

433 Teams

OBSTETRICS & GYNECOLOGY

**Anatomy of the Female Pelvic Organs
&
Fetal circulation.**

433OBGYNteam@gmail.com



جامعة
الملك سعود
King Saud University



Aims:

- To fully understand the anatomy of the female pelvis in terms of bones and tissues, and fetal skull, this would help in explaining the mechanism of Labor.

Objectives:

❖ Student at the end of session should be able to:

1. Describe the anatomy of female bony pelvis and diameters
2. Discuss the important landmarks and anatomy in the female pelvis that play important role in the progress of normal vaginal delivery.
3. Understand the relationship between the female pelvis (Bones & Soft Tissue) and fetal skull, in order to understand the mechanism of labour
4. List the types of female pelvis and the importance of pelvic shape in normal vaginal delivery
5. describe the fetal skull anatomy, landmarks and diameters that are involved in vaginal delivery
6. Identify the blood supply, venous drainage, innervation and lymphatic drainage of female organs.

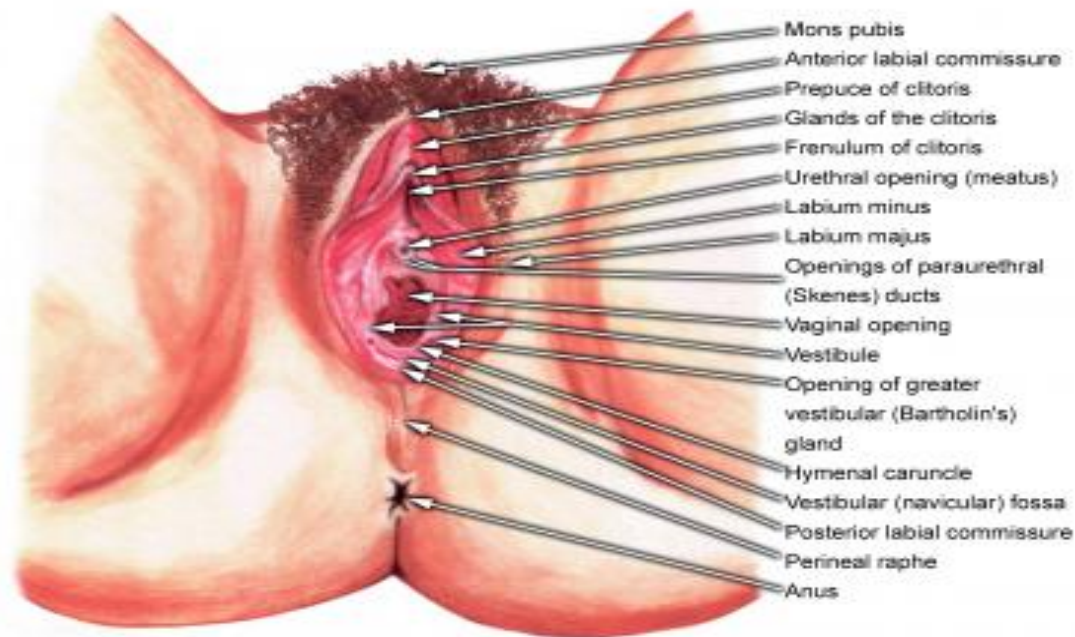


Useful definitions

- **Lie of the fetus:** the longitudinal axis of the fetus with respect to the longitudinal axis of the mother.
- **Attitude:** position of fetal limb, body and head with respect to each other
- **Denominator:** Occiput in cephalic presentation
- **Presentation:** the part of the fetus nearest to pelvic inlet
- **Malpresentation:** any presentation other than vertex (Brow, face, breech, shoulder) to maternal pelvis
- **Position:** relationship of the denominator
- **Malpoistion:** incorrect positioning of the vertex
- **Station:** level of descent of the presenting part with respect to the maternal pelvis (reference point; ischila spines)
- **Engagement of the head:** passage of widest diameters of fetal head through the inlet of the pelvis/ brim
- **Parogram:** graphic presentation of labour against time.
- **Dystocia:** difficult labour
- **Pelvimetry;** Clinical and X-ray
- **Engagement of the head**
- **Cephalo-Pelvic disproportion(CPD**



The Vulva: External organs of the female



Include:

- ✓ Mons veneris
- ✓ Labia majora
- ✓ Labia minora
- ✓ The clitoris
- ✓ The vestibule

The vestibule has six openings:

- ✓ Urethral meatus
- ✓ Two skene's ducts
- ✓ Vaginal orifice
- ✓ Two Bartholin ducts.

Bartholin glands : lies on each side of the vagina, in the posterior lower third 1/3 of the interior of the vulva.

