Fetal Membranes & Placenta

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Content

- Development & function of fetal membrane, including chorion, amnion, yolk sac, umbilical cord, & allantois.
- Development & function of placenta
- Twins and other multiple pregnancies
Functions of fetal membrane and placenta:

- Nutrition
- Protection
- Respiration
- Excretion
- Endocrine
- Immunological barrier
epiblast

amnion

primitive streak

early

late

Extraembryonic mesoderm

hypoblast

exocoelomic membrane (& cavity)

primary yolk sac

secondary yolk sac

extraembryonic somatic mesoderm

cytotrophoblast

syncytiotrophoblast

chorion

cytotrophoblast

syncytiotrophoblast

chorion
Decidua:

- decidua basalis
- decidua capsularis → degeneration
- decidua parietalis
I. Chorion:

- extraembryonic somatic mesoderm
- cytотrophoblast
- syncytiotrophoblast
- chorion
1. chorionic villi
(1) primary chorionic villi:
(2) secondary chorionic villi:
(3) tertiary chorionic villi:
2. cytotrophoblastic shell (细胞滋养层壳)

(1) stem villi (anchoring villi):

(2) branch villi (terminal villi):
3. villous chorion (chorion frondosum) & smooth chorion (chorion laeve)
4. intervillous space:

isolated lacunae in the syncytiotrophoblast → fused to lacunar networks → intervillous space
5. abnormal growth of the trophoblast:

*Hydatidiform Moles* (葡萄胎), *Choriocarcinomas* (绒毛膜癌)
II. Amnion & Amniotic fluid

1. amniotic sac, amniotic cavity, amniochorionic membrane
2. amniotic fluid:

(1) origin, circulation and exchange:
   ① by mother       ② by fetus

(2) composition:
(3) volume: 10w: 30ml → 20w: 350ml → 37w: 700-1000ml

(4) abnormalities:

- **Oligohydramnios**  < 400ml  (At full term)
- **Polyhydramnios**  > 2000ml
- **Amnionic band**
(5) significance:

1) protection.
2) prevent adherence of the amnion to the fetus.
3) controlling the embryo’s temperature.
4) enabling the embryo to move freely and grow.
5) maintaining homeostasis of fluid and electrolytes.
6) permitting normal fetal lung development.
7) dilating and washing the cervix during the labor.
8) prenatal diagnosis.
III. Yolk sac

- rapid growth of CNS
- head and tail folds

the embryonic disc

- Folding
- rapid growth of somites
- lateral fold

- Cylindrical embryo
1. significance:

(1) transfer of nutrients (2-3w).

(2) primitive gut (4w).

(3) blood development (mesoderm, 3-5w).

(4) primordial germ cells (endoderm, 3w).
2. fate:

yolk stalk $\rightarrow$ *Meckel’s diverticulum*
IV. Allantois

1. origin: finger-like diverticulum from the caudal wall of the yolk sac that extends into the connecting stalk.
2. significance:

(1) blood formation: 3-5w

(2) umbilical vein and arteries.

(3) a part of urinary bladder.

3. fate:

urachus $\rightarrow$ median umbilical ligament
V. Umbilical cord

Mucous connective tissue covered by amnion, including two arteries, one vein, atretic allantois and atretic yolk stalk.

1-2cm in diameter, 30-90cm in length (average 55cm)
False knots & True knots
PLACENTA

I. Composes and Shape:

1. Composes: fetomaternal organ
   
   \[
   \begin{align*}
   & \text{the fetal component: the villous chorion} \\
   & \text{the maternal component: the decidua basalis}
   \end{align*}
   \]
2. shape: discoid, 15-20cm in the diameter, 2-3cm thickness, 500-600gm weight.

(1) maternal surface of the placenta: rough cotyledon, groove (placenta septa)
(2) fetal surface of the placenta: smooth.

amnion, umbilical cord, and radiating chorionic vessels
II. The fetomaternal junction:

cytotrophoblastic shell, stem villi (anchoring villi)
III. Placental circulation

fetal placental circulation
( within the villus )

umbilical A. $\rightarrow$ arterio-capillary-venous system $\rightarrow$ umbilical V.

metabolic products $\leftrightarrow$ gaseous products

spiral A. $\rightarrow$ intervillous space $\rightarrow$ endometrial V.

maternal placental circulation

intrauterine growth retardation (IUGR)
IV. Placental membrane or Placental barrier

1. < 20w
   (1) Syncytiotrophoblast.
   (2) Cytotrophoblast and basal lamina.
   (3) Connective tissue in the chorionic villi.
   (4) Endothelium and basal lamina of the fetal capillary.

2. > 20w
   (1) Syncytiotrophoblast and basal lamina.
   (2) Endothelium and basal lamina.
V. Functions of placenta

1. transport
2. defense
3. endocrine secretion:

(1) protein hormones:
1) human chorionic gonadotropin (hCG)
2) human chorionic somatomammotropin (hCS)
   or human placental lactogen (hPL)
3) human chorionic thyrotropin (hCT)
4) human chorionic corticotropin (hCACTH)

(2) steroid hormones:
1) progesterone  2) estrogens
VI. Parturition (分娩)
Twins and other multiple pregnancies

I. Twins

1. dizygotic twins
   - Same or different sex.
   - External and genetic features are no more alike than other brothers or sisters.
   - Alike than other brothers or sisters.
   - Separate placenta, chorionic sac and amniotic cavity
   - Sometimes two placentas fuse into one.
2. monozygotic twins (单卵双胎)

- Same sex, very similar physical appearance
- Identical blood groups and genetic makeup.

(1) separation of the embryonic blastomere (35%)

- Separate placenta, chorionic sac and amniotic cavity
- Sometimes two placentas fuse into one.
(2) separation of the inner cell mass (65%)

- Same placenta and chorionic sac
- Separate amniotic cavity
(3) division of the embryonic disc

1) Separate twins

2) Conjoined Twins
   (联胎)

3) Parasitic twin
   (寄生胎)
II. Other multiple pregnancies

- Triplets
- Quadruplets