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Stages of pregnancy

Pregnancy: Pregnancy is a stage from fertilization to parturition that is the fetus will develop during this period. **Gestation:** The period of pregnancy (time).

Stages of pregnancy

1. Stage of Ovum or Blastocyte: مرحلة البيضة أو الأريمة

Start from zygote until the development of primary fetal membranes (10-12 days). During this stage, the zygote undergoes mitosis in the ampulla-isthmus junction of the oviduct (2 cells, 4 cells, 8 cells, and then 16-32 cells which are called "Morula"), this process of divisions are called "Cleavage".

On day 4 or 5, the morula enters the uterus and the number of cells becomes 64 or more cells and is called "Blastocyte". The blastocyte consists of outer cell mass (trophoblast) and inner cell mass (embryoblast) as well as the fluid's absorption from the endometrium.

Usually, the blastocyte remained in the same region where the ovulation occurs, but maybe "emigration" into the opposite region of the uterus. On day 11 or 12; the blastocyte attachment to the endometrium and the embryo nourishment from the source's materials of the blastocyte and the other which absorb from the uterus.

In women, primates, and rodents; the blastocyte hole and digest part from the endometrium to implant it. This process is called "Implantation".

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2. Stage of embryo (organogenesis) مرحلة الجنين (التعضي)

This stage extends from:

- 12-45 days of pregnancy in a cow
- 12 to 34 days in the ewe.
- 12 to 60 days in mare.

In this stage; most body systems and organs of the embryo are formed and we can know the sex of the fetus at the end of this stage.

- Day 24 of pregnancy: elongates the trophoblast.
- Day 16 - 20: formation of amnion sac.
- Day 22: formation of the heart.
- Day 22 - 25: closed of the neural tube, formation of allantois sac buds of horns, buds of forelimbs, and development of the eyes and brain.
- Day 30: adhesion of the fetal membranes and formation of the villi. The embryo in this stage; nourish by the secretion of the uterine glands which is called "uterine milk". Uterine milk is a white to yellow color fluid, cloudy (same as the pus), and contains glycogen, fructose, leukocytes, fatty grains, minerals, and antibodies. The uterine glands secrete the uterine milk under the action of progesterone. At this stage; most anomalies or early embryonic death may occur.

3. Stage of Fetus مرحلة الجنين (النمو الجنيني)

This stage extends from the end of the embryo stage (34-60 days) until the parturition. During this stage; the embryo continues to grow and develop and increase in the fetus weight, also in this stage, the differentiation of organs, tissues,

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and systems was occurring. During this period, ruminants, caruncles, and cotyledons develop and enlarge to supply nutrition to the fetus.

Fetal membranes الأغشية الجنينية

There are two types of fetal membranes:

A. Temporary fetal membrane (yolk sac).

B. Permanent fetal membranes (Amnion, Allantois, Chorion).

1. Yolk sac كيس المح

Initiate from endoderm and called "temporary placenta" that it has many functions:

- Providing the embryo with nutrients and o_2 through the blood vessels which developed on the sac.
- Absorbed the uterine milk from the uterus.
- Get rid of waste and co_2.

The yolk sac disappears after 2 weeks in cow and 4 weeks in mare.

2. Amnion (Amniotic membrane) غشاء الأمنيون (كيس السلي)

Form at the day 16 - 20 after fertilization in most farm animals, initiated from the ectoderm layer and surrounding the embryo from all sides except the umbilical cord ring. The amniotic membrane is filled with amniotic fluids to form an amniotic sac in which the embryo swims and floats. This sac consists of two layers:

- **The inner layer (True Amnion)**
- **The outer layer (False Amnion)**

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The amnion sac is transparent but tough. At the inner surface of the amnion sac, there are white, irregular, bulges called (epithelial plaques). The function of these bulges is unknown.

❖ **Amnion Fluid** السائل الامنيوني

Clear, colorless, mucous, and its volume at the end pregnancy period is about 2-8 litter in cows, 3-4 litters in buffalo, 3-7 litters in mares, 0.4-1 litter in doe, 350-700 ml in the ewe, 8-30 ml in bitch and queen, 40-200 ml in swine. The amniotic fluid contains albumin, enzymes, lipids, and minerals. The Source of amniotic fluid in the first and middle period of pregnancy is the amniotic epithelium and urine of the fetus which makes this fluid a watery appearance. In the second pregnancy period, the source of amniotic fluid is fetal saliva and secretions of the nose and pharynx so the appearance becomes thick and viscous.