Secrete mucus: alkaline

Blood supply: Pudendal artery from the femoral a Venous drainage in the corresponding vein.

Lymphatic:

1- inguinal glands

2- External iliac glands

Nerves: Branches of the pudendal nerve, perineal nerve (T12 L1-2, S2-4)

In labour: Catheterization, Episiotomy, Anaesthetic infiltration

The vagina

A Canal/tube extend from the vulva to the uterus

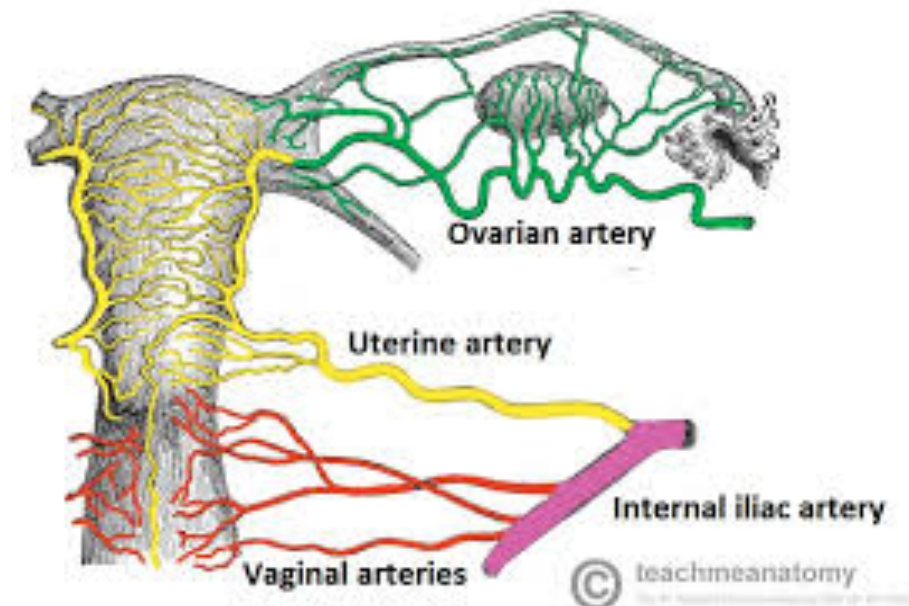
- Runs upwards and backwards
- Walls lie in close contact, easily separated.

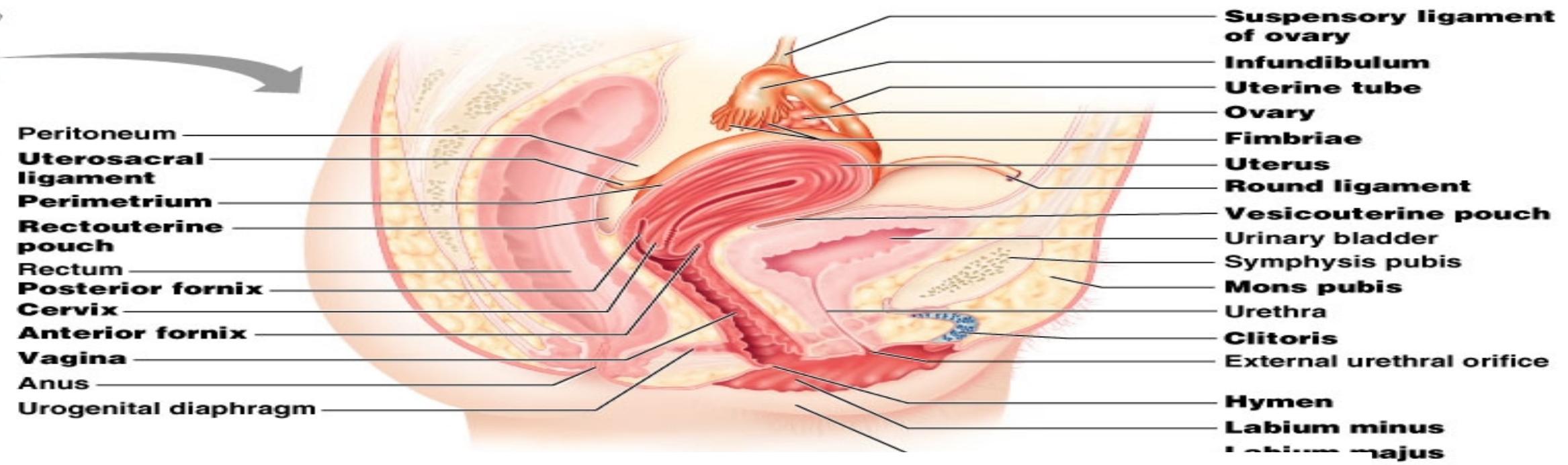
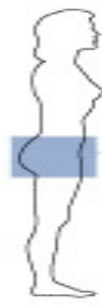
Speculum examination

