MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY

International Faculty

Department of obstetrics and gynecology

CONFIRMED by
Vice-rector for scientific and pedagogical work
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September 1, 2023

METHODOLOGICAL RECOMMENDATIONS
FOR LECTURE

International Faculty, Course V

Discipline "Obstetrics and Gynecology"

Lecture №1. Topic: Physiology of pregnancy. Methods of examination of pregnant women. Perinatal care.

Approved:

Meeting of the Department of Obstetrics and Gynecology of Odesa National Medical University

Protocol No. 1 dated August 28, 2023

Head of the Department of _____ (Ihor GLADCHUK)

Developer:
Ph.D., assistant professor of
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LECTURE №1:

PHYSIOLOGY OF PREGNANCY. METHODS OF EXAMINATION OF PREGNANT WOMEN. PERINATAL CARE.

RELEVANCE: During pregnancy there are progressive anatomical, physiological and biochemical changes not only confined to the genital organs but also to all systems of the body. This is principally a phenomenon of maternal adaptation to the increasing demands of the growing fetus. Unless well understood, these physiological adaptations of normal pregnancy can be misinterpreted as pathological.

Systematic supervision (examination and advice) of a woman during pregnancy is called antenatal (prenatal) care. The supervision should be regular and periodic in nature according to the need of the individual. Actually, prenatal care is the care in continuum that starts before pregnancy and ends at delivery and the postpartum period. Antenatal care comprises of careful history taking and examinations (general and obstetrical), advice given to the pregnant woman. Deep theoretical and practical knowledge of physiology of pregnancy and methods of obstetrical examination are needed for assessment of mother's health status, appropriate prenatal counseling and ensure successful obstetric outcome.

LEARNING OBJECTIVE is to gain basic knowledge about anatomical, physiological and biochemical changes during pregnancy, be familiar with the physiologic adaptations associated with a normal pregnancy, be able to differentiate between certain signs and symptoms that can be common to both disease processes and to physiologic adaptations of pregnancy, obtain knowledge about methods of obstetrical examination, appropriate prenatal counseling and supervision in order to provide successful obstetric outcome.

BASIC CONCEPTS: Fertilization and development of a fertilized egg. Placenta, its structure and function. Critical periods of embryo and fetal development. Influence of harmful factors on the embryo and fetus. Physiological changes in a woman's body during pregnancy. Hygiene and nutrition of a pregnant woman. Methods of examination of pregnant women: diagnosis of early and late pregnancy. Orientation of baby in the uterus. Management of physiological pregnancy. Laboratory diagnosis of HIV infection. Counseling in the context of HIV infection. The concept of counseling and its ethical principles. Counseling skills. Determination of maternity leave date and date of birth.

PLAN AND ORGANIZATIONAL STRUCTURE OF THE LECTURE

№	The main stages of the lecture, their content	Type of lecture, equipment of the lecture	Time distribution
1.	*Preparatory stage*		

	❑ Defining of educational goals		3 min
	❑ Providing of positive motivation		2 min
2.	*The main stage*		
	❑ Presentation of lecture material	Clinical	90%
	Plan:		
	– Physiological changes in the mother's body during pregnancy. - Diagnosis of pregnancy. - Methods of examination of pregnant women. - Methods of assessment of fetal wellbeing. - Perinatal protection of the fetus.	Multimedia equipment (computer, projector, screen, TV). Power Point presentation	15 min 15 min 20 min 15 min. 15 min
3.	*The final stage* Lecture summary. Answers to questions. Tasks for self-preparation		5 min

EDUCATIONAL MATERIALS

PHYSIOLOGICAL CHANGES DURING PREGNANCY

GENITAL TRACT CHANGES

Uterus

The effect of the hormonal stimulation is most marked upon the tissues of the genital tract, and the uterine muscle fibers grow to 15 times their prepregnancy length during pregnancy, whereas uterine weight increases from 50 g before pregnancy to 1000 g at term. In the early weeks of pregnancy the growth is by hyperplasia, and more particularly by hypertrophy of the muscle fibers, with the result that the uterus becomes a thick-walled spherical organ. From the 20th week growth almost ceases and the uterus expands by distension, the stretching of the muscle fibers being due to the mechanical effect of the growing fetus. With distension the wall of the uterus becomes thinner and the shape cylindrical. The uterine blood vessels also undergo hypertrophy and become increasingly coiled in the first half of pregnancy, but no further growth occurs after this, and the additional length required to match the continuing uterine distension is obtained by uncoiling the vessels.

