Objectives:  
- To understand the development of umbilical cord  
- To know the fetal membranes and their arrangement

primitive umbilical ring
Is the oval line of reflection between the amnion and embryonic ectoderm (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; and
(c) the canal connecting the intraembryonic and extraembryonic cavities.

The primitive umbilical cord
The amniotic cavity enlarges rapidly at the expense of the chorionic cavity, and the amnion begins to envelop the connecting and yolk sac stalks, crowding them together and giving rise to the primitive umbilical cord.
Distally, the cord contains the yolk sac stalk and umbilical vessels. More proximally, it contains some intestinal loops and 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 umbilical 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.
For example, insertion of it at the placental margin produces a battledore placenta, and its attachment to the fetal membranes is a velamentous insertion of the cord.

The umbilical cord is usually 1 to 2 cm in diameter and 30 to 90 cm in length (average, 55 cm). 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.
The umbilical cord usually has two arteries and one vein that are surrounded by mucoid connective tissue (Wharton jelly). Because the umbilical vessels are longer than the cord, twisting and bending of the vessels are common.

Fetal membranes
Thin layers or tissues which surround the embryo or foetus and provide for its nutrition, excretion and protection.
They are: allantois; yolk sac; amnion and chorion.

Amnion
Is a transparent greyish membrane which lines the chorion. It covers the foetal surface of the placenta and the umbilical cord.
The amniotic sac contains the foetus swimming in the liquor amni.

Amniotic fluid (liquor amni)
Nature: Is a clear, pale, slightly alkaline pH 7.2 fluid.
The amount of fluid increases:
- 30 mL at 10 weeks of gestation
- 450 mL at 20 weeks
Foetal Membranes

o 800 to 1,000 mL at 37 weeks. Then decreases later on to be scanty in post-term pregnancy

**Composition:** Water 98%-99%, Carbohydrates (glucose and fructose), Proteins (albumin and globulin), Lipids, Hormones (estrogen and progesterone), Enzymes (alkaline phosphatase), Minerals (sodium; potassium and chloride), Suspended materials as vernix caseosa, lanugo hair, desquamated epithelial cells and meconium.

**Circulation of amniotic fluid**
The amniotic fluid is not in a static state but is in a continuous turnover, 500 ml of it are replaced each hour

**Origin of amniotic fluid**
 Foetal: (1) active secretion from the amniotic epithelium; (2) transudation from the foetal circulation; (3) foetal urine
Maternal: transudation from maternal circulation
The foetal origin contributes more in production of amniotic fluid.

Uptake of amniotic fluid is by
- Absorption through the amnion to the maternal circulation
- Foetal swallowing

**Functions of amniotic fluid**
- Protects the foetus against injury
- A medium for free foetal movement
- Permits musculoskeletal development
- Facilitate symmetric growth and development of the foetus
- Maintains the foetal temperature
- Source of oral fluid for the foetus

**During pregnancy**
- It acts as an antiseptic for birth canal after rupture of the membranes

**Clinical Correlates**

**Hydramnios** or **polyhydramnios** is the term used to describe an excess of amniotic fluid (1,500 to 2,000 mL)
**Oligohydramnios** refers to a decreased amount (less than 400 mL).
Both conditions are associated with an increase in the incidence of birth defects.

**Amniotic Bands**
Occasionally, **tears in the amnion** result in amniotic bands that may encircle part of the fetus, particularly the limbs and digits.
Amputations, ring constrictions, and other abnormalities, including craniofacial deformations, may result

**Origin of the bands is probably from** infection or toxic insults that involve either the fetus, fetal membranes, or both.

**Chorion**
- This the outer membrane
- It forms a large portion of the connective tissue thickness of the placenta on its foetal side. It is the structure in and through which the major branching umblical vessels travel on the surface of the placenta
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
Normally, each embryo has its own amnion, chorion, and placenta but sometimes
the placentas are fused.
Each embryo usually receives the appropriate amount of blood, but on occasion,
large anastomoses shunt more blood to one of the partners than to the other.

Possible relations of fetal membranes in monozygotic twins
a. Splitting occurs at the two-cell stage, and each embryo has its own placenta,
amniotic cavity, and chorionic cavity.
b. Splitting of the inner cell mass into two completely separated groups. The two
embryos have a common placenta and a common chorionic sac but separate
amniotic cavities
c. the separation occurs at the bilaminar germ disc stage, just before the
appearance of the primitive streak. The embryos have a common placenta, a
common amniotic cavity, and 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.

Parturition (Birth)
For the first 34 to 38 weeks of gestation, the uterine myometrium does not
respond to signals for parturition (birth). However, during the last 2 to 4 weeks of
pregnancy, this tissue undergoes a transitional phase in preparation for the onset
of labor.

Labor itself is divided into three stages:
• effacement (thinning and shortening) and dilatation of the cervix (this
  stage ends when the cervix is fully dilated),
• delivery of the fetus, and
• delivery of the placenta and fetal membranes

Clinical Correlates
Preterm Birth
Factors initiating labor are not known and may involve
a. “retreat from maintenance of pregnancy,” in which pregnancy-
supporting factors (e.g., hormones) are withdrawn, or
b. active induction caused by stimulatory factors targeting the uterus.

Probably, components of both phenomena are involved.

Preterm birth
(delivery before 34 weeks)
is due to premature rupture of the membranes, premature onset of labor, or
pregnancy complications requiring premature delivery.
Maternal hypertension and diabetes as well as abruptio placenta are risk factors.
Maternal infections, including bacterial vaginosis, are also associated with an
increased risk.

Thank you
Next Lecture: Birth Defects