- The posterior vaginal wall is longer than the anterior 11.5 cm (4.5 in) vs 7.5 cm
- Cervix enters the vagina at a right angle.
- Tornices = four (Anterior, posterior, lateral)

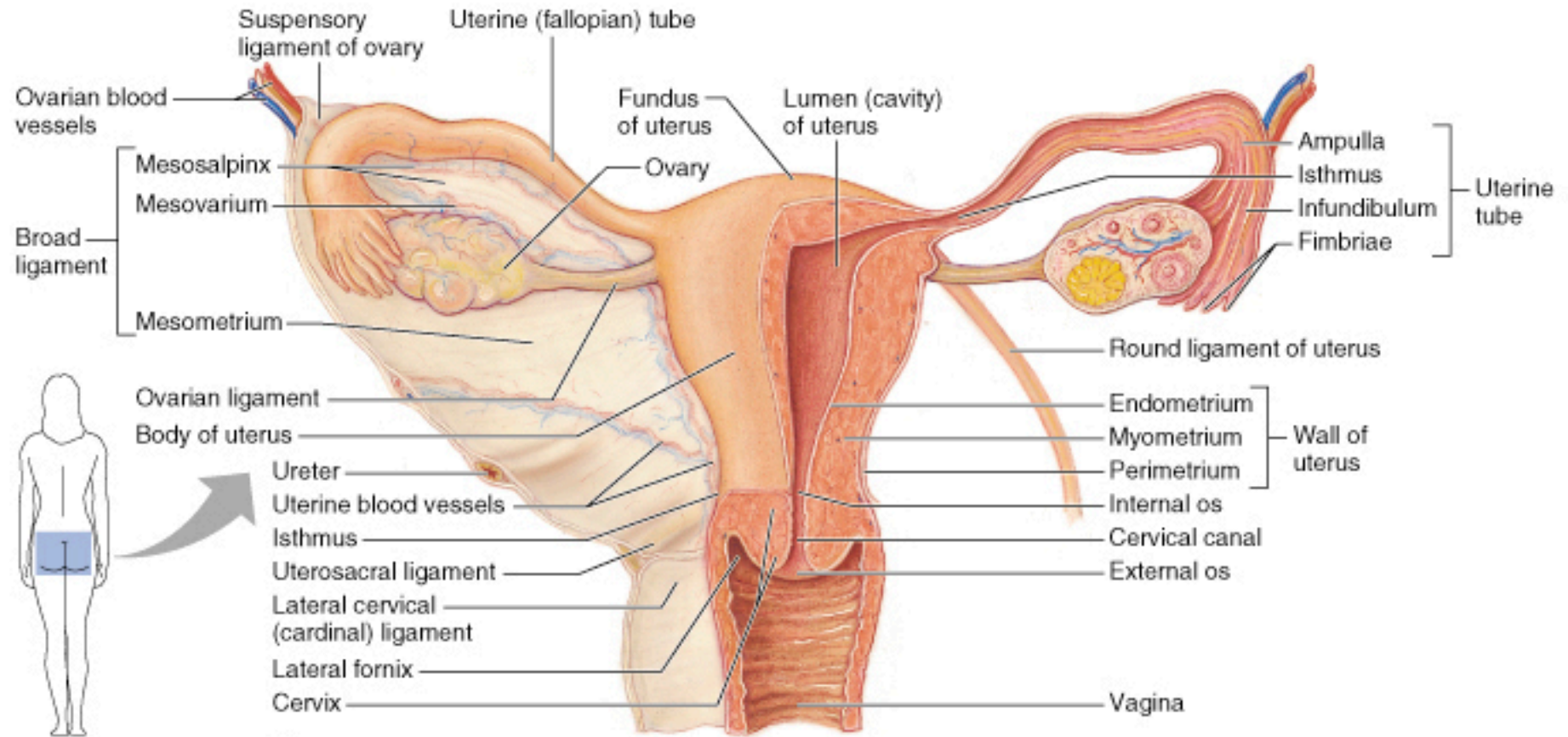
Blood supply

- Vaginal aa, uterine aa, middle haemorrhoidal, inferior vesical, pudendal branch of the internal iliac aa.
- Venous drainage to corresponding veins.
- **Lymph:** inguinal, internal iliac, sacral glands
- **Nerves:** sympathetic and parasympathetic
- **Relations:**
 - Anterior:** base of the bladder on upper ½ of vagina.
 - Posterior:** Pouch of Douglas in the lower ½
 - Rectum centrally
 - Perineal body inferiorly





Copyright © 2004 Pea



(a)

Copyright © 2001 Benjamin Cummings, an imprint of Addison Wesley Longman, Inc.