The uterus is derived from the two Müllerian ducts and the myometrium is made up of a thin external, largely longitudinal, layer; a thin inner, largely circular layer; and a thick, intricately interlaced middle layer, which comprises two spiral systems of interdigitating muscles derived from the two Müllerian ducts through which the blood vessels run. Apposition of two double curve muscle fibers give the figure of ‘8’ form. Thus, when the muscles contract, they occlude the blood vessels running through the fibers and hence called living ligature. The proportion of muscle to connective tissue

is greatest in the fundal area and diminishes as the lower segment of the uterus and cervix is approached, the lower half of the cervix having no more than 10% of muscle tissue.

The effect of the uterine distension is to stretch both interdigitating spiral systems and to increase the angle of crossing of the fibers, in the thinner lower segment area where the fibers cross at an angle of about 160° and are less stretched. Incision of the myometrium in this zone is anatomically more suitable, and experience of lower segment caesarean section confirms that healing is better.

Contractions (Braxton-Hicks): Uterine contraction in pregnancy has been named after Braxton-Hicks who first described its entity during pregnancy. From the very early weeks of pregnancy, the uterus undergoes spontaneous contraction. This can be felt during bimanual palpation in early weeks or during abdominal palpation when the uterus feels firmer at one moment and soft at another. Although spontaneous, the contractions may be excited by rubbing the uterus. The contractions are irregular, infrequent, spasmodic and painless without any effect on dilatation of the cervix. The patient is not conscious about the contractions. Intrauterine pressure remains below 8 mm Hg. Near term, the contractions become frequent with increase in intensity so as to produce some discomfort to the patient.

The lower uterine segment is that part of the lower uterus and upper cervix lying between the line of attachment of the peritoneum of the uterovesical pouch superiorly and the histological internal os inferiorly. It is that part of the uterus where the proportion of muscle diminishes, this muscle being replaced increasingly by connective tissue (75%), which forms 90% of the cervical tissues (mainly collagen fibers). Because of this the lower uterine segment becomes stretched in late pregnancy as the thickly muscled fundus draws it up from the relatively fixed cervix.

Cervix

The cervix becomes softer and swollen in pregnancy, with the result that the columnar epithelium lining the cervical canal becomes exposed to the vaginal secretions. This change in the cervix is due to oestradiol, which increases the hygroscopic properties of the cervical connective tissue and loosens the acid mucopolysaccharides (glycosaminoglycans) of the collagen-binding ground substance.

Prostaglandins act on the collagen fibers, especially in the last weeks of pregnancy. At the same time, collagenase is released from leucocytes, which also helps in breaking down collagen. The cervix becomes softer and more easily dilatable – the so-called ripening of the cervix. In this way the cervix is more easily able to dilate in labor.

Vagina

The vaginal mucosa becomes thicker, the vaginal muscle hypertrophies, and there is an alteration in the composition of the surrounding connective tissue, with the result that the vagina dilates more easily to accommodate the fetus during parturition. The changes, initiated by oestrogen, occur early in pregnancy and there is increased desquamation of the superficial vaginal mucosal cells with increased vaginal discharge

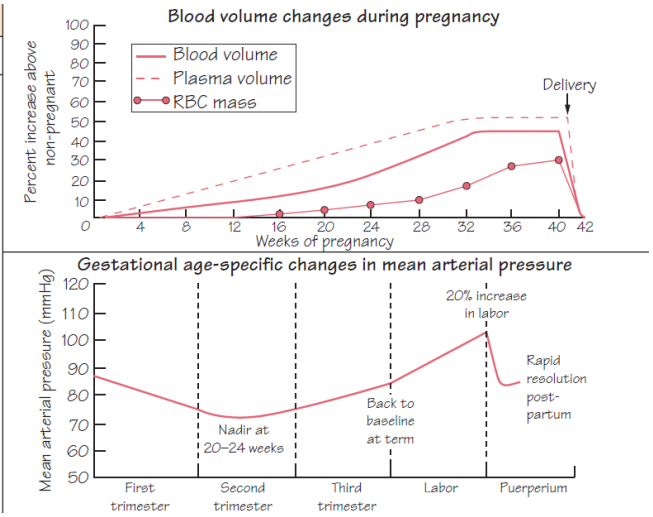
in pregnancy. Should pathogens, whether bacterial, fungal (such as candida) or parasitic (such as trichomonas), enter the vagina they can more easily establish themselves and, consequently, vaginitis is more frequently found in pregnancy.

CARDIOVASCULAR SYSTEM

The plasma volume increases to fill the additional intravascular space created by the placenta and the blood vessels. The red cell mass increases to meet the increased demand for oxygen. Because the increase in the red cell mass is proportionately less than the increase in the plasma volume, the concentration of the erythrocytes in the blood falls, with a reduction in the haemoglobin concentration. Although the haemoglobin concentration falls to about 120 g/L at the 32nd week, a larger total haemoglobin is present than when not pregnant. Concurrently the number of white blood cells increases (to about 10 500/mL), as does the blood platelet count.

