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COURSE TITLE: EMBRYOLOGY

1) Ovulation is the release of an oocyte from the ovarian follicle. Before ovulation occurs, there are certain events that occur; the increase in the diameter of the secondary follicle to become a mature graafian follicle. Alongside the final development of the graafian follicle, there is and abrupt increase in luteinizing hormone which causes the primary oocyte to complete meiosis 1 and it also causes the follicle to enter the preovulatory mature vesicular stage.

In the mean time the surface of the ovary bulges out locally and the stigma appears

For the oocyte to be released 2 events must occur and they are caused by the luteinizing surge;

- 1) Increase in the collagenase activity which results to the digestion of collagen fibers, and
- 2) Increase in prostaglandin level; which increases the response to LH surge and causes local muscular contractions.

The local muscular contractions extrude the oocyte as well as the surrounding granulosa cells which form the cumulus oophorus, these contractions are as a result of the increase in the prostaglandin level.

Clinical correlates

- 1) Mittelschmerz: it is also known as middle pain. It is an abdominal pain experienced by women during ovulation and normally occurs at the middle of the menstrual cycle. It's one of the many signs of ovulation.
- 2) Anovulation: it's a condition in which a woman does not ovulate as a result of low gonadotrophins. Although some gonadotropin stimulants can be administered but

they cause multiple ovulations which result in the high risk of multiple pregnancies.

2)

MEIOSIS 1	MEIOSIS 2
Meiosis 1 is a heterotypic division	Meiosis 2 is a homotypic division
Homologous chromosomes are present at the beginning	Individual chromosomes are present at the beginning
It's a more complex division and takes more time	its less complex and takes less time
Homologous duplicated chromosomes split at anaphase 2	Sister chromatids split at anaphase 2
It results to the formation of 2 diploid daughter cells	It results to the formation of 4 haploid daughter cells
Exchange of genetic materials occurs during crossing over at prophase 1	There is no exchange of genetic materials

3) there are five stages involved in fertilization;

- passage of the sperm through the corona radiata: only capacitated sperms can pass through the corona radiata and capacitation involves the removal of the glycoprotein material and seminal proteins from the plasma membrane of the sperm.

- penetration of the zona pellucida: the zona pellucida is an amorphous coating that surrounds the egg, facilitates and maintains sperm binding and induces acrosome reaction. The acrosome binds to the zonapellucida 3 on the zona pellucida. The acrosin is then secreted and aids the sperm in penetrating the zona pellucida. As soon as the head of the sperm touches the surface the permeability of the zona pellucida changes which cause the secretion of the lysosomal enzymes by the cortical granules on

the plasma membrane of the oocyte. They prevent sperm penetration and inactive binding sites for sperms on the zona pellucida surface.

-Fusion of the plasma membrane of the sperm and oocyte: the plasma membrane of the sperm and the oocyte fuses together but the break down at the site of fusion as a result the head and tail of the sperm enters the cytoplasm but the plasma membrane is left behind.

- completion of the second meiotic division of the oocyte and the formation of the female pronucleus: completion of the second meiotic division occurs when the sperm penetrates the oocyte and this leads to the formation of a mature oocyte and a second polar body

- formation of the male pronucleus: this occurs when the nucleus of the sperm enlarges in the cytoplasm of the oocyte as a result the male pronucleus is formed and the tail degenerates

- zygote formation: the male and female pronucleus both undergo fusion to form ootid which then becomes a zygote.

4) differences between monozygotic and dizygotic twins

Monozygotic twins are developed by the splitting of a fertilized Embryo into two	Dizygotic twins are developed by two separate simultaneous fertilization events
Monozygotic twins have genetic profiles that are almost identical to each other	Dizygotic twins have completely different genetic profiles
They are always of the same sex	They maybe of the same or opposite sex
They are also called identical twins	They are also called fraternal twins
Two fetuses grow in the same placenta	Two fetuses grow in two different membranes

There is a high risk of tsts in monozygotic twins	There is a low TTS risk in dizygotic twins
Non hereditary	Its hereditary
The cause of monozygotic twins is currently unknown	It occurs as a result of in vitro fertilization, hereditary predisposition or the use of fertility drugs.

5) The second week of development

These events take place during the second week of development:

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

Day eight

At the eighth day of development, the blastocyst is partially embedded in the endometrium. the syncytiotrophoblast continues to invade the endometrium, thereby eroding endometrial blood vessels and endometrial and More cells in the cytotrophoblast divide and migrate into the syncytiotrophoblast, where they fuse and lose their individual cell membranes. The embryoblast differentiates into 2; thr hypoblast which is cuboidal and the epiblast which is columnar. The epiblast and hypoblast then form the trilaminar germ disk, the amnioblast lines the amniotic cavity.

Day nine

the blastocyst is deeply embedded in the endometrium and the surface epithelium is closed by the fibrin coagulant. Vacuoles appear at the region of the trophoblast 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 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.

Day ten to twelve of development

The blastocyst is completely embedded in the endometrium, and the surface epithelium almost entirely covers the original defect in the uterine wall. Cells of the syncytiotrophoblast penetrate deeper into the stroma and erode the endothelial lining of the endometrial capillaries. The ruptured endometrial capillaries are known as sinusoids. The lacunae begin to communicate with the sinusoids, as a result the maternal blood enters the lacunar system. The communication results in the formation of a primordial uteroplacental circulation. When maternal blood flows into the lacunae it provides oxygen and nutrients for the fetus.

- A whole new population of cells appears between the inner surface of the cytotrophoblast and the outer surface of the exocoelomic cavity. These cells form a fine, loose connective tissue called the extraembryonic mesoderm. The large cavities develop in the extraembryonic mesoderm, and 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 known as 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 known as decidual reaction. The main function of the decidual reaction is to provide nutrition for the early embryo and an immunologically privileged site for the conceptus

Day thirteen of development

The surface defect in the endometrium has been completely covered by the surface epithelium, bleeding occurs occasionally at the implantation site as a result of increased blood flow into the lacunar spaces, the Cells of the cytotrophoblast proliferate locally and penetrate into the syncytiotrophoblast, and forms cellular columns surrounded by syncytium .The primary yolk sac becomes reduced in size and is known as the secondary yolk sac. The new cavity is called the secondary yolk sac or definitive yolk sac or the secondary umbilical vesicle. the Exocoelomic cysts are found in the extraembryonic 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