The Cervix

Forms the lower 1/3 of the uterus

- Enter the vagina at a right angle
- Barrel shape
- 2.5 cm (1 in) long
- **Two parts:**
 - Supravaginal
 - Intra vaginal
- **Cervical os**
 - Internal os
 - External os
- Cervical canal between the internal os and the external os
- Transformation zone; squamous-columnar junction.

Blood supply: Uterine aa

Lymphatic drainage: Internal iliac, sacral glands

Innervation: nerve supply to the pelvis is broadly arranged as lumbar and sacral plexus formed from ventral rami of spinal nerves

The Cervix

Supports:

- Cardinal ligaments
- Pubocervical ligaments
- Uterosacral ligaments

In pregnancy:

- Rich blood supply – bluish coloration
- Soft
- Cervical glands – mucus plug “operculum”

Late in pregnancy – softer and starts to dilate.

In labor:

- The longitudinal fibres of the uterus contract and retract pulling upward thus reducing the length of the cervix.
- The cervix is made up of fibrous and elastic tissue
- *Full dilatation marks the end of the first stage of labour.*

The Uterus

The uterus lies in the true pelvis.

Anteverted (A/V) and anteflexed (A/F) in position.

The body of the uterus lies above the bladder.

Size:

- i. Length: 7.5 cm
- ii. Wide: 5 cm
- iii. Thick: 2.5 cm
- iv. Weight: 50 - 75 gm

Gross structure:

- i. The cervix lower 1/3
- ii. The isthmus
- iii. The cavity
- iv. The corpus
- v. The cornua
- vi. The fundus

Layers:

Endometrium

Myometrium

Perimetrium - peritoneum

Adherent, where??? Loose,???

Blood supply:

Arteries:

Fundus - ovarian artery (aa)

Body - uterine aa, directly from internal iliac aa

The relationship between the ureter and uterine aa

❖ Uterine aa runs behind the peritoneum, crosses transverse cervical ligament (Cardinal ligament) then the aa pass anterior to and above the ureter 1.5cm from lateral vaginal wall fornix

Venous:

Right ovarian vein - inferior vena cava

Left ovarian vein - renal vein

Lymph:

internal and external iliac gland

inguinal / Sacral gland

THE FALLOPIAN TUBE

- 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
- **Communicate**; superiorly with the uterine cavity, Inferiorly with the perineal cavity
- Length 10 cm (4cm) : 3 mm thick
- **4 PARTS**
 - i. Interstitial
 - ii. Ampula
 - iii. Infundebulum
 - iv. Fimbrial
- **BLOOD SUPPLY:**
 - i. ovarian aa
 - ii. Uterine aa
 - iii. Venous drainage by corresponding veins

The Ovaries

- Lie in the posterior wall of the broad ligament at the fibrial 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.
- **Blood supply**
 - i. Ovarian aa
 - ii. Ovarian vein
- **Lymphatic:** Lumbar glands
- **Nerves:** Ovarian plexus
- **SUPPORTS:**
 - i. They lie in a fossa
 - ii. Attached to broad ligament – meso ovarian
 - iii. The meso salpinx is the broad ligament that extend between the fallopian tube and the ovary.
- **The Fallopion tubes, ovaries and broad ligments are called *Adenxa***

Ligaments

- **Round ligaments:**
 - i. Maintains uterus in A/V + A/F
 - ii. From the cornua of the uterus – pass downwards and insert in the tissue of the labia majora.
- **Broad ligaments:**
 - i. Not true ligament
 - ii. Folds of peritoneum extend laterally from the uterus to the pelvic side walls.
- **Cardinal ligaments:**
 - i. Pubocervical
 - ii. Uterosacral

THE NORMAL FEMALE PELVIS

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

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

4 pairs of foramen(nerves, blood vessels/lymph)

Bones joined by cartilage in the young and bone in adult

The Sacrum

A triangular shape; articulate with 5th lumbar vertebra.

The hollow of the sacrum – smooth and concave

The alae of the sacrum - give the appearance of wings.

- The sacral promontory** is the centre 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 labour**

Right & Left In-nominate Bones

- Each made of 3 separate parts meet in the acetabulum.
 - Ilium*: most immanent, 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”

All three bones meet at the acetabulum.

