

Physiology of the Pregnancy Physiology of the Fetus

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Pregnancy



Pregnancy

Pregnancy or **gestation**, is the time during which one or more offspring develops inside a woman. A multiple pregnancy involves more than one offspring, such as with twins. Pregnancy can occur by sexual intercourse or assisted reproductive technology. It usually lasts around 40 weeks from the last menstrual period (LMP) and ends in childbirth. This is just over 9 lunar months, where each month is about 29½ days. When measured from conception it is about 38 weeks. An embryo is the developing offspring during the first 8 weeks following conception, after which, the term fetus is used until birth.

Pregnancy

Pregnancy is typically divided into three trimesters. The first trimester is from week one through twelve and includes conception. Conception is followed by the fertilized egg traveling down the fallopian tube and attaching to the inside of the uterus, where it begins to form the fetus and placenta. The second trimester is from week 13 through 28. Around the middle of the second trimester, movement of the fetus may be felt. At 28 weeks, more than 90% of babies can survive outside of the uterus if provided high-quality medical care. The third trimester is from 29 weeks through 40 weeks.

Fetus 8 weeks



Fetus 20 weeks



Fetus 31 weeks



Stages of Fetal development



Stage of the Fetal Development

Fertilization

Fertilization is the union of an ovum and a spermatozoon. This usually occurs in the outer third of a fallopian tube, the ampullar portion.

Usually only one ovum reaches maturity each month. Once it is released, fertilization must occur fairly quickly, because an ovum is capable of fertilization for only 24 hours (48 hours at the most). After that time, it atrophies and becomes nonfunctional.

Fertilization

Because functional life of a spermatozoon is about 48 hours (max 72 hours), the total critical time span during which sexual relations must occur for fertilization to be successful is about 72 hours (48 hours before ovulation plus 24 hours after)

Fertilization

As the ovum is extruded from the Graafian follicle of an ovary with ovulation, it is surrounded by a ring of mucopolisaccharide fluid (the zona pellucida) and a circle of cells (the corona radiata). The ovum is propelled into a nearby fallopian tube

Fertilization

Normally, an ejaculation of semen averages 2.5 ml of fluid containing 50 to 200 million spermatozoa per ml or an average of 4 million sperm per ejaculation. Spermatozoa deposited in the vagina during intercourse generally reach the cervix in 80 seconds and the outer end of fallopian tube with 5 minutes

Fertilization

All the spermatozoa that achieve capacitation rich the ovum and cluster around the protective layer of corona cells. Hyaluronidase (a proteolytic enzyme) is apparently released by the spermatozoa and acts to dissolve the layer of cells protecting the ovum

Fertilization

Under ordinary circumstances only 1 spermatozoa is able to penetrate the cell membrane of the ovum. Once it s penetrate the cell, the cell membrane change composition to became impervious to other spermatouza

Fertilization

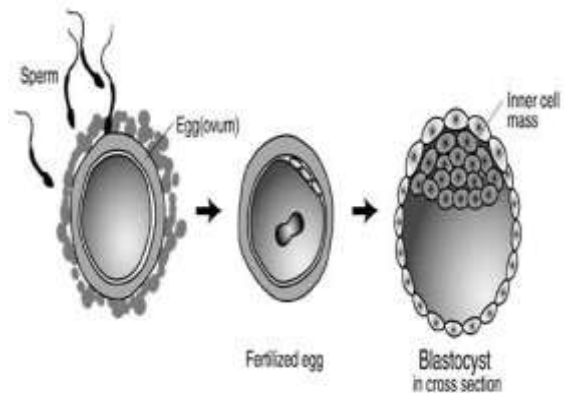
Immediately after penetration of the ovum the chromosomal material of the ovum and the spermatozoon fuse the resulting structure is called ZYGOTE. Because the spermatozoon and ovum each carried 23 chromosome (22 autosomes and 1 sex chromosome) the fertilized ovum has 46 chromosomes. If an X- carrying spermatozoon entered the ovum the resulting child will have two X chromosomes and will be female (XX). If Y carrying – the resulting will have YX chromosomes - male (YX)

Implantation

Once fertilization is complete the zygote migrates over the next tree to four days toward the body of uterus. The first cleavage occurs at about 24 hours cleavage divisions continue to occur at the rate of one every 22 hours . By the time the zygote reaches the body of uterus it consist of 16 – 50 cells. At this stage because of it s bumpy outward appearance, it s termed a MORULA

