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Physiological Changes in a Woman during Pregnancy

18/mhs02/095

Nursing, 200L

May 21, 2020

Maternal physiological changes in pregnancy are the adaptations during pregnancy that a woman’s body undergoes to accommodate the growing embryo or fetus. In order to meet with the demands of pregnancy, physiological adaptations occur in the mother. These adaptations allow her to support and protect the fetus. We will take a systems based approach to discuss the different changes which occur during pregnancy.

## ENDOCRINE SYSTEM:

During pregnancy a woman experiences a change in her endocrine system. Throughout pregnancy the levels of progesterone and estrogen increase; the estrogen being produced by the placenta and the progesterone being produced by the corpus luteum and later by the placenta.

The increase levels results in an increase in hepatic production of thyroid binding globulin **(TBG).** As a result, freer T3 and T4 bind to the TBG; this causes more thyroid stimulating hormone to be released from the anterior pituitary gland. Therefore, the free T3 and T4 levels remain unchanged – but the total T3 and T4 levels rise.

**Thyroxin**is essential for fetus’s neural development, but the fetal thyroid gland is not functional until the second trimester of gestation. Hence, increasing T3 and T4 levels in the mother ensures that there is a constant supply of thyroxin to the fetus early in pregnancy.

**CARDIOVASCULAR**:

 During pregnancy progesterone levels increases. Progesterone acts to decrease systemic vascular resistance in pregnancy which leads to a decrease indiastolic blood pressure during the first and second trimester of pregnancy. In response to this the cardiac output increases by about 30-50%. An increase in blood pressure in pregnancy could be an indication of pre-eclapmsia.

Pregnancy results in the activation of the renin-angiotensin system. This leads to an increase in sodium levels and water retention. This means that the total blood volume increases.

**RESPIRATORY SYSTEM:**

Anatomically, the growth of the fetus during pregnancy causes upward displacement of the diaphragm. This however, does not decrease the total lung capacity significantly since there is also an increase in the transverse and anterior-posterior diameters of the thorax.

In pregnancy a woman faces an increase in their metabolic rate which leads to an increased demand for oxygen. The tidal volume and the minute ventilation rate increases to help the mother meet the oxygen demands.

Many women experience hyperventilation during pregnancy. It is thought that the reason for this is the increased carbon dioxide production and the increased respiratory drive caused by progesterone. This hyperventilation results in a respiratory alkalosis with a compensated increase in renal bicarbonate excretion.

**GASTRO INTESTINAL:**

The growth of the uterus causes a number of anatomical changes related to the gastrointestinal tract. One of these would be the upward displacement of the stomach as the uterus grows. This would lead to an increase in the intra-gastric pressure which would predispose the mother to getting symptoms of reflux, along with symptoms such as nausea and vomiting. The appendix may also move to the right upper quadrant of the abdomen as the uterus enlarges.

**URINARY:**

 Increased cardiac output during pregnancy causes an increase in renal plasma flow which increases the GFR by about 50-60%. This would mean that there is an increase in renal excretion. So in pregnancy the levels of urea and creatinine will be lower.

Progesterone affects the urinary collecting system causing relaxation of the ureter (resulting in hydro ureter). There is also relaxation of the muscles of the bladder. Both of these changes cause urinary stasis which predisposes a woman to UTIs, commonly pyelonephritis.

**HEMATOLOGICAL CHANGES:**

In pregnancy there is an increase in fibrinogen and clotting factors in the blood and a decrease in fibrinolysis. Additionally, due to an increase in progesterone levels stasis of blood and vasodilation occurs. All these factors increase the risk of thromboembolic disease in pregnancy. During pregnancy the plasma volume increases significantly. However, the red cell mass does not increase by as much. This results in a physiological dilution anemia (Khanna, 2018).

####  CHANGES IN THE UTERUS, CERVIX AND VAGINA

#### The uterus:

After conception, the uterus provides a nutritive and protective environment in which the fetus will grow and develop. It increases from the size of a small pear in its non-pregnant state to accommodate a full-term baby at 40 weeks of gestation. The tissues from which the uterus is made continue to grow for the first 20 weeks, and it increases in weight from about 50 to 1,000 grams. After this time, it doesn’t get any heavier, but it stretches to accommodate the growing baby, placenta and amniotic fluid. By the time the pregnancy has reached full term, the uterus will have increased to about five times its normal size:

##### **The cervix:**

The cervix remains 2.5 cm long throughout pregnancy. In late pregnancy, softening of the cervix occurs in response to increasing painless contractions of its muscular walls.

##### **The vagina:**

The vagina also becomes more elastic towards the end of pregnancy. These changes enable it to dilate during the second stage of labor, as the baby passes down the birth canal

### PREGNANCY-RELATED CHANGES IN POSTURE AND JOINTS:

A pregnant woman’s entire posture changes as the baby gets bigger. Her abdomen transforms from flat or concave (dished) to very convex (bulging outwards), increasing the curvature of her back. The weight of the fetus, the enlarged uterus, the placenta and the amniotic fluid together with the increasing curvature of her back, puts a large strain on the woman’s bones and muscles. As a result, many pregnant women get back pain. Too much standing in one place or leaning forward can cause back pain, and so can hard physical work

In addition, progesterone causes a loosening of ligaments and joints throughout the body.

**CHANGES IN BODY WEIGHT DURING PREGNANCY:**

Continuing weight increase in pregnancy is considered to be one favorable indication of maternal adaptation and fetal growth. However, routine weighing of the mother during pregnancy is not now thought to be necessary, because it does not correlate well with pregnancy outcomes. The expected increase in weight of a healthy woman in an average pregnancy, where there is a single baby, is as follows:

* About 2.0 kg in total in the first 20 weeks
* Then approximately 0.5 kg per week until full term at 40 weeks
* A total of 9 -12 kg during the pregnancy.

#### OEDEMA IN PREGNANCY:

A combination of the slight increase in the permeability of the smallest of blood vessels (they allow more fluid to leak out into the tissues), the additional weight of the uterus, and the downward force of gravity, slow down the rate at which blood is pumped back to the heart from the lower half of the body. Fluid often collects in the tissues of the legs and feet of pregnant women after the first trimester, instead of being absorbed into the blood circulation. The swelling caused by this collection of fluid is called oedema. It is a common condition in pregnant women, particularly if they stand for a long time during the day. Oedema of the hands may also occur.