Functions of amniotic fluid are: killing the microbes, preventing the adhesions between the fetus and sacs, and at the parturition playing a very important role in the lubricant of the birth canal to help fetus expulsion. The presence of feces (meconium) of the fetus in the amnion fluid refers to dead the fetus and the color of the fluid becomes yellowish-green.

3. Allantois (Allantois membrane) غشاء الالنتويس (كيس اللقانقي)

It is developed at 2-3 weeks of pregnancy from the endoderm (primitive gut). The allantois consists of two layers:

- Outer layer: it is reached in blood vessels and attached to the chorion to form chorioallantois. The blood vessels are connected to the aorta of the fetus by umbilical arteries, and there are also connected to the liver of the fetus and posterior vena cava by the umbilical vein.

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- Inner layer: surrounding the amnion and covering the allantoic part of the allantois cord. The sac which forms between the two membranes is filled with allantois fluid.
- The chorioallantois extends to the tip of each horn where it becomes empty of blood vessels thus will undergo degeneration and called "Necrotic End of Placenta".
- The allantois membrane attachment the bladder of the fetus by "Urechus" which extended within the umbilical cord.
- The allantois sac act as a fetus's urine reservoir.
- Calcium salts: may be found precipitated in allantois as white lines or spots at days 60-90 of pregnancy in cows, then there will disappear after being deposited in the bones of the fetus.
- Other structures can be also seen in the allantois sac called "Hippomones" formed by the precipitation of minerals, albumin, mucous, and damaged tissues. The function of these structures is unknown.
- In ruminants, there are many areas of attachments between the amnion and allantois which divided the allantois sac into many compartments. This attachment isn't found in mare.

❖ **Allantois fluid** السائل الالنتوبي

It is the volume at the end of pregnancy 4-15 litters in cows, 8-18 litters in mares, 0.5-1.5 litters in ewe and doe, 10-50 ml in bitch, 3-15 ml in queen, 100-200 ml in swine.

Allantois fluid is clear, watery and its color is yellowish because of the urine of the fetus as well as albumin, urea, and fructose.

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4. Chorion: غشاء الكوريون

- Initiated from trophoblast and surrounding all fetal membranes. Chorion joint with the allantois to form chorio-allantois that represents "Fetal Placenta".
- It is rich in blood vessels and logins with endometrium by "Villi" which inter to the "Crypts" in the endometrium.

Placenta: It is the outer layer of fetal membranes that initiates from the union of chorion and allantois and is attached directly to the endometrium.

Classification of placenta

A. Anatomical classification التصنيف التشريحي

1. **Diffuse placenta** النوع المنتشر
2. **Cotyledonary placenta** النوع الفلقي
3. **Zonary placenta** النوع الحزامي او النطاقي
4. **Discoid placenta** النوع القرصي

B. Classification according depth of endometrium which involved in implantation تصنيف اعتمادا على عمق بطانة الرحم المشاركة بالغرس

1. **Deciduae placenta** المشائم المتساقطة

In women, bitch, queen, and rodents; in this type, part of endometrium epithelium and tissues was decided during parturition.

2. **No deciduae placenta** المشائم غير المتساقطة

In other mammals; in this type, the placenta was removed with no change in the endometrium.

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Functions of placenta

1. Transfers of nutrition and o_2, and disposal of waste and co_2 between fetal and maternal circulation.
2. Formation of several enzymes such as transferees, hydrolase, isomerase, and formation and transport of hormones (progesterone, PMSG, HCG).
3. Transport of electrolytes such as K^{++}, $Na^{+,}$ and Cl^{+}.
4. Transports of amino acids by simple diffusion.
5. Transport the immune-globulins (in women).
6. Transport the insulin.
7. Development and protection of the fetus from any trauma or accident by the fetal fluids.

Umbilical cord

It's a long cord that connects the fetus with the placenta and consists from:

1. Umbilical vein (1): transfer nutrients and o_2 from the dam to the fetus.
2. Umbilical artery (2): transfers the co_2 from the fetus to the dam.
3. Urechus: act as fetal ureter to transfer urine from the fetal kidney to the allantoic sac and partially to the amniotic sac.

Length of the umbilical cord:

- Cow: 30 cm.
- Mare: 90 cm.
- Sow: 15 cm.
- Bitch and queen: 7 cm.