Implantation

Large cells tent to collect at the periphery of the ball, living a fluid space surrounding an inner cell mass. At the this stage, the structure is termed a BLASTOCYST. The cells in the outer ring are known trophoblast cells. They are the part of the structure that will late formed the placenta and membranes. The inner cell mass (embryoblast cells) is the portion of the structure that ll form the embryo

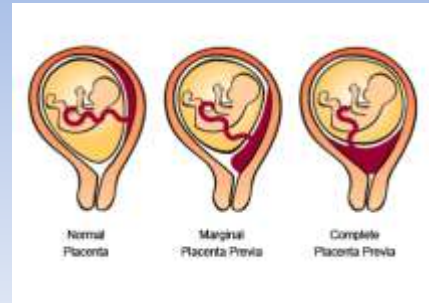


Implantation

The blastocyst is able to invade the endometrium because as the trophoblast cells on the outside of the structure touch the endometrium. They produce the proteolytic enzymes that dissolve the tissue they touch. If the point of implantation is low into the uterus, the growing placenta may occlude the cervix and make birth of the child difficult (placenta previa)

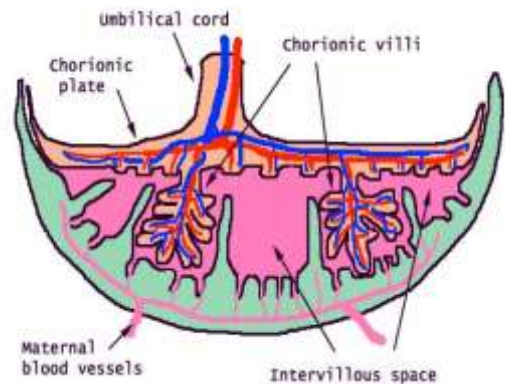
Once implanted the zygote, is an EMBRYO

Implantation

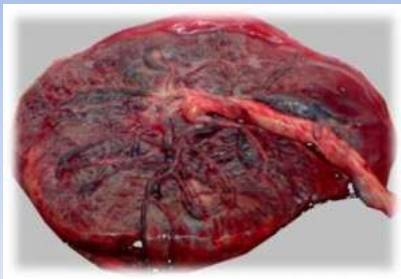


Chorionic Villi

Once implantation is achieved, the trophoblastic layer of cells of the blastocyst begins to mature rapidly. As early as the 11th or 12th day, miniature villi, or probing "fingers", termed chorionic villi, reach out from the single layer of cells into the uterine endometrium



The Placenta



The Placenta

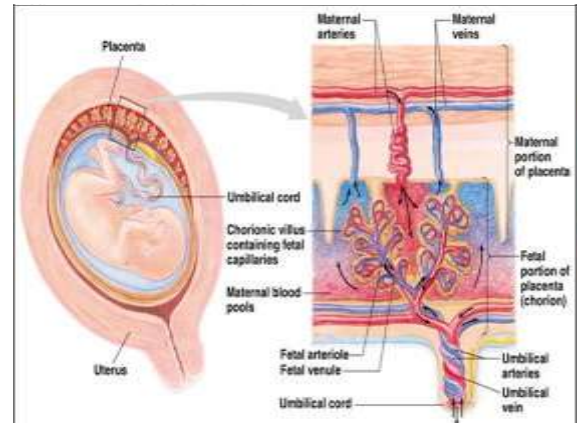
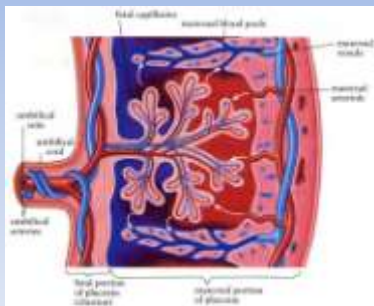
The Placenta arises out of trophoblast tissue. It serves as the fetal lungs, kidneys and gastrointestinal tract and a separate endocrine organ throughout pregnancy. It grows parallel to that of the fetus



The Placenta

As early as the 12th day of pregnancy, maternal blood begins to collect in the intervillous space of the uterine endometrium surrounding the chorionic villi. By the 3rd week, oxygen and other nutrients and water diffuse from the maternal blood through the cell layer of the chorionic villi to the villi capillaries.