- **PELVIC JOINTS**

- The two sacroiliac joints
- The symphysis pubis
- The sacrococcygeal joints

- **THE PELVIC LIGAMENTS**

- Sacroiliac ligament = strongest in the body
- Sacro tuberos
- Sacro spinous
- Inguinal ligament

THE COCCYX

- 4 Fused coccygeal vertebrae
- Triangular shape
- Articulate with the sacrum
- Muscles are attached to its tip.

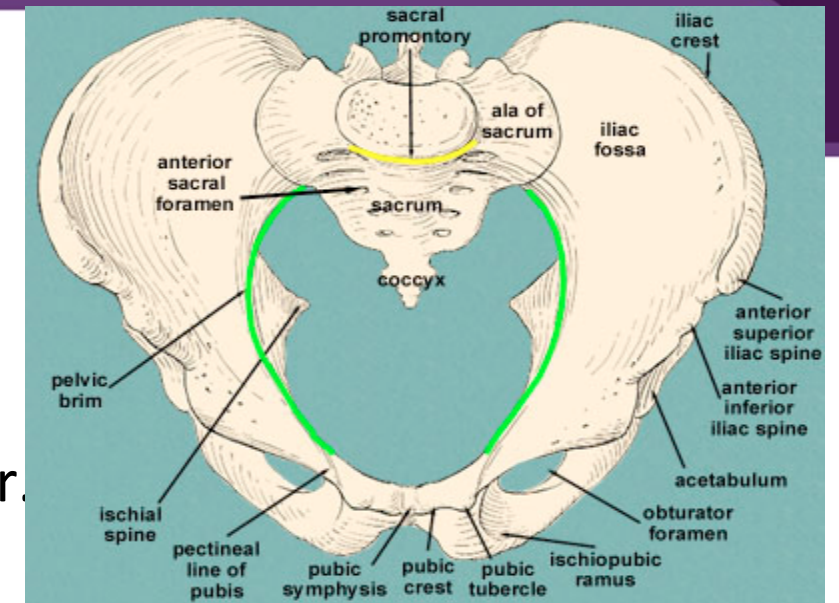
DIVISIONS OF THE PELVIS

The brim divides the pelvis into two parts:

- ❖ **The false:** lies above the pelvic brim, not important in obstetrics
- ❖ **The true:** what lies below the pelvic brim.

It has a : cavity, outlet and a brim

- Forms the curved canal through which the fetus pass during labour.



The brim or inlet (Round in shape)

- Bounded:
 - anteriorly by the pubis
 - Laterally by iliopectineal lines
 - Posteriorly by ale and sacral Promontory
 - Widest diameter is, Transverse
- **True Conjugate:** (Anteroposterior diameter) from sacral promontory to upper inner border of Symphysis pubis.
- **Diagonal Conjugate:** From sacral promontory to under border of symphysis pubis.

The Pelvic cavity

- Extend from the brim above to the pelvic outlet below
- The posterior wall, 11 cm formed by hollow of the sacrum
- The anterior wall is formed by the symphysis pubis and obturator foramen 3.8 cm
- The lateral walls sacrosciatic ligamnets and ischial spines
- Interspinal Diameter

The pelvic outlet

- i. Anatomical outlet
- ii. Obstetrical outlet

The anatomical outlet

- is formed by fixed points, useful landmarks for taking pelvic measurements.
- Bounded:
 - i. anteriorly by pubic Arch
 - ii. Laterally by sacrosiatic lig&Ischail Tuberosity
 - iii. Posteriorly by tip of Coccyx

The obstetrical outlet

- The landmarks are:
 - i. The lower border of the symphysis pubis
 - ii. The ischial spines
 - iii. The sacro-spinous ligament
 - iv. The lower border of the sacrum.

Pelvic Floor

- **There are six layers of tissue.**

1. An outer covering of skin
2. Subcutaneous fat
3. Superficial muscles enclosed in fascia
4. Deep muscles enclosed in fascia
5. Pelvic fascia, thickened to form pelvic ligaments
6. Peritoneum

- **Superficial muscles:**

- 1) Transverse perinei
- 2) Bulbo-cavernosus
- 3) Ischio-cavernosus

- **Deep muscles**

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. ischio coccygeus
3. pubo- coccygeus

The 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

Perineal body

- Lies between the vaginal and rectal canals
Is triangular, the base is the skin and the apex pointing upward each side is 3.8 cm in length

Three layers of tissue

1. outer covering of skin
2. superficial pelvic floor
 - bubo-cavernous
 - transverse perinei
3. deep pelvic floor muscle.

