ISSN: 3066-9855
Research Article
Journal of Gynecology Obstetrics and Mother Health

Maternal Physiology During Pregnancy

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Submitted: 07 February 2024 **Accepted:** 14 February 2024 **Published:** 20 February 2024

https://doi.org/10.63620/MKJPNR.2024.1011

Citation: *Siniša, F. (2024) Maternal Physiology During Pregnancy. J of Gyne Obste & Mother Health 2(1), 01-05.*

Abstract

During pregnancy, women experience a number of physiological changes. The changes enable the body to adapt to pregnancy, they begin during the first week of conception, and disappear after childbirth and rarely leave consequences on the woman's body. The first sign of pregnancy is the absence of menstruation, and after 4-6 weeks there is a significant increase in the breasts. As the uterus grows and begins to fill the small pelvis, the cervix and the cervix become softer. Due to the sudden growth of the uterus, some pregnant women feel discomfort.

Keywords: Woman, Pregnancy, Maternal Physiology, Fetus, Delivery

Introduction

Pregnancy is a “physiologic” period that extends past regular body structure [1]. Numerous modifications take place from anatomy to biochemistry, psychology to body structure. Knowing those modifications is essential for the proper analysis and remedy as they are able to exacerbate an current disorder, reason a brand new disorder, or simply may be misinterpreted as pathologic. In order to tailor the proper technique to pregnant sufferers, healthcare experts need to recognize each issue of the diversifications of this length.

During pregnancy, a female undergoes massive bodily and physiologic modifications [2]. The female’s immune device is weakened, making an allowance for the improvement of various oral pathologies. Many of the modifications at some point of being pregnant are mediated with the aid of using hormones: There is a 10-fold growth in estrogen and a 30-fold growth in progesterone at some point of being pregnant. This ends in altered periodontal microvascularization. Increased hormones also are related to elevated ranges of bacteria.

A common misconception approximately being pregnant is that enamel are weakened at some point of being pregnant. However, calcium isn't always taken away from enamel during pregnancy; the elevated danger for dental caries is because of nutritional modifications, in particular elevated snacking on carbohydrate-wealthy ingredients and the intake of smaller, extra common carbohydrate-wealthy meals. This carbohydrate-wealthy food regimen feeds oral bacteria, main to an growth in dental plaque, acidity, and teeth decay. In addition, modifications in oral hygiene, morning sickness, and modifications to the maternal immune device may have an effect on oral health. In general, the prevalence of gingivitis and periodontal ailment will increase during pregnancy. Higher ailment ranges appear like correlated with elevated age, decrease ranges of education, and multiparity (having multiple child).

Preconception

By age 25, approximately 50% of U.S. ladies have had at the least one delivery [3]. The maximum fertility rate happens in 25- to 30-year-old women. By age 44, >85% have given delivery at the least once. About 84% of reproductive-age women, whilst requested, solution that that they'd a health-care go to in the previous year. Therefore, widely wide-spread preconception care may be finished if health-care carriers make it a concern and plan for it at each possibility. The technique need to be “each reproductive-age female, each time”. Every reproductive-age female need to be requested at each health-care encounter: “Are you considering pregnancy?” and “Could you possibly become pregnant?” Increased cognizance of preconception care may be achieved thru enhancing health resources, public outreach, and advertising. Despite its brilliant effectiveness, now no longer all fitness-care plans cowl preconception care. A preconception go to (or regularly more than one) need to be widespread number one care, as said with the aid of using the Center for Disease Control. It need to be as routine, if now no longer extra so, as prenatal care, as need to the screening and interventions related to it. A clean political will to power the investment and coverage insurance for preconception care is required.

