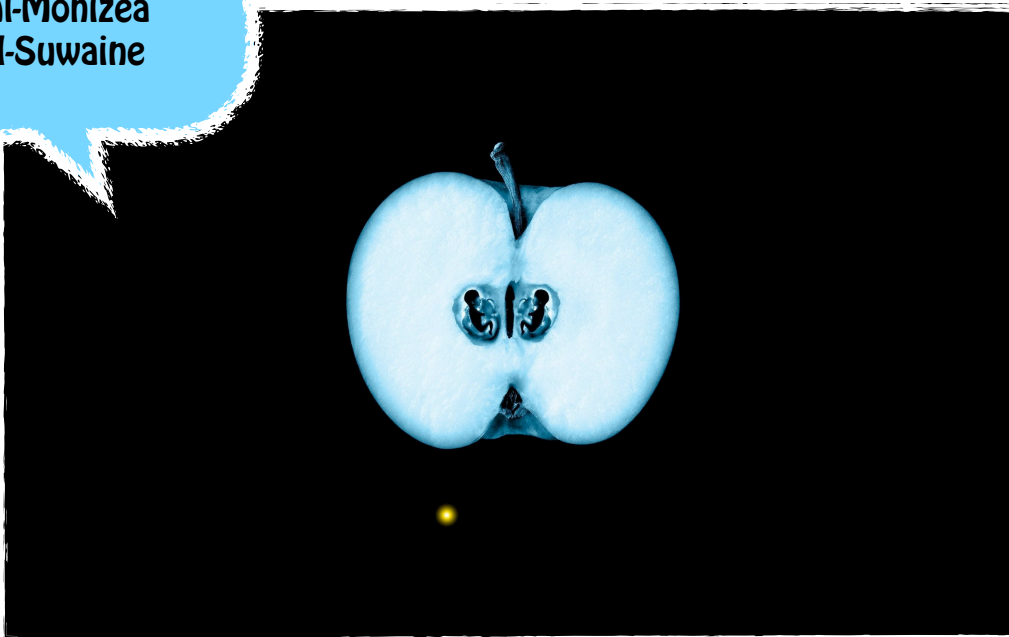


EMBRYOLOGY

Foundation block

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Fetal Membranes

FETAL MEMBRANES

Functions:

1)protection 2)nutrition 3)respiration 4)excretion 5)synthesis of hormones.



Components:

1)Umbilical Cord:

A *pathway* which connects the *ventral* aspect of the embryo with the *fetal surface* of the placenta (chorion). Tortuous (convoluted) with smooth surface (because it's covered by the amnion). 30-90 cm long. Normally, it is attached near the centre of the fetal surface of the placenta.

It consists of:

A-Connecting stalk: 3 umbilical vessels (2 arteries+ 1 vein) & allantois. Embedded in Wharton's jelly (extra-embryonic mesoderm) It remains throughout pregnancy.

B-Yolk stalk: (Vitello-intestinal duct): elongated duct which connects gut to yolk sac.

*It contains Vitelline Vessels+intestinal loops.

*Later on , yolk sac is obliterated and the vitelline vessels disappear.

Abnormalities of umbilical cord:

May include attachment, length or knots.

A)Abnormal attachment:

1. **Velamentous insertion of the cord(dangerous)** : UC is attached to the amnion away from placenta. blood vessels may rupture during labor.
2. **Battledore placenta(not dangerous)** : UC is attached to the margin of the placenta.

B) Abnormal length:

1. **Very Long Cord (dangerous)**: It may surround the neck of the fetus and causes its death.
2. **Very Short Cord (dangerous)**: May cause premature separation of placenta, or the cord itself may rupture.

B) Knots:

1. **True knots (very dangerous)**: Are rare (1%) of pregnancy, but very dangerous because they may cause obstruction to blood flow in umbilical vessels, leading to fetal anoxia & fetal B- Non-dangerous attachments:
2. **False knots (harmless)**: UC looks tortuous due to twisting of umbilical vessels (umbilical vessels are longer than the cord), these knots are normal and do not cause any harm.

2) Yolk sac:

***Function**: transfer of nutrients to the embryo during *2nd & 3rd* weeks, when the **uteroplacental circulation** is not established. It does not contain any yolk.

*Its development passes through three stages:

A) Primary yolk sac:

- Appears in the Blastocyst stage at 10-days, it lies ventral to the embryonic plate.
- Its roof is formed by hypoblast (primary endoderm),
- Its wall is formed by exocoelomic membrane, it lines the inner surface of the cytotrophoblast, and separated from it by the extraembryonic mesoderm.

B) Secondary Yolk Sac:

- Appears in the *chorionic vesicle* stage.
- Its roof is formed by **hypoblast** (embryonic endoderm), its wall is formed by exocoelomic membrane + inner layer (splanchnic layer) of the extraembryonic mesoderm.
- **At day 16**: a diverticulum appears from its dorsocaudal end (Allantois) into the substance of the connecting stalk.

B) Definitive Yolk Sac:

- After folding, part of Yolk Sac is enclosed within the embryo to form the **Gut** (*Foregut, Midgut & Hindgut*).
- The remainder of Yolk Sac that remains outside the embryo becomes the Definitive Yolk Sac.
- The midgut is temporarily connected to Definitive Yolk Sac by a narrow duct Vitello-intestinal duct (Yolk stalk), which is incorporated inside the umbilical cord.

