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PLACENTA ITS CRUCIAL ROLE

S. Sangeetha*

Lecturer, Department of Anatomy, Saveetha Dental College, Saveetha Institute of Medical sciences And Technology (SIMATS) Saveetha University, Chennai-600077.

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***Corresponding Author**
S. Sangeetha
Lecturer, Department of Anatomy, Saveetha Dental College, Saveetha Institute of Medical sciences And Technology (SIMATS) Saveetha University, Chennai-600077.

ABSTRACT

The placenta is an organ that develops in your uterus during pregnancy. This structure provides oxygen and nutrients to your growing baby and removes waste products from your baby's blood. The placenta attaches to the wall of your uterus, and your baby's umbilical cord arises from it. The placenta is a large organ that develops during pregnancy. It is attached to the wall of the uterus, usually at the top or side. The umbilical cord connects the placenta to your baby. Blood from the mother passes through the placenta, filtering oxygen, glucose and other nutrients to your baby via the umbilical cord. The placenta also filters out substances that could be harmful to your baby and removes carbon dioxide and waste products from your baby's blood. The placenta produces a number of hormones that are needed during pregnancy, such as lactogen, oestrogen and progesterone. It keeps the mother's blood separate from the baby's blood to protect the baby against infections. Towards the end of the pregnancy, the placenta passes on antibodies to protect the baby after birth. The importance of the placenta was reviewed in this paper.

KEYWORDS: Placenta, pregnancy, blood, umbilical cord, birth.

INTRODUCTION

The placenta is a temporary organ that connects the developing fetus via the umbilical cord to the uterine wall to allow nutrient uptake, thermo-regulation, waste elimination, and gas exchange via the mother's blood supply; to fight against internal infection; and to produce hormones which support pregnancy. Placentas are a defining characteristic of placental mammals, but are also found in marsupials and some non-mammals with varying levels of development.[1] The placenta functions as a fetomaternal organ with two components: the fetal placenta (Chorion frondosum), which develops from the same blastocyst that forms the fetus, and the maternal placenta (Decidua basalis), which develops from the maternal uterine tissue. It metabolizes a number of substances and can release metabolic products into maternal or fetal circulations. The placenta is expelled from the body upon birth of the fetus.[2]

The placenta is a large organ that develops during pregnancy. It is attached to the wall of the uterus, usually at the top or side. The umbilical cord connects the placenta to your baby. Blood from the mother passes through the placenta, filtering oxygen, glucose and other nutrients to your baby via the umbilical cord. The placenta also filters out substances that could be harmful to your baby and removes carbon dioxide and waste products from your baby's blood. The placenta produces a number of hormones that are needed during pregnancy, such as lactogen, oestrogen and progesterone. It keeps the mother's blood separate from the baby's blood to protect the baby against infections. Towards the end of the pregnancy, the placenta passes on antibodies to protect the baby after birth.

Although all mammalian placentae have the same functions, there are important differences in structure and function in different groups of mammals. For example, human, bovine, equine and canine placentae are very different at the both gross and the microscopic levels. Placentae of these species also differ in their ability to provide maternal immunoglobulins to the fetus.[3]

The placenta often develops low in the womb but moves to the side or up as the womb stretches. The position of the placenta will be checked at your 18-week ultrasound. The placenta is expelled from your body after the birth, usually about 5 to 30 minutes after your baby is born. This is called the third stage of labour. After the baby is born you will continue to have mild contractions. You will have to give one more push to deliver the placenta. Sometimes your abdomen will be massaged or you will be given an injection of oxytocin and the umbilical cord will be gently pulled to help deliver the placenta.

