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DEPARTMENT: MBBS 200L

COURSE: EMBRYOLOGY

SECOND WEEK OF DEVELOPMENT

Second week of human development is characterized by three events;

1. Completion of Implantation of the blastocyst.
2. Formation of bilaminar embryonic disc.
3. Formation of extraembryonic structures like amniotic cavity, amnion, yolk sac, chorionic sac, connecting stalk.

DAY 8

The blastocyst is partially (slowly) embedded in the endometrium. The cells of the syncytiotrophoblast continue to erode the endometrium. The cells of the cytotrophoblast continue to divide and migrate to the region of the syncytiotrophoblast.

The cells of the region of the embryoblast differentiate into two layers; a layer of columnar cells called epiblast and a layer of cuboidal cells called hypoblast. The epiblast is adjacent to the amniotic cavity. The hypoblast is adjacent to the blastocyst cavity. The epiblast and the hypoblast together form an ovoid shaped disc called bilaminar embryonic disc.

The region of the epiblast adjacent to the cytotrophoblast is the amnioblast/amnion. A small cavity forms between the cells of the epiblast which enlarges to form the amniotic cavity. The amnioblast together with the cells of the epiblast line the amniotic cavity. The endometrium adjacent to the implantation site is edematous and highly vascular.

DAY 9

The blastocyst is deeply embedded in the endometrium. The cells of the syncytiotrophoblast continue to erode the endometrium. The cells of the cytotrophoblast divide and migrate to the region of the syncytiotrophoblast. The surface defect in the epithelium is closed by the fibrin coagulum.

At the region of the trophoblast, vacuoles are formed which fuse to form trophoblastic lacunae. This is known as the lacunae stage. The cells of the hypoblast form a membrane called exocoelomic membrane (Heuser's membrane). The membrane lines the inside of the cytotrophoblast. This membrane together with the hypoblast forms a cavity called the exocoelomic cavity or the primitive yolk sac or primary umbilical vesicle.

DAY 11-12

The blastocyst is completely embedded in the endometrium. The surface epithelium almost completely covers the defect in the endometrium. The blastocyst now produces a slight protrusion in the lumen of the uterus. The cells of the cytotrophoblast divide and migrate into the region of the syncytiotrophoblast. The cells of the syncytiotrophoblast continue to erode the endometrium and erode the endometrial lining of the endometrium. As a result, these capillaries are ruptured. These ruptured capillaries are called sinusoid. The trophoblastic lacunae then communicate with these sinusoids to form the primordial uteroplacental circulation. Through this circulation, when maternal blood flows into the lacunae, nutritive substance and oxygen are made available to the embryo.

A new population of cells forms between the inner cells of the cytotrophoblast and the outer surface of the exocoelomic membrane. These cells which are derived from the yolk sac form a loose connective tissue called the extraembryonic mesoderm. Soon, large cavities develop in the extraembryonic mesoderm and when these become confluent, they form a space called the extraembryonic cavity or the 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.

Soon after, the endometrial connective tissue cells then undergo a transformation called decidual reaction. The cells swell because of the accumulation of glycogen and lipid in their cytoplasm. These cells are then called decidual cells. The primary function of the decidual reaction is to provide nutrition for the early embryo and to provide an immunologically privileged site for the conceptus.

DAY 13

The surface defect in the endometrium has been completely covered by the surface epithelium. As a result of increased blood flow to the lacunar spaces, there is occasional bleeding.

The cells of the cytotrophoblast proliferate locally and penetrate into the endometrium and form/acquire a syncytium. This cellular column with syncytial covering is known as primary villi. The secondary yolk sac is formed as a result of the reduction in size of the primary yolk sac. The secondary yolk sac is also known as definitive yolk sac or secondary umbilical vesicles. In humans, the yolk sac contains no yolk but helps in the transfer of nutrients between the fetus and mother. The secondary yolk sac is smaller than the original exocoelomic cavity or primary yolk sac. A large part of the primary yolk sac is pinched off to form exocoelomic cysts. These exocoelomic cysts are found in the exocoelomic cavity or coelom. Meanwhile, the exocoelomic cavity expands to form the chorionic cavity. The extraembryonic mesoderm lining the inside of the cytotrophoblast is then known as the chorionic plate. The connecting stalk is the only place where extraembryonic mesoderm traverses the chorionic cavity. The connecting stalk becomes the umbilical cord as a result of development of blood vessels.

CLINICAL CORRELATES

1. Human Chorionic Gonadotropin (hCG): The syncytiotrophoblast produces a hormone called the human chorionic gonadotropin (hCG), which enters the maternal blood via lacunae. It maintains the hormonal activity of the corpus luteum in the ovary during pregnancy. hCG can be detected in maternal blood or urine as early as day 10 of pregnancy and is the basis for pregnancy tests.

Enough hCG is produced by the syncytiotrophoblast at the end of the second week to give a positive pregnancy test, even though the woman is probably unaware that she is pregnant

2. Extrauterine Implantation: Blastocysts may implant outside the uterus. These implantations result in ectopic pregnancies. 95% to 98% of ectopic implantations occur in the uterine tubes, most often in the ampulla and isthmus.

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