Placenta & Fetal membranes

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Objectives

The 1st medical student will be able to answer the following questions after reading this lecture

- > Define the different components of placenta
- Define spiral arteries and mention their significance during pregnancy
- > State the Changes that occur in spiral arteries in preclampsia
- Mention the placental changes at the end of pregnancy
- Define some placental abnormalities
- > Describe in a few sentences the surfaces of delivered placenta
- > State the significance of examination of placenta
- Mention the structures passing through primitive umblical ring, primitive umbilical cord and umbilical cord
- Define umbilical cord & mention their abnormalities
- Enumerate the fetal membranes
- Compare between arrangement of fetal membranes in monozygotic and dizygotic twins

The placenta



is a fetomaternal organ that has two components :

- A fetal part that develops from the chorionic sac
- A maternal part that is derived from the endometrium

The three regions of the decidua are named according to their relation to the implantation site

- The decidua basalis is the part of the decidua deep to the conceptus that forms the maternal part of the placenta.
- The decidua capsularis is the superficial part of the decidua overlying the conceptus.
- The decidua parietalis is all the remaining parts of the decidua.



CHORION

Chorion laeve :

- is the greater part of the chorion
- is in contact with decidua capsularis
- becomes smooth.
 Chorion frondosum :
- is in contact with decidua basalis
- the villi over this part increase greatly in size and complexity



Spiral arteries



- Maternal blood is delivered to the placenta by spiral arteries in the uterus.
- Erosion of these maternal vessels to release blood into intervillous spaces is accomplished by endovascular invasion by cytotrophoblast cells.



- Cytotrophoblast cells invade the terminal ends of spiral arteries creating hybrid vessels
- cytotrophoblast cells undergo an epithelial to endothelial transition.
- Invasion of the spiral arteries by cytotrophoblast cells transforms these vessels from smalldiameter, high-resistance vessels to larger-diameter, lowresistance vessels

Preeclampsia

- is a condition characterized by maternal hypertension, proteinuria, and edema.
- It may begin suddenly anytime from about 20 weeks' gestation to term and
- The condition appears to be a trophoblastic disorder related to:
 - failed or incomplete differentiation of cytotrophoblast cells,
 - many of which do not undergo their normal epithelial to endothelial transformation



Structure of the Placenta



- By the beginning of the fourth month, the placenta has two components:
- (a) a fetal portion, formed by the chorion frondosum and
- (b) a maternal portion, formed by the decidua basalis

- On the fetal side, the placenta is bordered by the **chorionic plate**
- On the maternal side, the placenta is bordered the decidual plate
- **junctional zone**: trophoblast and decidual cells intermingle. This zone
- During 4th & 5th months, the decidua forms a number of decidual septa, which project into intervillous spaces
- The placenta is divided into a number of compartments, or cotyledons
- These septa do not reach the chorionic plate (contact between intervillous spaces in the various cotyledons is maintained).



Structure of villi at various stages of development placental membrane

4th week



4th month



Placental Abnormalities

- **Placenta Accreta** : Abnormal adherence, with absence of decidua basalis.
- Placenta Increta : Occurs when the placenta penetrates into the uterine muscle, but does not penetrate the uterine serosa.
- **Placenta Percreta** : Placental villi penetrate myometrium and through to uterine serosa.





Placental Abnormalities

 When the blastocyst implants close to or overlying the internal os of the uterus, the abnormality is called placenta previa.



Separation of the placenta

Term Placenta



Fetal side

Maternal side

- The placenta is torn from the uterine wall approximately 30 minutes after birth of the child, is expelled from the uterine cavity.
- The expelled placenta
- is discoid with a diameter of 15 to 25 cm,
- is approximately 3 cm thick, and
- weighs about 500 to 600 g.

The fetal surface of the placenta (facing the fetus)



- Has a shiny ,smooth surface provided by the amniotic membrane that covers it .
- A number of large arteries and veins, the chorionic vessels, converge toward the umbilical cord .
- The attachment of the umblical cord is usually eccentric.

maternal side of the placenta



- Is textured and spongy looking
- Is divided by a series of fissures into lobules or cotyledons
- The fissures contain the remains of septae which extended between the maternal and fetal portions

Examination of the placenta

- prenatally by ultrasonography or magnetic resonance imaging. or
- postnatally by gross and microscopic study

- may provide clinical information about the causes of
- . IUGR,
- 2. placental dysfunction,
- fetal distress and death, and
- 4. neonatal illness .



Placental studies

 can also determine whether the placenta is complete. Retention of a cotyledon or an accessory placenta in the uterus may cause severe uterine hemorrhage.



(a) an increase in fibrous tissue in the core of the villus,

(b) thickening of basement membranes in fetal capillaries,

(c) obliterative changes in small capillaries of the villi, and

(d) deposition of fibrinoid on the surface of the villi in the junctional zone and in the chorionic plate. Excessive fibrinoid formation frequently causes infarction of an intervillous lake or sometimes of an entire cotyledon.