Episiotomy, types, indications,

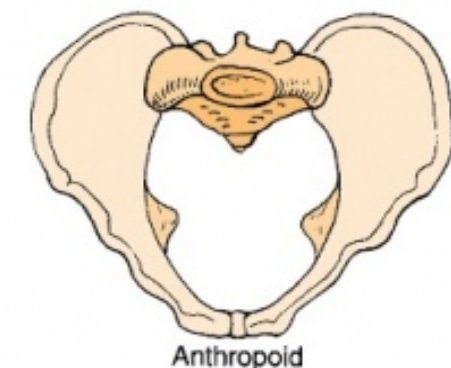
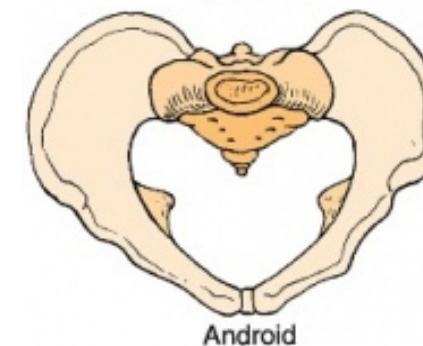
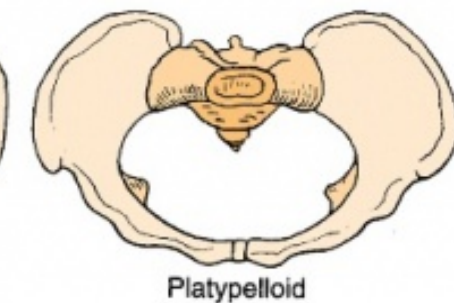
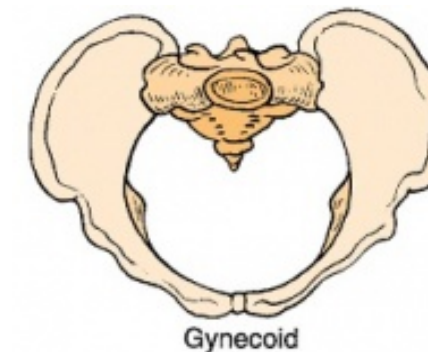
Average measurements of pelvis

- **Brim:**
Antero-posterior = 11.5 cm
Transverse = 13.0 cm
- **Cavity:**
Antero-posterior = 12.0 cm
Transverse (I/S) = 10.5 cm
- **Outlet**
Antero-posterior = 12.5 cm
Transverse = 11.0 cm

Types of Pelvis

Four Types

- Gynaecoid Pelvis 50%
- Anthropoid 25%
- Android Pelvis 20%
- Platypelloid (flat) 5%



FETAL SKULL

- **Vault of fetal skull** –from orbital ridge to nape of neck(frontal, parietal, occipital) membranes and not cartilage
- There are 5 points – ossification centers
- Calcification begins as early as 5 weeks after conception
- Premature baby is born, intracranial damage!!!!
- Skull is divided into **regions**:
 - ❖ The vault.
 - ❖ The face.
 - ❖ The base
- **Bones**:
 - Two frontal bones
 - Two parietal bones
 - One occipital bone

Suture, an area of membrane which has not ossified

- Lambdoid suture
- Sagittal suture
- Coronal suture
- Frontal suture
- Temporal suture

- **Fontanelles very important landmarks**

Areas where two or more sutures meet.

- **Anterior fontanelle**, diamond in shape where sagittal and frontal sutures meet (Bregma)
- **Posterior fontanelle**, where lambdoid and sagittal sutures meet (lambda).

CIRCUMFERENCES OF THE FETAL SKULL

- The engaging Diameter in a well flexed head:
suboccipito-bregmatic+ Biparietal / In Vertex presentation

From nape of neck to centre of Bregma 9.5cm

- The engaging Diameter in a Deflexed head (partly extended)

OccipitoFrontal+Biparietal/ In Occipito posterior Position

From root of nose to occipital protuberance 11.5 cm

- The engaging Diameter in extended head

Submento bregmatic + Biparietal

In Face presentation

Root of nose to junction of head and neck 9.5 cm

- The engaging Diameter in Brow presentation

Mento vertical

From point of chin to posterior fontanelle 14 cm

AREAS OF THE SKULL

1. Glabella: the bridge of the nose/ root of nose
2. Sinciput : the forehead/ Brow
3. Bregma: the anterior fontanelle
4. **Vertex**
5. Lambda: the posterior fontanelle
6. Occiput
7. Suboccipital area
8. Mentum: the chin
9. *Malposition*
10. *Malpresentation*

DIAMETERS OF FETAL SKULL

Bipareital

1. Bitemporal
2. Suboccipital-bregmatic
3. Occipito frontal
4. Mentovertical
5. Submento-bregmatic

Effect of Labour and delivery

- **Moulding:** the change in the shape of the fetal skull as it adapts to the birth canal in labour
- **Caput succedaneum:** oedema forms in the fetal scalp subcutaneous tissues during labour
- **Cephalhaematoma:** swelling due to bleeding between the skull bones and the periosteum.