Therefore, providers of all specialties need to be privy to the evidence-primarily based totally hints. Organizations representing family and inner remedy, obstetrics and gynecology, nurse midwifery, nursing, public health, diabetes, neurology, cardiol-

ogy, and plenty of different institutions have supported hints for preconception care. Unfortunately, practitioners seldom put into effect them, although it is an possibility to optimize the health of the female impartial of whether or not she is making plans being pregnant. Only one out of six obstetrician-gynecologists (ob-gyns) or family physicians gives preconception care to the bulk of ladies for whom they offer prenatal care. Preconception care can also additionally regularly want to be multidisciplinary care. Prior to being pregnant, a female could have numerous different medical problems affecting extraordinary specialties, and her care need to arise in near collaboration the various extraordinary fields involved. Maternal body structure is extraordinary than nonpregnant person body structure. An whole field, maternal-fetal remedy, is devoted to the care of pregnancies with maternal or fetal troubles, and those experts are in particular adept at directing exceptional practices for preconception counseling.

Preconception care happens exceptional if all practitioners, which include number one and distinctiveness care, both immediately put into effect or correctly refer for implementation of powerful preconception screening and intervention. The worse state of affairs is the notion that a positive pregnancy take a look at is a superb cause to "stop all medicines" thereby preventing ailment remedy. Prevent panic: get ladies equipped for a healthful being pregnant earlier than birth control is stopped.

Blood

The blood volume will increase at some point of pregnancy in order to offer the essential factors and vitamins for the fetal and placental increase and to fulfill the wishes of the increased uterus [1]. It additionally gives safety towards impaired venous blood go back associated with maternal function (erect and supine positions) at some point of pregnancy and repayment for the postpartum blood loss. Blood extent will increase progressively at some stage in being pregnant. It suggests an growth of approximately 15% withinside the frst trimester after which with the maximum fast growth at mid-trimester mainly till 32–34 weeks of gestation with a median of 40–45% above nonpregnant state. Then, it suggests a mild growth and plateau on the final weeks of gestation.

The spleen enlarges in length as much as 50% at some stage in pregnancy. The sure cause of this splenomegaly is unknown, but it is probably because of the growth in blood extent and hemodynamic modifications.

Cardiovascular System

Cardiovascular and hemodynamic modifications at some point of being pregnant have a essential position in assembly the wishes of the developing fetus however on the identical time in preserving the integrity of maternal cardiovascular functions [1].

As the uterus grows at some stage in the pregnancy, it elevates the diaphragm and so pushes the coronary heart to left-upward function even as inflicting the heart to rotate on its lengthy axis. Along with elevated plasma extent, the coronary heart suggests growth in myocardial mass and intracardiac extent. At time period, left ventricle mass expands 18–22% to make sure the ok blood deliver to mother and fetus. The cause of this growth is the elevated preload because of elevated plasma extent among gestational weeks 10 and 20.

One of the important modifications at some point of pregnancy is the 30–forty% growth in cardiac output. This growth may even be 20% extra in multifetal pregnancies in comparison to singletons. On twenty fourth week of gestation, cardiac output reaches its maximum level. This growth is related to elevated stroke extent and coronary heart price in conjunction with decreased systemic vascular resistance. Heart price suggests 10–15 beats/min growth at time period which begins offevolved with the aid of using the second one trimester. Uterine length and maternal function additionally have an effect on cardiac output. Especially on the in addition weeks of gestation, maternal supine function can lessen the cardiac flling with the aid of using inflicting aortocaval compression which immediately impacts cardiac feature. Supine hypotensive syndrome develops in about 10% of time period pregnancies and is characterised with the aid of using hypotension, bradycardia, and syncope. In the supine function, the stress at the inferior vena cava in conjunction with femoral and pelvic veins will increase which in flip slows down the stream and reasons often visible edema which can also additionally predispose the improvement of varicose veins withinside the legs and vulva and hemorrhoids or even deep-vein thrombosis. As the mom modifications her supine function to lateral recumbent function (laying to her side), increased venous stress returns to regular.

During regular pregnancy systemic vascular resistance, systolic, and diastolic blood pressures lower approximately 20%, 8%, and 2.0% respectively. Hormones which take a position in blood stress renovation with their increased ranges are renin, angiotensin II (AII), prostacyclin (PGI2), atrial natriuretic peptide (ANP), mind natriuretic peptide (BNP), nitric oxide (NO), estradiol (E2), and progesterone (P).