Structure

Placental mammals, such as humans, have a chorioallantoic placenta that forms from the chorion and allantois. In humans, the placenta averages 22 cm (9 inch) in length and 2–2.5 cm (0.8–1 inch) in thickness, with the center being the thickest, and the edges being

the thinnest. It typically weighs approximately 500 grams (just over 1 lb). It has a dark reddish-blue or crimson color. It connects to the fetus by an umbilical cord of approximately 55–60 cm (22–24 inch) in length, which contains two umbilical arteries and one umbilical vein.[4] The umbilical cord inserts into the chorionic plate (has an eccentric attachment). Vessels branch out over the surface of the placenta and further divide to form a network covered by a thin layer of cells. This results in the formation of villous tree structures. On the maternal side, these villous tree structures are grouped into lobules called cotyledons. In humans, the placenta usually has a disc shape, but size varies vastly between different mammalian species.[5] The placenta occasionally takes a form in which it comprises several distinct parts connected by blood vessels.[6] The parts, called lobes, may number two, three, four, or more. Such placentas are described as bilobed/bilobular/bipartite, trilobed/trilobular/tripartite, and so on. If there is a clearly discernible main lobe and auxiliary lobe, the latter is called a *succenturiate placenta*. Sometimes the blood vessels connecting the lobes get in the way of fetal presentation during labor, which is called *vasa previa*.

Placental Health

Various factors can affect the health of the placenta during pregnancy, with some under your control and some not. For example:

- **Maternal age.** Some placental problems are more common in older women, especially after age 40.
- **A break in your water before labor.** During pregnancy, your baby is surrounded and cushioned by a fluid-filled membrane called the amniotic sac. If the sac leaks or breaks before labor begins, also called your water breaking, the risk of certain placental problems increases.
- **High blood pressure.** High blood pressure can affect your placenta.
- **Twin or other multiple pregnancy.** If you're pregnant with more than one baby, you might be at increased risk of certain placental problems.
- **Blood-clotting disorders.** Any condition that either impairs your blood's ability to clot or increases its likelihood of clotting increases the risk of certain placental problems.
- **Previous uterine surgery.** If you've had a previous surgery on your uterus, such as a C-section or surgery to remove fibroids, you're at increased risk of certain placental problems.
- **Previous placental problems.** If you've had a placental problem during a previous pregnancy, you might have a higher risk of experiencing it again.
- **Substance use.** Certain placental problems are more common in women who smoke or use cocaine during pregnancy.
- **Abdominal trauma.** Trauma to your abdomen — such as from a fall, auto accident or other type of blow — increases the risk of the placenta prematurely separating from the uterus (placenta abruption).

Placental Problems

During pregnancy, possible placental problems include placental abruption, placenta previa and placenta accreta. These conditions can cause potentially heavy vaginal bleeding. After delivery, retained placenta is sometimes a concern. Here's what you need to know about these conditions:

- **Placental abruption.** If the placenta peels away from the inner wall of the uterus before delivery — either partially or completely — a condition known as placental abruption develops. This can deprive the baby of oxygen and nutrients and cause you to bleed heavily. Placenta abruption could result in an emergency situation requiring early delivery.
- **Placenta previa.** This condition occurs when the placenta partially or totally covers the cervix — the outlet for the uterus. Placenta previa is more common early in pregnancy and might resolve as the uterus grows.
- Placenta previa can cause severe vaginal bleeding during pregnancy or delivery. The management of this condition depends on the amount of bleeding, whether the bleeding stops, how far along your pregnancy is, the position of the placenta, and your and your baby's health. If placenta previa persists late in the third trimester, your health care provider will recommend a C-section.
- **Placenta accreta.** Typically, the placenta detaches from the uterine wall after childbirth. With placenta accreta, part or all of the placenta remains firmly attached to the uterus. This condition occurs when the blood vessels and other parts of the placenta grow too deeply into the uterine wall. This can cause severe blood loss during delivery.
- In aggressive cases, the placenta invades the muscles of the uterus or grows through the uterine wall. Your health care provider will likely recommend a C-section followed by removal of your uterus.
- **Retained placenta.** If the placenta isn't delivered within 30 minutes after childbirth, it's known as a retained placenta. A retained placenta might occur because the placenta becomes trapped behind a partially closed cervix or because the placenta is still attached to the uterine wall. Left untreated, a retained placenta can cause severe infection or life-threatening blood loss.

Signs or Symptoms of Placental Problems

- Vaginal bleeding
- Abdominal pain
- Back pain
- Uterine contractions

Development

The placenta begins to develop upon implantation of the blastocyst into the maternal endometrium. The outer layer of the blastocyst becomes the trophoblast, which forms the outer layer of the placenta. This outer layer is divided into two further layers: the underlying cytotrophoblast layer and the overlying

syncytiotrophoblast layer. The syncytiotrophoblast is a multinucleated continuous cell layer that covers the surface of the placenta. It forms as a result of differentiation and fusion of the underlying cytotrophoblast cells, a process that continues throughout placental development. The syncytiotrophoblast (otherwise known as syncytium), thereby contributes to the barrier function of the placenta.The placenta grows throughout pregnancy. Development of the maternal blood supply to the placenta is complete by the end of the first trimester of pregnancy week 14 (DM).

