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DEPARTMENT:NURSING

PHYSIOLOGICAL ADAPTATIONS OF THE FEMALE TO PREGNANCY.

Genital Changes

—The body of the uterus

-Height and weight(hyperplasia)

the height increases from 7.5cm to 35cm

the weight increases from 50g to 1000g at term.

—Uterine Ligaments

Show hypertrophy

—Dextrorotation

The uterus is tilted and twisted to the right in 80% of cases

the LUS formed from the isthmus

formed from the 4th month to reach 10cm at full term

-The Cervix

-edema and congestion, and becomes soft

-mucus plug(operculum):cervical mucus closing the cervical canal

-increased secretion from its gland

The Vulva

 Shows increased vascularity and varicosities

The Vagina

-show increased vascularity >>>soft, moist and Bluish

-distention of vagina at birth

The Ovary

 Shows increased vascularity and size

One ovary contains the corpus luteum

—Pelvic ligaments

 -relaxation of the ligaments

 -relaxation of the pelvic joint

 -the pelvic become more mobile and increases in capacity

Breast Changes

 -Increased in size and vascularity

 >>>>warm, tense and tender

-Increased pigmentation of the nipple and areola

-secondary areola appear

 (Light pigmentation around the 1ry areola)

-Montgomery tubercles appears on the areola

 (Dilates sebaceous glands)

-Colostrum like fluid is expressed at the end of the 3rd month.

Skin Changes

* Pigmentation

due to increased melanocyte stimulating hormone

 -linea nigra: pigmentation of the linea alba, more marked below the umbilicus

 -Chloasma gravidarum: butterfly pigmentation of the face( mask of the pregnancy)

* Striae gravidarum

-stretch of the abdominal wall

>>>>rupture of the subcutaneous elastic fibers

>>>>pink lines in flanks

-become white after labor

Wight Increase

-There is an increase weight of approximately 12.5Kg at term

-The main increase occurs in the 2nd half of the pregnancy,Kg/week

* Causes

Growth of the conceptus

Enlargement of the maternal organs

Maternal storage of fat

Increase in maternal blood and intestinal fluid.

Skeletal Changes

-Increased lumbar lordosis

-Relaxation of pelvic joints and ligaments

 Due to progesterone and relaxin

Urinary Changes

-Kidneys

Increase in size

Hydronephrosis

Effective renal plasma flow is increased

 Dilatation of the ureters

 -Atony of the ureteric muscles }caused by progesterone and relaxin

 Hydro-ureter

-vesico-ureteric reflux increased- pressure of the uterus on the ureters affects more the right ureter due to the dextro-rotation of the uterus

Changes in the ureter in pregnancy leads to urinary stasis and pyelitis.

Frequency of micturition

Causes: 1st trimester : pressure of the uterus on the bladder

 Late in pregnancy : engagement of the head

Urinary Output

-diminished on a normal fluid intake

-increase in tubular reabsorption

-100 extra liters of fluid pass into the renal tubules each day

-extracellular water is increased by 6 to 7 liters during pregnancy

-this is due to increased amounts of aldosterone progesterone and estrogen.

Gastrointestinal Changes

-Increased salivation (ptyalism)

-Taste is often altered very early in pregnancy

-Increase appetite and thirst>>>frequent small snacks

-Heart burn (reflux oesophagitis)

 Relaxation of the cardiac sphincter due to progesterone and relaxin

-Emesis gravidarum, morning sickness in 50%

-Decreased gastric acidity,which interfere with iron absorption

-Constipation

 Reduced gut motility due to progesterone

 Increased water and salt absorption

-Liver

 -Hepatic synthesis of albumin, plasma globulin and fibrinogen increase

-Total hepatic synthesis of globulin increases stimulated by estrogen

-Hormone-binding globulin rise

-Gall bladder increases in size and empties more slowly

-Relaxation of fall bladder increases the tendency of stone formation

-Cholestasis is almost physiological

-Secretion of bile is unchanged

Cardiovascular Changes

-Fall in total peripheral resistance by 6 weeks gestation to a nadir 40% by mid gestation

-Circulatory Under-filling

 Activation of renin-angiotensin-aldosterone system necessary expansion of the plasma volume

 The bigger the expansion,the bigger the baby birthweight

-Total extracellular volume 16% by term

-Plasma osmolarity by 10mOsm/Kg as water is retained.

Cardiovascular Changes

The heart

 -the heart rate raises synchronously by 10-15b.p.m

-stoke volume rises

-cardiac output begins to rise by 35-40% in a first pregnancy and ~50% in later pregnancies

The Blood Pressure

-Korotkoff 5 used with auscultatory techniques

-Slight drop in the 2nd trimester

 Small fall in systolic,greater fall in diastolic B.P

 Opening of arterio- venous shunts at the placenta

 >>>>>>Increased pulse pressure

-Supine hypotension syndrome in 8% of the women

 2nd half of the pregnancy:

Maternal hypotension occurs in the supine position due to pressure of the uterus on the inferior vena cava

>>>>Decreased venous return and cardiac output

Noradrenaline

 -pressor response to angiotensin II reduced in normal pregnancy,unchanged to noradrenaline

-plasma noradrenaline is not increased in normal pregnancy

Pulmonary Circulation

-able to absorb high rate of flow without an increase in pressure

-pressure in right ventricle,pulmonary arteries and capillaries does not change

-Pulmonary resistance falls in early pregnancy

-Progressive venodilation-rises in venous distenbility+capacitance throughout a normal pregnancy

Respiratory Changes

-Tidal volume rises by 30% in early pregnancy}driven by progesterone

 40-50%by term

-Fall in respiratory reserve and residual volume

>>>>>>>>>decrease the threshold

 Increase the sensitivity of medulla oblongata to Co2

-Respiratory rate does not change

 >>>>>the minute ventilation rises by a similar amount From 7.25L to 10.5L

-Elevation of the diaphragm in late pregnancy Dyspnea.