Endocrine System

Thyroid gland suggests physiological growth and an growth in vascularization at some point of being pregnant [1]. The imply thyroid extent will increase from 12 to fifteen mL at some stage in gestation. As the human chorionic gonadotropin (HCG) will increase at some point of the frst trimester, it stimulates the thyroid gland because of its alpha subunit's resemblance with thyroid-stimulating hormone (TSH). Parallel with this growth in α-HCG, serum TSH decreases at some point of first trimester.

High estrogen ranges stimulate hepatic synthesis of thyroid-binding globulin (TBG), which in flip reasons a upward thrust in general serum thyroxine (T4) and triiodothyronine (T3) ranges. Free T3 and T4 ranges are arguable at some point of being pregnant. Some research document no alternate or maybe an growth, while a few document a mild lower, but in widespread, in comparison to nonpregnant ladies, unfastened-hormone concentrations have a tendency to be decrease at time period pregnancy.

Iodine need is increased. The increased renal clearance of iodide along with the fetal requirements is responsible for this increase which causes a relative iodine-defcient state. Especially in regions where the iodine intake is low, goiter is commonly observed during pregnancy and may manifest as high TSH and low T4 levels.

The pituitary gland enlarges by 136% during pregnancy. Hypertrophy and hyperplasia of lactotroph cells stimulated by high

estrogen levels are responsible for this growth. In parallel with this increase, prolactin levels may exceed 200 ng/ml at the time of appointment.

Antidiuretic hormone (vasopressin) levels do not change during pregnancy. Placental secretion of growth hormone suppresses growth hormone, making it detectable by the sixth week of gestation.

Adrenocorticotropic hormone (ACTH), cortisol (both free and total), and urinary free cortisol increase during pregnancy and peak during labor. Aldosterone levels also rise during pregnancy.

Placenta

The placenta connects mother and fetus by transforming and transferring nutrients for the growth and development of the fetus and itself [4]. Metabolic end-products originating in the fetus or placenta are eliminated by their entry into the maternal circulation. A unique function of the placenta is its role as an endocrine organ that produces steroid and protein hormones. These characteristics should be taken into account when considering placental therapy to improve outcomes for placental, fetal, or maternal disease.

In other words, the fetal and maternal circulatory systems are separated by placental tissues that change during pregnancy. Anatomically, the surface area over which maternal-fetal exchange takes place increases and the distance between maternal and fetal blood decreases. Morphologically, the thickness of the syncytiotrophoblast decreases and the cytotrophoblast becomes discontinuous as gestation progresses. Changes in villus structure are also observed, with an increased number of microvilli that facilitate exchange between mother and fetus. These villi and syncytiotrophoblasts allow the maternal and fetal circulations to approach each other without contact and provide a transport barrier between the two circulations.

In the human placenta, the syncytiotrophoblast arises from the fusion of the cytotrophoblasts to form a syncytium on the maternal blood-facing surface of the placenta. The plasma membrane of the syncytiotrophoblast is polarized. The brush border membrane is in direct contact with the maternal blood and the basal membrane faces the fetal circulation. The brush border membrane has a microvillus structure that effectively reinforces its surface, whereas the basal membrane lacks this structure.

Anatomical interspecies differences in the number of trophoblast layers and connectivity between maternal and fetal tissues lead to species-specific differences in placental function, and data collected during the preclinical stages of drug development. The human placenta is unique in its villous structure. Factors such as diffusion, potential across the placenta, extent of maternal and fetal blood flow, and differences in metabolism, transport proteins, and other mechanisms for exchange between maternal and fetal circulation should be considered. Due to these anatomical differences in placental morphology and function, conflicting results on maternal and fetal pharmacokinetics are often seen between humans and many animal species. The thalidomide tragedy was paramount in dispelling the misconception that the placenta is a barrier and an evolving regulator of controlled animal-based preclinical teratology research. differences may also lead to misinterpretation of teratogenic effects.

The widely used drugs diazepam and salicylates have been shown to have teratogenic effects in animals, but there is no increased risk of such effects in humans.

