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DISCUSS THE SECOND WEEK OF DEVELOPMENT

This period usually occurs between the 19th and 24th day of the menstrual cycle. This coincides roughly with the 6th to 10th day following ovulation. Week 2 is about the implantation process and blastocyst differentiation. Note that all cells produced from the initial fertilization event are defined as the "conceptus" and will include cells with both embryonic and extraembryonic futures. In the conceptus, this is a period of blastocyst "hatching" rapid blastocyst differentiation into extraembryonic and embryonic tissues and proliferation. In placental animals, this is the first physical interaction between the conceptus and the maternal uterine wall with adplantation and the commencement of implantation.

The following events take place during the 2nd week of development:

1. Completion of implantation of the blastocyst
2. Formation of bilaminar embryonic disc(epiblast and hypoblast)
3. Formation of extraembryonic structures(amniotic cavity, amnion, umbilical vesicle [yolk sac], connecting stalk, and chorionic sac)

**Day 8**

* At the eighth day of development, the blastocyst is partially (slowly) embedded in the endometrium
* the syncytiotrophoblast continues its invasion of the endometrium, thereby eroding endometrial blood vessels and endometrial glands
* More cells in the cytotrophoblast divide and migrate into the syncytiotrophoblast, where they fuse and lose their individual cell membranes

Cells of the inner cell mass or embryoblast also differentiate into 2 layers:

The hypoblast layer, which is made up of small cuboidal cells, and it is adjacent (nearer) to the blastocyst cavity

 The epiblast layer which is made up of high columnar cells, and it adjacent to the amniotic cavity

The hypoblast and epiblast layers together form a flat ovoid shaped disc called the bilaminar embryonic disc

At the same time, a small cavity appears within the epiblast which enlarges to form the amniotic cavity

Epiblast cells adjacent to the cytotrophoblast are called amnioblasts

Amnioblasts together with the rest of the epiblast, line the amniotic cavity

The endometrium adjacent to the implantation site is oedematous and highly vascular

* The blastocyst is more deeply embedded in the endometrium, and the penetration defect in the surface epithelium is closed by a coagulum called **fibrin**
* Vacuoles appear at the region of the trophoblast and they fuse to form lager lacunae
* this phase of trophoblast development is known as the **lacunar stage**
* the cells of the hypoblast adjacent to the cytotrophoblast form a thin membrane called the **exocoelomic (Heuser’s) membrane**
* this membrane lines the inner surface of the cytotrophoblast
* the **exocoelomic (Heuser’s) membrane** together with the hypoblast forms the lining of the **exocoelomic cavity,** or **primitive yolk sac** or **primary umbilical vesicle**
* The blastocyst is completely embedded in the endometrium,
* and the surface epithelium almost entirely covers the original defect in the uterine wall
* The blastocyst now produces a slight protrusion into the lumen of the uterus
* cells of the syncytiotrophoblast penetrate deeper into the stroma(tissue) and erode the endothelial lining of the endometrial capillaries
* These ruptured endometrial capillaries are called **sinusoids**
* The lacunae then begin to communicate with the sinusoids, and maternal blood enters the lacunar system
* The communication of the eroded endometrial capillaries with the lacunae establishes the **primordial uteroplacental circulation**
* When maternal blood flows into the lacunae, oxygen and nutritive substances are available to the embryo
* a new population of cells appears between the inner surface of the cytotrophoblast and the outer surface of the exocoelomic cavity
* These cells which are derived from yolk sac cells form a fine, loose connective tissue called the **extraembryonic mesoderm**
* Soon, large cavities develop in the extraembryonic mesoderm, and when these become confluent, they form a new space known as the **extraembryonic cavity,** or **chorionic cavity** or **extraembryonic coelom**
* This space surrounds the primitive yolk sac and amniotic cavity, except where the germ disc is connected to the trophoblast by the connecting stalk
* The extraembryonic mesoderm lining the cytotrophoblast and

 Amnion is called the **extraembryonic somatic mesoderm**

* the lining covering the yolk sac is known as the **extraembryonic splanchnic mesoderm**
* As the conceptus implants, the endometrial connective tissue cells undergo a transformation, called **decidual reaction**
* During this transformation, the cells of the endometrium swell because of the accumulation of glycogen and lipid in their cytoplasm, and they are known as **decidual cells**
* The primary function of the decidual reaction is to provide nutrition for the early embryo and an immunologically privileged site for the conceptus

**13th day of development**

* The surface defect in the endometrium has been completely covered by the surface epithelium
* Occasionally bleeding occurs at the implantation site as a result of increased blood flow into the lacunar spaces

Cells of the cytotrophoblast proliferate locally and penetrate into the syncytiotrophoblast, forming cellular columns surrounded by syncytium

Cellular columns with the syncytial covering are known as primary villi

The primary yolk sac becomes reduced in size and is known as the secondary yolk sac

 This new cavity is known as the secondary yolk sac or definitive yolk sac or the secondary umbilical vesicle

In humans the yolk sac contains no yolk but is important for the transfer of nutrients between the foetus and mother

This yolk sac is much smaller than the original exocoelomic cavity or primitive yolk sac

During its formation, large portions of the exocoelomic cavity are pinched off to form exocoelomic cysts

* **Exocoelomic cysts** are often found in the extraembryonic cavity or chorionic cavity or extraembryonic coelom
* Meanwhile, the extraembryonic coelom expands and forms a large cavity, the **chorionic cavity**
* The extraembryonic mesoderm lining the inside of the cytotrophoblast is then known as the chorionic plate
* The only place where extraembryonic mesoderm traverses the chorionic cavity is in the **connecting stalk**
* With development of blood vessels, the connecting stalk becomes the **umbilical cord**

**Anomalies that occur in second week of development**

Abnormal implantation sites or Ectopic Pregnancy occurs if implantation is in uterine tube or outside the uterus.

* sites - external surface of uterus, ovary, bowel, gastrointestinal tract, mesentery, peritoneal wall
* If not spontaneous then, embryo has to be removed surgically

**Tubal pregnancy** - 94% of ectopic pregnancies

* if uterine epithelium is damaged (scarring, pelvic inflammatory disease)
* if zona pellucida is lost too early, allows premature tubal implantation
* Embryo may develop through early stages, can erode through the uterine horn and reattach within the peritoneal cavity.

**REFERENCES**

<https://embryology.med.unsw.edu.au/embryology/index.php/Week_2>

**DIAGRAM OF SECOND OF WEEK OF DEVELOPMENT**