-Carbon dioxide production rises sharply during the 3rd trimester as fetal metabolism increases.

-The fall in maternal P CO2

 Allows more efficient placental transfer CO2 from the fetus

 Results in a fall in plasma bicarbonate concentration (from 24-28mmol/L to 18-22mmol/L

>>>>fall in plasma osmolarity

 Venous pH rises slightly (from 7.35 to 7.38)

The increased alveolar ventilation—small rise in PCO2 (from 96.7 to 101.8mmHg)

-Rightward shift of the maternal oxyhaemoglobin dissociation curve (due to an increase in 2,3-DPG in erythrocytes)

>>>>Oxygen unloading to the fetus which has:

 -lower PCO2(25-30mmHg,3.3-4KPa)

 - marked leftward shift of the oxyhaemoglobin dissociation curve(due to sensitivity of fetal hemoglobin dissociation curve(due to lower sensitivity of fetal haemoglobin to 2.3-DPG.

-Increase of 16% in oxygen consumption by term

-Fall in arterio-venous oxygen difference

-Pregnancy places greater demands on the cardiovascular than the respiratory system.

-Hematological Changes

—Circulating red cell mass increases by 20-30%

(Rises more in multiple pregnancies and iron supplements)

—Serum iron concentration halves by term (rental clearance)red cell folate concentration falls less

—Mild maternal anaemia associated with increased placental/birthweight ratio decreased birthweight

-Erythropoietin rises especially if iron supplements is not taken

-Human placental lactogen May stimulate haematopoiesis

-Fall in packed cell volume from 36% in early pregnancy to 32% in the 3rd trimester (normal plasma volume expansion)

-WBC count rises(increase in polymorphonuclear leukocyte)

-Neutrophil number rises with oestrogen

Peak at 33weeks

Stabilizing after that

Until labour and puerperium when they rise sharply

-T and B lymphocyte counts do not change but their function is suppressed

(Women becomes more susceptible to viral infections,malaria and leprosy)

-platelets count and platelets volume are largely unchanged

—Coagulation

 -factors Vii,Viii and X rises

 -absolute plasma fibrinogen doubles

 -antithrombin III falls

 -erythrocytes sedimentation and rates increase

 -protein C unchanged

 -Protein S concentrations, co-factor of protein C, fall in 1st and 2nd trimesters

 -Plasma fibrinolytic activity decreases during pregnancy and labour returns to normal values within an hour of delivery of placenta.

Endocrinal Changes

—Pituitary

 -anterior pituitary increases in size and activity

 -posterior pituitary releases oxytocin on the onset of labor

Thyroid

-increases in size and activity:physiological goiter

-most pregnant women are euthyroid

-thyroid binding globulin concentrations double (not other thyroid binding proteins)

-total T3,T4 are increased(not the free T3,T4)

 —Parathyroid

 -increases in size and activity to regulate calcium metabolism.

 ——Adrenals

 -Increases in size and activity

 -total cortisol is increased (free cortisol unchanged)

 ——Placental hormones

 Progesterone

 -produced by corpus luteum

 -levels rise steadily during pregnancy,output reaches 250mg/day

 -actions:

 -colon activity reduced,nausea,constipation

 -reduced bladder and ureteric tone

 -diastolic pressure reduced,venous dilatation

 -raises temperature

 —Placental hormones

 Oestrogen

 -Source:

 Ovary in early pregnancy

 Later,oestrone and oestradiol produced by the placenta increased a hundred fold

 Oestriol produced by the placenta and fetal adrenals increased thousand folds

 -levels :output of oestrogen reaches a maximum of at least 30-40mg/day

 Oestriol accounts 85%

 Levels increase up to term

Possible actions:

 1.Induced growth of uterus and control its function

 2.Responsible for the development of breasts(with progesterone)

 3.After chemical constitution of connective tissue,become more pliable

 4.Cause water retention

 5.Reduce sodium excretion

—-Metabolic Changes

 -Carbohydrate metabolism

 -Pregnancy is hyperlipidaemic and glucosiric

 -after mid-pregnancy,resistance of insulin develops

 -plasma glucose concentration rise,maintained between

 4.5-5.5mmol/L

 -glucose crosses the placenta,the fetus use glucose as primary energy substrate,transport occurs by carrier mediated mechanism

 -the insulin resistance is endocrine-driven,via increase in cortisol and hPl

 - concentration of glucagons and catecholamines are unaltered

—Carbohydrate Metabolism

 -Carbohydrate deposited in the liver as glycogen

 -Some escapes to general circulation

 -portion metabolism by the tissue:

 Converted to depot fat

 Stored as muscle glycogen

-first noticeable change occurs in blood sugar

-tested by giving a load of oral glucose(glucose tolerance test)

-the blood sugar,after meal,remains high facilitating placenta transfer

-with increased placental production of steroid,less glycogen deposited in the liver and muscles

 -the effect of fasting is pronounced in pregnancy

 Overnight fast of 12hours

 Hypoglycemia, production of ketone bodies

—-Protein metabolism

 -positive nitrogen balance

 - on average 500g of protein retained by the end of pregnancy

 -blood and urine urea are reduced.

—Fat Metabolism

 -by 30weeks,4kg are stored in form of

 Depot fat in the abdominal wall, back and thights

 Modest amount in breasts.