Metabolism

During pregnancy, maternal metabolism undergoes important changes to meet the needs of the growing fetus and placenta [1]. During pregnancy, the metabolic rate increases by 20% compared to the non-pregnant state. Approximate total weight gain during pregnancy is 12 kg. The fetus, placenta, and amniotic fluid account for about 35% of this weight gain, with the rest coming from increased maternal blood and extravascular fluid volume, adipose tissue, breast enlargement, and uterine tissue.

ICU

An obstetrician caring for a patient in an intensive care unit (ICU) said: Sometimes explicitly requested. For example, it may simply be implied in the context of a more specific question, such as "Is this safe for babies?" fetus. The obstetrician is accustomed to treating her two patients simultaneously, one of whom she (the fetus) is now completely dependent on her one patient, and is generally self-sufficient. Intervention is unacceptable. However, peers in other fields may not be familiar with this kind of dual perspective and may fear the myth of mother-fetal conflict. is the best way to maintain maternal stability.

The primary goal of critical care remains the same, but the presence of a fetus may interfere with management. For example, for a woman admitted to her ICU for a primary obstetric illness, delivery can dramatically reverse pathology. Similarly, her CPR, performed on women in the second trimester and beyond, is effective when the uterus is empty. Apart from these circumstances, the restoration of maternal physiology remains the key to ensuring the ultimate well-being of the fetus, and the interests of the fetus do not conflict with those of the mother. Nonetheless, interventions or treatments that are relatively resilient and maintain or improve maternal physiologic status are beneficial to the fetus.

In most cases, obstetric patients admitted to the ICU have a better prognosis than GP non-obstetric patients, but both serious obstetric and non-obstetric illnesses can affect fetal and neonatal outcomes. There is a nature.

Fetal Growth

The regulation of fetal growth is complex and based on maternal, placental and fetal interactions [6]. A major determinant is the movement of nutrients and oxygen across the placenta, which depends on the interplay of genetic determinants, endocrine signaling, and substrate supply. About 40% of fetal growth is determined by genetic factors that influence the production of growth factors. Insulin growth factor 1 (IGF-1) and IGF-2, transplacental substrate transport and tissue formation kinetics. The remaining 60% is determined by the intrauterine environment of the fetus. This largely reflects maternal physiology and placental function.

In normal fetal development, exponential growth reaches its maximum rate in the third trimester. At this point, the fetal total body fat mass increases significantly. Functional maturation of the placenta occurs gradually during pregnancy to facilitate nutrient transport and fetal growth.

Nutrient transport across the placenta is dependent on placental surface area, protein transporter concentrations, and transporter binding affinities for essential nutrients such as glucose, amino acids and fatty acids. Placental oxygen diffusion is determined by fetoplacental surface area and placental fetal maternal blood flow. A maternal cardiac output that increases by 30–40% during normal pregnancy increases uterine perfusion from 50 mL/min at her 10th week to her 1300 mL/min at term. This significant increase in uterine perfusion exceeds the minimum requirement for fetal oxygenation and helps protect against rapid fluctuations in perfusion.

Regarding the fetal circulation, one-third of the total cardiac output is conducted to the placenta during the second trimester and one-fifth at term. Towards the end of pregnancy, cord blood recirculation within the fetus also increases. There are fetal circulatory adaptations to ensure preferential distribution of blood flow, first to the liver (70-80%) and then to the heart. In the heart, nutrient-rich blood flows into the right atrium to nourish the heart muscle and brain. Finally, the ductus venosus (DV) carries oxygenated cord blood directly to the heart, bypassing the liver and providing adequate blood flow to the brain, cardiovascular, and adrenal systems for fetal growth and function. maintain.

The final non-genetic factor that is important in determining fetal size in all pregnancies is 'maternal constraint'. This refers to a series of unclear physiological processes by which maternal and uteroplacental factors act to limit fetal growth and influence its predetermined growth trajectory.

Regulation of fetal growth is clearly complex and, as mentioned above, depends on interactions between mother, placenta and fetus. Anomalies can affect any of these compartments.