Fate of Yolk Sac:

- *At the 6th week, Yolk stalk detached from midgut.
- *In (2%) of adults, its proximal intra-abdominal part persists as ileal diverticulum (Meckel diverticulum).
- *At 10 week, small definitive yolk sac lies in the chorionic cavity between amniotic & chorionic sacs
- *At 20 weeks, as pregnancy advances, definitive yolk sac atrophies and becomes a very small cyst.
- **In unusual cases*, it persists under the amnion near the attachment of UC on the fetal surface of the placenta. Its persistence is of **no significance**.

*Functions of Yolk Sac:

- a) **3rd w**: blood formation.
- b) **4th w**: endoderm of YS is incorporated into embryo to form primordial (primitive) gut.
- c) Its endoderm gives rise to the epithelium of respiratory system and G.I.T.

3) Allantois:

3rd week: Appears as a *diverticulum* from caudal wall of Y.S. that extends into connecting stalk. It forms blood from 3-5 w.

3rd month: Its intra-embryonic part extends from UB to UC as *thick tube*, (**urachus**). Its blood vessels persist as the umbilical vein & arteries.

After birth: The urachus is obliterated and fibrosed to form *median umbilical ligament* that extends from apex of UB to umbilicus.

*Functions of Allantois:

- a) 3-5rd w: blood formation in its wall.
- b) Its blood vessels persist as umbilical arteries and vein.
- c) Fluid from amniotic cavity is diffused into the umbilical vein to enter the fetal circulation for transfer to the maternal blood.

4) Amnion:

- * It is a thin, transparent & tough fluid-filled, membranous sac surrounding the embryo.
- * At First : It is seen as a small cavity lying **dorsal** to the embryonic plate.
- * At Stage of Chorionic Vesicle: The amnion becomes separated from the chorion by **chorionic cavity** or **extra embryonic coelom**.
- * After Folding: the amnion expands greatly and is becomes on the **ventral surface** of the embryo.
- * As a result of expansion of the amnion, the extra embryonic coelom is gradually obliterated and amnion forms the epithelial covering of umbilical cord.

5) Amniotic Fluid:

- * It is a **watery fluid** *inside* the amniotic cavity (sac).
- * It has a *major* role in **fetal growth & development**.
- * It increases slowly, to become **(700-1000) ml** by full term (37) weeks.
- * Composition: **99% water** + un-dissolved material of desquamated fetal epithelial cells + organic + inorganic salts.
- * **As pregnancy advances**, composition of amniotic fluid changes as **fetal excreta (meconium = fetal feces & urine) are added**.
- * Source: Fetal & Maternal Sources:
 - 1- Secreted by **amniotic cells**.
 - 2- *Most of fluid* is derived from **Maternal tissue** by:
 - Diffusion across amnio-chorionic membrane **from placenta**.

- Diffusion **across** chorionic plate (chorionic wall related to placenta) **from the maternal blood in the intervillous spaces.**

3- Later, it is derived from Fetus through:

Skin, Fetal Respiratory Tract & mostly by Excreting Urine (at beginning of 11th week)

***Functions of Amniotic Fluid:**

- Provides **symmetrical external growth** of the embryo
- Acts as a **barrier to infection** (it is an aseptic medium)
- Permits **normal fetal lung development**
- **Prevents adherence of embryo to amnion**
- It **protects embryo against external injuries**
- Keeps the **fetal body temperature constant**
- Allows the embryo to move freely, **aiding muscular development in the limbs**
- It is involved in **maintaining homeostasis of fluids & electrolytes**
- It permits studies on fetal enzymes, hormones and diagnosis of fetal sex and chromosomal abnormalities.

***Circulation and fate of amniotic fluid:** Remains constant & in balance.

1. **Most of the fluid:** is swallowed and few passes into lungs by fetus, and absorbed into fetal blood, where it is metabolized.
2. **Part of the fluid:** passes through placental membrane into maternal blood in intervillous space,
3. **Other parts:** excreted by fetal kidneys into amniotic sac.

*Anomalies of amniotic fluid:

<ul style="list-style-type: none"> - <u>Oligohydramnios:</u> - The volume is less than ½ liters 	<ul style="list-style-type: none"> - <u>Polyhydramnios (Hydramnios):</u> - The volume is more than 2 liters, diagnosed by <u>Ultrasonography</u>.
<ul style="list-style-type: none"> - <u>Causes:</u> 1. Placental insufficiency with low placental blood flow Preterm rupture of amnio-chorionic membrane occurs in 10% of pregnancies 2. Renal Agenesis (failure of kidney development) 3. Obstructive Uropathy (urinary tract obstruction) lead to absence of fetal urine (the main source) 	<ul style="list-style-type: none"> - <u>Causes</u> 1. Fetal (1-20%) : Esophageal atresia. 2. Maternal (2-20%) : defects in maternal circulation. 3. Idiopathic (3-60%)
<ul style="list-style-type: none"> - <u>Complications:</u> - Fetal abnormalities (pulmonary, facial & limb defects) 	



Can you..

- List components of the fetal membrane?
- Describe stages of development of the components?
- Describe structure and function of components?
- Describe fate and possible congenital anomalies?

WELL DONE~!