AIMS

1. To predict and thus prevent postpartum haemorrhage related to the placenta
2. To understand the major events in fetal circulation; during pregnancy and after birth

Objectives:

Student at the end of session should be able to:

- Understand the major variant in the fetal circulation than that of the adult
- Know the significance of ductus venosus ductus arteriosus and the first breath.
- Explain the changes that occur after birth.
- Familiarize yourself with the placental structure.
- Know the significance of placental and umbilical cord inspection after birth
- Differentiate between the different types of placental abnormalities and their significance

Describe the placental transfer of oxygen and CO₂ of the fetal circulation.

- Describe components of the fetal circulation.
- Explain how the fetal circulation differs from the adult circulation.



The placenta

Structure of the mature placenta

Maternal surface lies next to the uterus on inspection, chorionic villi are arranged in lobes/cotyledons – 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.

Structure of the mature placenta

1. Flat, Roughly circular
2. 22 cm in Diameter
3. 2cm thick in the centre
4. Weight: 1/6 of the baby's weight

The circulatory system of the mother is not directly connected to that of the fetus, so the placenta functions as the respiratory center for the fetus

As well as a site of filtration for plasma nutrients and wastes. Water, glucose, amino acids, vitamins, and inorganic salts freely diffuse across the placenta along with oxygen.

The uterine arteries carry oxygenated blood to the placenta, and permeates the sponge like material there.

Abnormalities of placental development.

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

Foramen Ovale

- Blood is shunted from right atrium to left atrium, skipping the lungs.
- More than one-third of blood takes this route.
- a valve with two flaps that prevent back-flow

Umbilical cord:

- At full term: 40-50 cm long
1.5 cm in diameter
- Twisted in appearance
- Two umbilical arteries
- One umbilical vein
- Wharton jelly
- Abnormal insertion of the cord
 - Battledore insertion
 - Velamentous insertion
- 2 umbilical arteries:
- Return non-oxygenated blood, fecal waste, CO₂ to placenta
- 1 umbilical vein : brings oxygenated blood and nutrients to the fetus

Facilitates gas and nutrient exchange between maternal and fetal blood.

The respiratory function of the placenta requires that oxygenated blood be returned via the umbilical vein and into the fetal circulation.

High venous return from the placenta (oxygenated blood O₂ saturation 70-80%) through the umbilical vein.

Delivers most oxygenated blood to fetal heart and brain.

This maintains the right-left shunt through the foramen ovale

10% of it goes through the pulmonary artery to the lung.

The remainder of the blood from the superior vena cava mixes with that of IVC and passes directly to the right ventricle.

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 atrium and hence to the left ventricles and ascending aorta to be directed to the brain, heart and upper extremities.

Most of the blood into the inferior vena cava (IVC), this mixes with returning non oxygenated blood from the lower limbs and kidney, liver. However, only partial mixing of the two streams.

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)

High pulmonary vascular resistance maintains the right-left shunt through the ductus arteriosus.

How does the blood move??

- Umbilical vein carries oxygenated blood and nutrients from the placenta to the fetus.

How is the blood dispersed??

- ½ Of the blood enters the liver while the other half comes into the ductus venosus and then into the inferior vena cava

What is happening further down??

- Common iliac arteries branch into the external and internal iliacs.
- The blood in the internal iliacs come into the umbilical arteries and flow back to the placenta to gather oxygen and to get rid of the waste products
- Some of the blood moves from the aorta through the internal iliac arteries to the umbilical arteries, and re-enters the placenta, the maternal circulation

What happens after birth?

Once the baby is born and the lung, renal, digestive and liver functions are working the fetal circulation undergoes some changes since they are no longer needed

What happens to these special structures after birth?

- Umbilical arteries atrophy
- Umbilical vein becomes part of the fibrous support ligament for the liver
- The foramen ovale, ductus arteriosus, ductus venosus atrophy and become fibrous ligaments

Fetal circulation

Cardiovascular system

Major variant are explained by:

☐ the presence of umbilical-placental circulation

and

☐ absence of significant pulmonary circulation.

