency of ductus arteriosus in utero?
High pulmonary vascular resistance maintains the right-left shunt through the ductus arteriosus

At birth:

- Blood circulation after birth:
 - the closure of the shunts (Ductus arteriosus & Foramen ovale) completes the transition of fetal circulation to newborn circulation.
- Umbilical vessels contract:
 - Cessation of umbilical blood flow causes a fall in pressure in the right atrium. The foramen ovale is a valvular opening, the valve functioning from the right to left.
 - The left atrial pressure rises and thus closure of the foramen ovale.
- Breathing:
 - Ventilation of the lung helps to create a negative thoracic pressure, this opens the pulmonary circulation and thus diverts blood from ductus arteriosus then gradually closes.

MCQs

1. What is the landmark in vertex position?
a) Brigma b) mentum c) occipital bone
2. What's the engaging diameter in face presentation?
a) Suboccipital-bregmatic b) Submento-bregmatic c) Supraoccipitomenal
3. which of the following ligaments does not support the uterus?
a) cardinal ligaments b) round ligament c) broad ligaments
4. which of the following is an important landmark in labor?
a) Symphysis pubis b) ischial tuberosity c) ischial spine
5. In average pelvis measurement, which side is larger in pelvic outlet?
a) Anteroposterior b) Transverse
6. Which pelvic shape allow the fetus to pass through easily?
Android b) Anthropoid c) Gynecoid

Answers:

1- C. 2- B. 3- B+C. 4- C. 5- A. 6- C.