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Write a short note on implantation.

Implantation, in reproduction physiology, is the adherence of a fertilized egg to a surface in the reproductive tract, usually to the uterine wall (*see* uterus), so that the egg may have a suitable environment for growth and development into a new offspring. Fertilization of the egg usually occurs after the egg has left the ovary and is being transported through the fallopian tubes. Male sperm cells deposited in the female reproductive tract travel up to the fallopian tubes to unite with the egg. Once fertilized, the egg begins to undergo a series of cell divisions. The egg takes up to seven days to reach the uterus; by this time the single-celled egg has divided numerous times, so that it is a ball of approximately 200 cells.

The uterus has thick walls suitable for egg attachment and growth. A female hormone known as progesterone, secreted by the corpus luteum in the ovary, influences the readiness of the uterine wall for egg implantation. It increases the blood supply in the wall, water content, and secretion of glycogen, a nutrient for the surrounding tissue and developing egg. If the uterus is not first prepared by progesterone, the egg will not attach itself. Progesterone also inhibits muscular contractions in the uterine wall that would tend to reject the adhering egg.

When the egg reaches the uterus, it usually remains free in the uterine cavity for about a day. It then attaches to the uterine lining (the endometrium). Cells in the outer surface of the egg grow rapidly once contact is made with the uterine wall. The egg disrupts the surface of the endometrium and actively burrows into the deeper tissue. By the 11th day after fertilization, the egg has completely embedded itself into the endometrium. The product of conception—first the fertilized egg and then the developing child and the placenta—normally remains implanted in the human uterus for nine months.

Implantation consists of three stages:

(a) The blastocyst contacts the implantation site of the endometrium (apposition);

(b) trophoblast cells of the blastocyst attach to the receptive endometrial epithelium (adhesion); and

(c) invasive Trophoblast cells cross the endometrial epithelial basement membrane and invade the endometrial stroma (invasion)

The implantation stages of the blastocyst into the endometrium

This process extends over a time span from the end of the first week of embryonic development - namely from the moment of the hatching of the blastocyst - to the formation of the primitive placental circulation system in the middle of the second development week.

The endometrium structure is favorable for an implantation of the blastocyst. It undergoes structural alterations that are regulated by sexual hormones. This cycle can be divided into three phases: menstrual, follicular and luteinic. Each is characterized by its own histological appearance of the endometrium, especially the glandular epithelium.

The **implantation stage** begins with the apposition of the blastocyst at the uterine mucosa that normally is only formed in a region of the uterine wall
An implantation of the blastocyst outside this zone means an extra-uterine pregnancy with serious consequences for the person's health. The implantation stages of the blastocyst in the uterine endometrium can be seen as taking place in three phases: apposition, adhesion and the embedding in the endometrium. The apposition can only occur during a certain time period within the course of the cycle, the so-called "implantation window". The apposition is connected with the maturation of the endometrium. As soon as the adhesion on the endometrium is complete, the cells that lie on the periphery of the blastocyst - the trophoblast - differentiate into two cell types: the syncytiotrophoblast (ST, on the outside) and the cytotrophoblast (CT, on the inside). Through their lytic activity the ST cells erode numerous structures of the endometrium and induce the decidual reaction. This process leads to the embedding of the blastocyst into the endometrium, whereby at this time it is completely surrounded by ST cells. During the second week extra-cytoplasmatic vacuoles appear in the ST. They combine into lacunae that later become filled with maternal blood, which comes from vessels eroded by the lytic ST activity. The primitive utero-placental circulatory system is thereby engendered.

The stages of the implantation result in a cascade of the molecular mechanism that cause interactions between the trophoblast cells, on the one hand, and the cells and the extra-cellular matrix of the uterine mucosa, on the other. These interactions begin already at the moment the blastocyst hatches (preimplantation signals) changing the structural and functional properties of the uterus. These also promote the movement of the blastocyst in the direction of the implantation location and its modification in order to make the implantation easier. The

interactions between the blastocyst and the tuterine epithelium make sure the embryo has the right orientation as well as its adhesion to the uterine wall. The Interactions between the blastocyst and the endometrium regulate the invasion of the trophoblast and the embedding of the blastocyst into the endometrium.

Several factors can lead to an **abnormal implantation**. In addition to the normal implantation zone there are a variety of locations, both within and outside the uterus, where the blastocyst can embed itself (EUG = extra-uterine gravidity) Inside the uterus an implantation in the lower part leads to a placenta praevia It forms in the cervix uteri and prevents a normal birth. Its detachment can also lead to serious clinical complications (hemorrhages).

With **contraceptive methods** one distinguishes between mechanical and chemical ones. Mechanical methods (spiral IUD's) have a double function: on the one hand, they work towards preventing an embedding of the blastocyst in the endometrium, and, on the other, they immobilize the sperm cells. With chemical methods, which are meant to hinder implantation or early embryonic development, either high hormone dosages ("morning after pill") or receptor antagonists (RU 486) are prescribed.

- In humans, implantation is that this stage of pregnancy at which the embryo adheres to the walls of the uterus.
- At this stage of prenatal development, the conceptus is called a blastocyst.
- It is by this adhesion that the embryo receives oxygen and nutrients from the murder to be able to grow.
  Chorionic villi + uterine tissue (endometrium)= Placenta (Structural and functional unit between developing embryo and maternal body