- Low pressure system
- Lungs are closed
- Most oxygenated blood flows between the atria of the heart through the foramen ovale
 - This oxygen rich blood flows to the brain through the ductus arteriosus
- Low pressure system
- Right to left shunting
- Lungs non-functional
- Increased pulmonary resistance
- Decreased systemic resistance

Conversion Of Fetal To Infant Circulation

Blood circulation after birth,

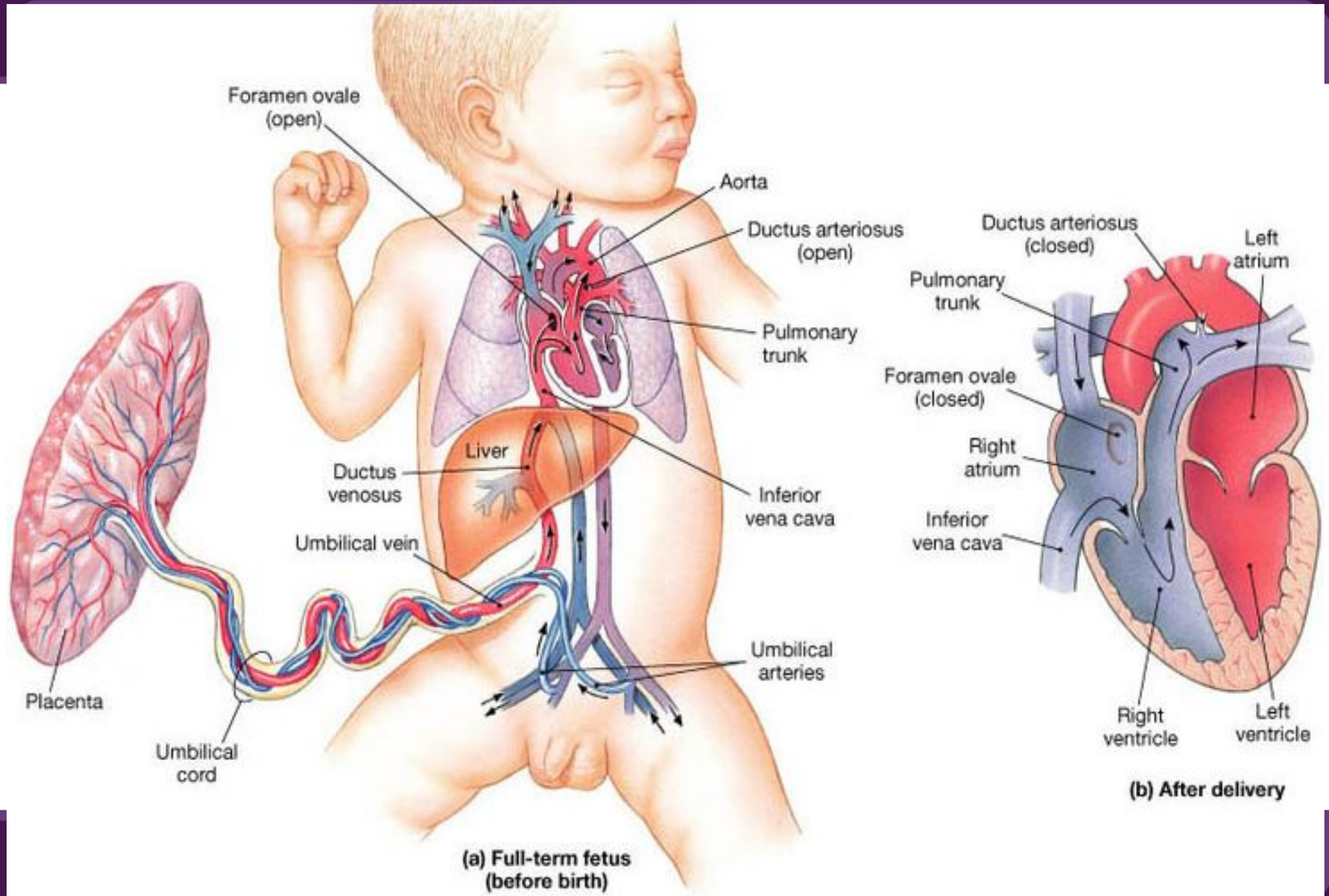
The closure of the shunts;

- Ductus arteriosus
- Foramen ovale

○ Completes the transition of fetal circulation to newborn circulation

Clamping the cord shuts down low-pressure system

- Increased atmospheric pressure (increased systemic vascular resistance) causes
 - Lungs to inflate with oxygen
 - Lungs now become a low-pressure system
 - Pressure from increased blood flow
 - High pressure system
- Left to right blood flow
- Lungs functional
- Decreased pulmonary resistance
- Increased systemic resistance



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 ovula.

Breathing

- Ventilation of the lung helps to create a negative thoracic pressure, this opens the pulmonary circulation and thus diverts blood from ductus arteriosus which then gradually closes.

What maintains patency of ductus arteriosus in utero?

Done by:

Falwah Alharthi

Revised by:

Razan AlDhahri