The circulation of placenta



The placenta

Placental osmosis is so effective that all but a few substances are able to cross from the mother into the fetus. Because almost all drugs are able to cross into the fetal circulation, it is important that a woman take no nonessential drugs during the pregnancy.

The placenta

About 100 maternal uterine arteries supply the mature placenta. To provide enough blood for exchange, the rate of uteroplacental blood flow in pregnancy increases from about 50 ml/min at 10 weeks to 500-600 ml/min at term.

The placenta

Uterine perfusion and thus placental circulation is most efficient when the mother lies on her left side. This position lifts the uterus away from the inferior vena cava. If the mother lies on her back and the weight of the uterus compresses the vena cava, placental circulation can be so sharply reduced that supine hypotension occurs

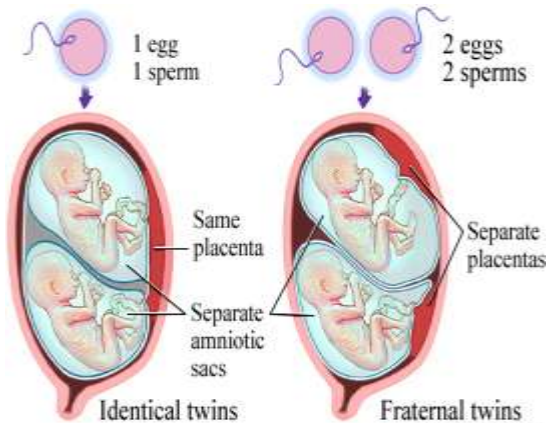
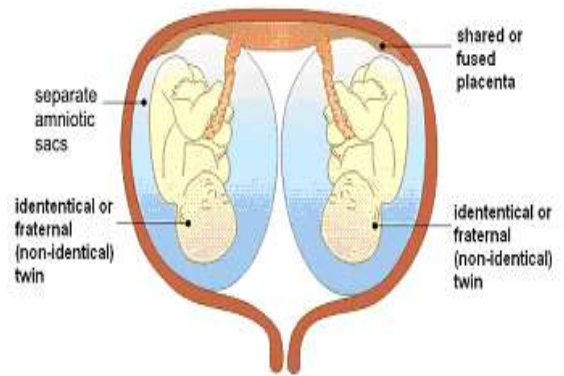
The Umbilical Cord



The Umbilical Cord

The Umbilical Cord is formed from the fetal membranes and provides a circulatory pathway that connects the embryo to the chorionic villi of the placenta. It is about 53 cm in length at term and about 2 cm thick. The bulk of the cord is a gelatinous mucopolysaccharide called Wharton's jelly, which gives the cord body and prevents pressure on the vein and arteries that pass through it





The Amniotic Fluid

Amniotic fluid is being newly formed by the amniotic membrane, so it never becomes stagnant. Some of it is absorbed by direct contact with the fetal surface of the placenta. The amount of amniotic fluid has grown greatly and ranges from 800 to 1200 ml. If for any reason the fetus is unable to swallow, excessive amniotic fluid or hydramnios (more than 2.000 ml)

The Amniotic Fluid

Hydramnios also can take a place in a woman with diabetes, because hyperglycemia causeve excessive fluid shift into the amniotic space. When the kidney became active fetal urine adds to the quantity of the amniotic fluid. A disturbance of kidney can occur oligohydramnios (fluid is less than 300 ml)

Fetus



Fetus

The pregnancy as usually measured in lunar months (4 weeks) or in trimesters (3 month period). A pregnancy is normal 10 lunar month (40 weeks – 280 days), a fetus grows in utero 9.5 month or tree full trimesters (38 weeks – 266 days)

4 Weeks Fetus

- Length: 0.75 to 1 cm
- Weight: 40 mg
- The apical cord is formed and fixed at the midpoint.
- Lateral wings that will form the back are folded farward to form at the midline.
- Head folds forward and becomes prominent, representing about one third of the torso structure.
- The back is bent so that the head shows in a shallow dip of the tail.
- The rudimentary heart appears as a prominent bulge on the anterior surface.
- Arms and legs are budding structures.
- Rudimentary eyes, ears, and nose are discernible.



8 Weeks Fetus

End of 8th Gestational Week

- Length: 2.5 cm (1 in)
- Weight: 20 g
- Organogenesis is complete.
- The heart, with a septum and valves, is beating normally.
- Facial features are definitely discernible.
- Arms and legs have developed.
- External genitalia are present, but sex is not distinguishable by simple observation.
- The primitive tail is regressing.
- Malrotation appears large because the fetal intestine is growing rapidly.
- Sonogram shows a gestational sac, diagnostic of pregnancy (Fig. 8.8).



