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COURSE TITLE: GENERAL EMBRYOLOGY

DISCUSS THE SECOND WEEK OF DEVELOPMENT

There are three events that take place during the second week of development:

- I. Completion of implantation of the blastocyst
- II. Formation of bilaminar germ or embryonic disc i.e. epiblast and hypoblast
- III. Development of extra embryonic structures i.e. amniotic cavity, amnion, yolk sac, connecting stalk and chorionic sac

Day Eight

The blastocyst is partially 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.

The cells of the inner cell mass called embryoblast will differentiate into 2 layers;

- i. **the hypoblast layer**, which is made up of small cuboidal cells which is adjacent to the blastocystic cavity, and
- ii. **the epiblast layer** which is made up of high columnar cells which is adjacent to the amniotic cavity

The hypoblast and epiblast layers together form a flat ovoid shaped disc called the **bilaminar embryonic disc**. The epiblast cells that are lying adjacent to the cytotrophoblast are called **amnioblast or amnion**. These cells along with the epiblast, line a small cavity that appears which is called the **amniotic cavity**. The endometrium adjacent to the implantation site is edematous and highly vascular.

Day Nine

The blastocyst is deeply embedded in the endometrium and the penetration defect in the surface epithelium is closed by a coagulum called **fibrin**. Vacuums appear at the region of the syncytiotrophoblast and they fuse to form larger 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 membrane together

with the hypoblast forms the lining of the **exocoelomic cavity, or primitive yolk sac or primary umbilical vesicle.**

Days Ten to Twelve

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 utero-placental 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** (which develops into the umbilical cord). The extraembryonic mesoderm lining the cytotrophoblast and amnion is called the **extraembryonic somatic mesoderm**. The extraembryonic somatic mesoderm also forms the connecting stalk. 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.

Days Thirteen to Fourteen

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 fetus 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 called 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**.