PRODUCTION OF HORMONES

- The placenta (syncytiotrophoblast is classified as an endocrine organ.
- It produces both protein and steroid hormones
- I. human Chorionic Gonadotropin (hCG)
- 2. estrogen
- 3. Progestrone
- 4. human Chorionic
- Somatomammotropin (hCS)



primitive umbilical ring

- amnio–ectodermal junction
- At the fifth week of development, the following structures pass through the ring

(a) the connecting stalk, containing the allantois and the umbilical vessels, consisting of two arteries and one vein;

(b) the yolk stalk (Vitelline duct), accompanied by the vitelline vessels

(c) the canal connecting the intraembryonic and extraembryonic cavities





The primitive umbilical cord

• The amniotic cavity enlarges rapidly at the expense of the chorion cavity, and the amnion begins to envelop the connecting and yolk sac stalks, crowding them together and giving rise to the primitive umbilic cord.



41/2 weeks

The primitive umbilical cord

- It contains
- I. the yolk sac stalk
- 2. umbilical vessels.
- 3. some intestinal loops
- 4. the remnant of the allantois
- When the allantosis and vitelline duct and its vessels are also obliterated, all that remains in the cord are the umblical vessels surrounded by a jelly of wharton which function as a protective layer for the blood vessels



The Umbilical Cord

 The attachment of the umbilical cord to the placenta is usually near the center of the fetal surface of this organ, but it may attach at any point.



Marginal insertion



 produces a battledore placenta,



velamentous insertion

 attachment of umblical cord to the fetal membranes



- The umbilical cord is usually 1 to 2 cm in diameter and 30 to 90 cm in length (average, 55 cm).
- Because the umbilical vessels are longer than the cord, twisting and bending of the vessels(false knots) are common.
- Excessively long or short cords are uncommon. Long cords have a tendency to prolapse and/or to coil around the fetus. A very short cord may cause premature separation of the placenta from the wall of the uterus during delivery.



This is an umbilical cord pseudoknot. It is not a true knot, but just an exaggerated loop of one of the umbilical arteries because it is longer than the vein.







 The umbilical cord usually has two arteries and one vein that are surrounded by mucoid connective tissue (Wharton jelly). However a single umblical artery is present and these babies have approximately a 20% chance of having cardiac and other vascular defects



Fetal membranes

- Thin layers or tissues which surround the embryo or foetus and provide for its nutrition, excretion and protection
- They are :
 A. amnion
 B. yolk sac;
 C. allantosis ;
 D. chorion





Amniotic fluid (liquor amni)

- Nature
- Composition
- Circulation of amniotic fluid
- Function
- During pregnancy
- During labour

Hydramnios or polyhydramnios

- is the term used to describe an excess of amniotic fluid (1,500 to 2,000 mL).
- Primary causes of hydramnios include
- I. idiopathic causes
- 2. maternal diabetes
- congenital malformations, that prevent the infant from swallowing the fluid

oligohydramnios

- refers to a decreased amount (less than 400 mL).
- may result from renal agenesis.
- May cause
- I. club foot
- 2. lung hypoplasia

Clinical Correlates Amniotic Fluid

Amniotic Bands



- Occasionally, tears in the amnion result in amniotic bands that may encircle part of the fetus, particularly the limbs and digits.
- May result in
- I. Amputations
- 2. ring constrictions and other abnormalities, including
- 3. Craniofacial deformations
- Origin of the bands is unknown

Premature rupture of the membranes (PROM)

- is the most common cause of preterm labor
- occurs in 10% of pregnancies.
- Unknown causes but risk factors include
- I. Previous pregnancies affected by prematurity
- 2. Black race
- 3. Smoking
- 4. Infections
- 5. Severe polyhydramnios

Fetal Membranes in Twins

- Arrangement of fetal membranes in twins , depending on the
- a. type of twins
- b. the time of separation of Monozygotic twins.

Dizygotic Twins_



each embryo has its own

- ✓ amnion
- chorion
- ✓ placenta

but sometimes the placentas are fused.

Possible relations of fetal membranes in monozygotic twins

- A .Splitting occurs at the two-cell stage,
 - each embryo has its own
 - ✓ placenta
 - ✓ amniotic cavity
 - \checkmark chorionic cavity .



Possible relations of fetal membranes in monozygotic twins



B .Splitting of the inner cell mass into two completely separated groups.

- The two embryos have
- > a common placenta
- > a common chorionic sac
- > separate amniotic cavities

Possible relations of fetal membranes in monozygotic twins

C .the separation occurs at the bilaminar germ disc stage before the appearance of the primitive streak .

- The embryos have
- > a common placenta
- > a common amniotic cavity
- > a common chorionic cavity .
- In cases of conjoined twins, in which the fetuses are not entirely split from each other, there is one amnion, one chorion, and one placenta.



Thank you