12 Weeks Fetus

End of 12th Gestational Week (First Trimester)

- Length: 7 to 8 cm
- Weight: 47 g
- Nail beds are forming on fingers and toes.
- Spontaneous movements are possible, although they are usually not felt or felt by the mother.
- Some reflexive work on the 12-week reflexes are present.
- Bone ossification centers are forming.
- Tooth buds are present.
- Sex is distinguishable by external appearance.
- Kidney secretion has begun, although some can not yet be excreted in amniotic fluid.
- Heartbeat is audible through Doppler technology.



16 Weeks Fetus

16 WEEKS



End of 16th Gestational Week

- Length: 14 to 17 cm
- Weight: 75 to 120 g
- Fetal brain waves are visible with an ordinary sonotape.
- Large (1 to 2 cm) downy hair on the back and area of neck, which apparently serves as a source of insulation for body heat, is well formed.
- Liver and pancreas are functioning.
- Fetus actively swallows amniotic fluid, demonstrating an intact baroreceptor-mediated swallowing reflex, since a protein is excreted in amniotic fluid.
- Sex can be determined by ultrasonography.

20 Weeks Fetus

- Spontaneous fetal movements can be sensed by the mother.
- Antibody production is possible.
- Hair fibres, extending to include eyebrows and hair on the head.
- Meconium is present in the upper intestine.
- Brown fat, a special fat that will aid in temperature regulation at birth, begins to be formed behind the kidneys, stomach, and posterior neck.
- Vertex reflex, which serves as a protective skin covering during compression like, begins to form.
- Distinct sleeping and activity patterns are distinguishable (the fetus has developed behaviours that will guide sleep/wake patterns throughout life).



24 Week Fetus

- End of 24th Gestational Week (Second Trimester)**
- Length: 28 to 35 cm
 - Weight: 570 g
 - Parents suddenly realize that mother is 6 to 8 for the fetus, the fetus is still in the 24th week of gestation, but now for the 24th week, fetus has been in the uterus for 24 weeks. The fetus has been in the uterus for 24 weeks. The fetus has been in the uterus for 24 weeks. The fetus has been in the uterus for 24 weeks.
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28 Weeks Fetus

- End of 28th Gestational Week**
- Length: 35 to 38 cm
 - Weight: 1,200 g
 - Long dorsal legs in nature, and surfboard can be demonstrated in amniotic fluid.
 - Testes begin to descend into the scrotal sac from the lower abdominal cavity.
 - The blood vessels of the retina are thin and cannot susceptible to damage from high oxygen concentrations (an important consideration when caring for preterm infants who need oxygen).



32 Week Fetus

- End of 32nd Gestational Week**
- Length: 44 to 45 cm
 - Weight: 1,600 g
 - Subcutaneous fat begins to be deposited (the knee springs, "leak-old man" appearance is low).
 - Fetus responds by movement to sounds outside the mother's body.
 - Active Moro reflex is present.
 - Birth position (vertex or breech) may be assumed.



36 Weeks Fetus

End of 36th Gestational Week

- Length: 42 to 46 cm
- Weight: 1,800 to 2,750 g (4 to 6 lb)
- Daily stores of glycogen, iron, carbohydrates, and calcium are deposited.
- Additional amounts of substances for use at birth are deposited.
- Side of the face has only one or two cutaneous creases, compared with the full creases pattern that will be evident at term.
- Amount of lanugo begins to diminish.
- Most babies turn into a vertex or head-down presentation during the month.



40 Weeks Fetus

End of 40th Gestational Week (Third Trimester)

- Length: 49 to 52 cm (average weight: 3,500 g (7 to 7.5 lb))
- In the third trimester, fetal growth is slower than in the second trimester.
- Fetal development begins to accelerate in what is known as the third trimester. The increase in weight is rapid. At birth, about 20% of body weight is added in this time.
- Fetus continues to gain weight.
- Fetus has the sides of the face covered in fine hair called lanugo.
- In preparation for leaving the womb, the fetus also begins to store fat. During the last 2 weeks, gaining the weight is faster than the last 2 weeks of the pregnancy. The fetus, around 40 weeks, is a full-term fetus. The last trimester of pregnancy has ended and birth is at hand.



Thank you for your attention