Placental circulation

Maternal blood fills the intervillous space, nutrients, water and gases are actively and passively exchanged, then deoxygenated blood is displaced by the next maternal pulse.

Maternal placental circulation

In preparation for implantation of the blastocyst, the endometrium undergoes decidualization. Spiral arteries in the decidua are remodeled so that they become less convoluted and their diameter is increased. The increased diameter and straighter flow path both act to increase maternal blood flow to the placenta. There is relatively high pressure as the maternal blood fills intervillous space through these spiral arteries which bathe the fetal villi in blood, allowing an exchange of gases to take place. In humans and other hemochorial placentals, the maternal blood comes into direct contact with the fetal chorion, though no fluid is exchanged. As the pressure decreases between pulses, the deoxygenated blood flows back through the endometrial veins.Maternal blood flow is approximately 600–700 ml/min at term.

Fetoplacental circulation

Deoxygenated fetal blood passes through umbilical arteries to the placenta. At the junction of umbilical cord and placenta, the umbilical arteries branch radially to form chorionic arteries. Chorionic arteries, in turn, branch into cotyledon arteries. In the villi, these vessels eventually branch to form an extensive arterio-capillary-venous system, bringing the fetal blood extremely close to the maternal blood; but no intermingling of fetal and maternal blood occurs ("placental barrier").[8]

Endothelin and prostanoids cause vasoconstriction in placental arteries, while nitric oxide causes vasodilation. The fetoplacental circulation is vulnerable to persistent hypoxia or intermittent hypoxia and reoxygenation,[8] which can lead to generation of excessive free radicals. This may contribute to pre-eclampsia and other pregnancy complications.[9] It is proposed that melatonin plays a role as an antioxidant in the placenta.[9]

Birth

Placental expulsion begins as a physiological separation from the wall of the uterus. The period from just after the child is born until just after the placenta is expelled is called the "third stage of labor". The placenta is usually expelled within 15–30 minutes of birth. Placental expulsion can be managed actively, for example by giving oxytocin via intramuscular injection followed by cord traction to assist in delivering the placenta. Alternatively, it can be managed expectantly, allowing the placenta to be expelled without medical assistance. Blood loss and the risk of postpartum bleeding may be reduced in women offered active management of the third stage of labour, however there may be adverse effects and more research is necessary.[10]

The habit is to cut the cord immediately after birth, but it is theorised that there is no medical reason to do this; on the contrary, it is theorised that not cutting the cord helps the baby in its adaptation to extrauterine life, especially in preterm infants.[11]

Functions

Nutrition and gas exchange

The placenta intermediates the transfer of nutrients between mother and fetus. The perfusion of the intervillous spaces of the placenta with maternal blood allows the transfer of nutrients and oxygen from the mother to the fetus and the transfer of waste products and carbon dioxide back from the fetus to the maternal blood. Nutrient transfer to the fetus can occur via both active and passive transport.[12] Placental nutrient metabolism was found to play a key role in limiting the transfer of some nutrients.[13] Adverse pregnancy situations, such as those involving maternal diabetes or obesity, can increase or decrease levels of nutrient transporters in the placenta potentially resulting in overgrowth or restricted growth of the fetus.[14]

Excretion

Waste products excreted from the fetus such as urea, uric acid, and creatinine are transferred to the maternal blood by diffusion across the placenta.

Immunity

IgG antibodies can pass through the human placenta, thereby providing protection to the fetus *in utero*.[15] This transfer of antibodies begins as early as the 20th week of gestational age, and certainly by the 24th week.[16] This passive immunity lingers for several months after birth, thus providing the newborn with a carbon copy of the mother's long-term humoral immunity to see the infant through the crucial first months of extrauterine life. IgM, however, cannot cross the placenta, which is why some infections acquired *during* pregnancy can be hazardous for the fetus.