Critical Care

The organization of the intensive care unit, from the days of Florence Nightingale writing about postoperative recovery areas near the operating room with bedside nurses, to the technical and It has evolved into a medically advanced intensive care unit [7]. However, modern critical care units are really still in their infancy, and the first National Institutes of Health consensus conference on critical care was convened over 30 years ago to develop treatment protocols, designs, and procedures for these units. and staffing guidelines. There are now over 6,000 intensive care units for her in the United States. The medical needs of these critically ill patients are very complex. Because it is necessary to address not only the medical or surgical issues, but also the psychosocial parameters of the disease that affect the patient. As a result of this complexity, critical care teams have expanded into many areas with varying levels of organizational control.

Extensions of these critical care models have been applied to obstetrics. Pregnancy alters maternal physiology in relation to many organ systems with important care changes noted in the blood, cardiopulmonary, renal, endocrine and gastrointestinal systems. In addition to maternal care, the needs of the fetus should be considered. This is most likely also influenced by the mother's current health status. Addressing the needs of this patient population requires specific expertise not only on the part of obstetricians, but also on the part of nursing staff and additional support staff who can provide respiratory support and pharmacological interventions. It is clear that these patients require a multi-team approach to ensure optimal care.

Labor

Labor and delivery are normal physiological processes that occur without complications in most women [8]. The purpose of managing this process is to facilitate safe births for mothers and their newborns. In addition, staff should strive to make the patient and her companions feel welcome, comfortable, and informed throughout the labor and delivery process. Physical contact between newborns and parents should be encouraged in the delivery room. Every effort should be made to promote family interaction and support the family's desire to be together. The role of obstetricians/midwives and delivery staff is to anticipate and manage potential complications that may harm the mother or fetus. Decisions to intervene should be carefully considered. Each intervention carries not only potential risks, but also potential benefits. In most cases, the best treatment is close observation and careful intervention when needed.

Before the onset of true labor, several preparatory physiologic changes commonly occur. The settling of the fetal head into the brim of the pelvis, known as lightening, usually occurs 2 or more weeks before labor in first pregnancies. In women who have had a previous delivery, lightening often does not occur until early labor. Clinically, the mother may notice a flattening of the upper abdomen and increased pressure in the pelvis. This descent of the fetus is often accompanied by a decrease in discomfort associated with crowding of the abdominal organs under the diaphragm (eg, heartburn, shortness of breath) and an increase in pelvic discomfort and frequency of urination.

The mechanism of contraction at the apex consists of presentation segment engagement, flexion, descent, internal rotation, extension, external rotation, and ejection. The progress of labor is determined by the size and shape of the pelvis, the size of the fetus, and the intensity of labor. Basically, delivery takes place along the line of least resistance, i.e. by matching the smallest possible diameter of the execution part to the most favorable dimensions and contours of the birth canal.

Operative Delivery

Operative Delivery refers to obstetric interventions in which active steps are taken to achieve delivery [9]. Operative delivery can be divided into surgical delivery and cesarean delivery. The success and safety of these procedures are based on operator skill, appropriate timing, and ensuring that the correct indications are met and contraindications are avoided.

Caesarean section is used when vaginal delivery is not possible or poses undue risk to mother and baby. Some indications for cesarean section are clear and simple, while others are relative. In some cases, good judgment is needed to decide whether a caesarean section or vaginal delivery is better. It is impractical to list all possible indications. However, there are few obstetric complications that are not treated by caesarean section. The following indications are currently the most common.

Conclusion

During pregnancy, the future mother experiences a series of changes that enable her body to adapt to pregnancy, growth

and development of the child, preparation for childbirth and childbirth and breastfeeding. Pregnancy causes physiological changes in all organ systems of the mother; most of them return to their pre-pregnancy state after delivery. In general, the changes are more pronounced in multiple pregnancies than in single pregnancies. Most of these changes are already noticeable during the first weeks after conception. Most can be explained by changes in the functioning of the glands or are a simple consequence of the physical adaptation of the mother's organs to the growth of the child.

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