Furthermore, the placenta functions as a selective maternal-fetal barrier against transmission of microbes. However, insufficiency in this function may still cause mother-to-child transmission of infectious diseases.

Endocrine function

- The first hormone released by the placenta is called the human chorionic gonadotropin hormone. This is responsible for stopping the process at the end of menses when the Corpus luteum ceases activity and atrophies. If hCG did not interrupt this process, it would lead to spontaneous abortion of the fetus. The corpus luteum also produces and releases progesterone and estrogen, and hCG stimulates it to increase the amount that it releases. hCG is the indicator of pregnancy that pregnancy tests look for. These tests will work when menses has not occurred or after implantation has happened on days seven to ten. hCG may also have an anti-antibody effect, protecting it from being rejected by the mother's body. hCG also assists the male fetus by stimulating the testes to produce testosterone, which is the hormone needed to allow the sex organs of the male to grow.
- Progesterone helps the embryo implant by assisting passage through the fallopian tubes. It also affects the fallopian tubes and the uterus by stimulating an increase in secretions necessary for fetal nutrition. Progesterone, like hCG, is necessary to prevent spontaneous abortion because it prevents contractions of the uterus and is necessary for implantation.
- Estrogen is a crucial hormone in the process of proliferation. This involves the enlargement of the breasts and uterus, allowing for growth of the fetus and production of milk. Estrogen is also responsible for increased blood supply towards the end of pregnancy through vasodilation. The levels of estrogen during pregnancy can increase so that they are thirty times what a non-pregnant woman mid-cycles estrogen level would be.
- Human placental lactogen is a hormone used in pregnancy to develop fetal metabolism and general growth and development. Human placental lactogen works with Growth hormone to stimulate Insulin-like growth factor production and regulating intermediary metabolism. In the fetus, hPL acts on lactogenic receptors to modulate embryonic development, metabolism and stimulate production of IGF, insulin, surfactant and adrenocortical hormones. hPL values increase with multiple pregnancies, intact molar pregnancy, diabetes and Rh incompatibility. They are decreased with toxemia, choriocarcinoma, and Placental insufficiency.[17]

Immunological barrier

The placenta and fetus may be regarded as a foreign body inside the mother and must be protected from the normal immune response of the mother that would cause it to be rejected. The placenta and fetus are thus treated as sites of immune privilege, with immune tolerance.

For this purpose, the placenta uses several mechanisms:

- It secretes Neurokinin B-containing phosphocholine molecules. This is the same mechanism used by parasitic nematodes to avoid detection by the immune system of their host.[18]
- There is presence of small lymphocytic suppressor cells in the fetus that inhibit maternal cytotoxic T cells by inhibiting the response to interleukin 2.[19]
- However, the Placental barrier is not the sole means to evade the immune system, as foreign fetal cells also persist in the maternal circulation, on the other side of the placental barrier.[20]

Clinical Significance

Numerous pathologies can affect the placenta.

- Placenta accreta, when the placenta implants too deeply, all the way to the actual muscle of uterine wall (without penetrating it)
- Placenta praevia, when the placement of the placenta is too close to or blocks the cervix
- Placental abruption/abruptio placentae, premature detachment of the placenta
- Placentitis, inflammation of the placenta, such as by TORCH infections.

Placental Insufficiency

Placental insufficiency is the failure of the placenta to provide enough nutrients to the unborn baby during pregnancy. This is caused by a failure of the placenta to grow or function properly, and it can result in fetal growth restriction and low birth weight. There are no known symptoms of placental insufficiency, but the unborn baby may move less frequently than expected. Fetal growth restriction can be detected by the health-care provider when they measure the height of the top of the uterus, called the fundus, during regular medical visits. The condition and size of the placenta, and the health of the baby, can also be monitored using ultrasound.

CONCLUSION

The placental health is important throughout the pregnancy. The placenta produces a number of hormones that are needed during pregnancy, such as lactogen, oestrogen and progesterone. It keeps the mother’s blood separate from the baby’s blood to protect the baby against infections. Towards the end of the pregnancy, the placenta passes on antibodies to protect the baby after birth. The knowledge of placenta is important in clinical practise since it plays a crucial role in pregnancy.

Conflict Of Interest

The author declares that there is no conflict of interest.

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