Central hemodynamic changes induced by pregnancy

Measurement	Non-pregnant	Term pregnant	Change
• Blood volume (mL)	3,500	5,000	+ 40%
• Mean arterial BP (mmHg)	86 ± 8	90 ± 6	no change
• Cardiac output (L/min)	4.3 ± 1	6.2 ± 1	+ 44%
• Heart rate (bpm)	71 ± 10	83 ± 10	+ 17%
• Central venous pressure (mmHg)	4 ±3	4 ± 3	no change
• Pulmonary capillary wedge pressure (mmHg)	6 ± 2	8 ± 2	no change
• Systemic vascular resistance (dyne/s per cm^{-5})	1,530 ± 520	1,210 ± 266	− 21%
• Pulmonary vascular resistance (dyne/s per cm^{-5})	119 ± 47	78 ± 22	− 35%
• Left ventricular stroke work index (g/m per m^2)	41 ± 8	48 ± 6	no change



Cardiovascular dynamics: To deal with the increased blood volume and the additional demand for oxygen in pregnancy the cardiac output increases by 30–50%. Most of the increased output is due to an increased stroke volume, but the heart rate increases by about 15%. The increased cardiac output is balanced by a decrease in the peripheral resistance. For these reasons, blood pressure falls in early pregnancy rising back to prepregnancy levels by the third trimester.

In common with other blood vessels, the veins of the legs become distended. The leg veins are affected particularly in late pregnancy because of the obstruction to venous return caused by the higher pressure of the venous blood returning from the uterus and the mechanical pressure of the uterus on the vena cava. This may lead to varicosities in the leg veins (and occasionally the vulvar veins) of susceptible women.

Regional distribution of the blood: The uterus receives the greatest proportion of the blood flow, which is vital to perfuse the placenta properly, reaching 500 mL/min by late pregnancy. Renal blood and plasma flow increase to 400 mL/min above non-pregnant levels by the 16th week of pregnancy, and remain at this high level to term. Blood flow through the capillaries of the skin and mucous membranes increases, reaching a maximum of 300–400 mL/min by the 36th week. The increased skin blood

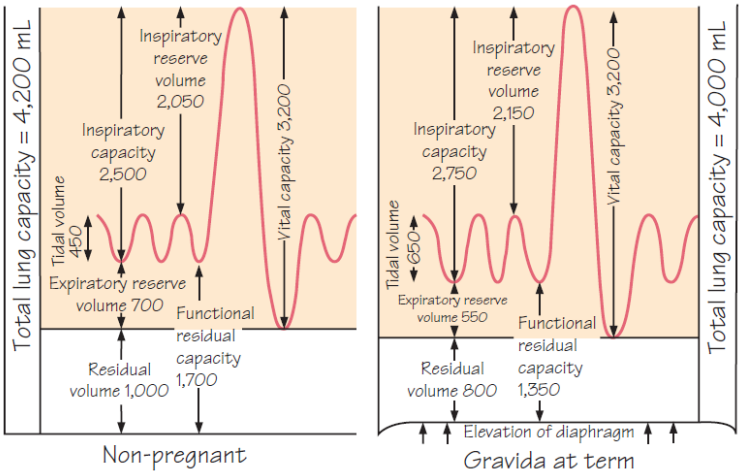
flow is associated with peripheral vasodilatation. This is the reason why pregnant women 'feel the heat', sweat easily and often profusely, and may complain of nasal congestion.

RESPIRATORY SYSTEM CHANGES

Respiratory adaptations during pregnancy are designed to optimize maternal and fetal oxygenation, and to facilitate transfer of CO2 waste from the fetus to the mother.

Many pregnant women report a subjective perception of shortness of breath (dyspnea) in the absence of pathology. The reason for this is unclear.

Respiratory changes in pregnancy



Effect of pregnancy on pulmonary-function testing

- Forced expiratory volume in one second (FEV_1)…no change in pregnancy (80–85% of vital capacity)
- Forced vital capacity (FVC)…….no change (~ 3.5 L)
- FEV_1/FVC ratio…….no change (>85%)
- Peak expiratory flow rate…….no change (~ 450 L/min)

The mechanics of respiration change with pregnancy. The ribs flare outward and the level of the diaphragm rises 4 cm.

During pregnancy, tidal volume increases by 200 mL (40%), resulting in a 100–200 mL (5%) increase in vital capacity and a 200 mL (20%) decrease in the residual volume, thereby leaving less air in the lungs at the end of expiration. The respiratory rate does not change. It is thought that this effect is due to the increased secretion of progesterone. The end-result is an increase in minute ventilation and a drop in arterial PCO_2 (see table below). Arterial PO_2 is slightly raises. A compensatory decrease in bicarbonate enables the pH to remain unchanged. Pregnancy thus represents a state of compensated respiratory alkalosis.

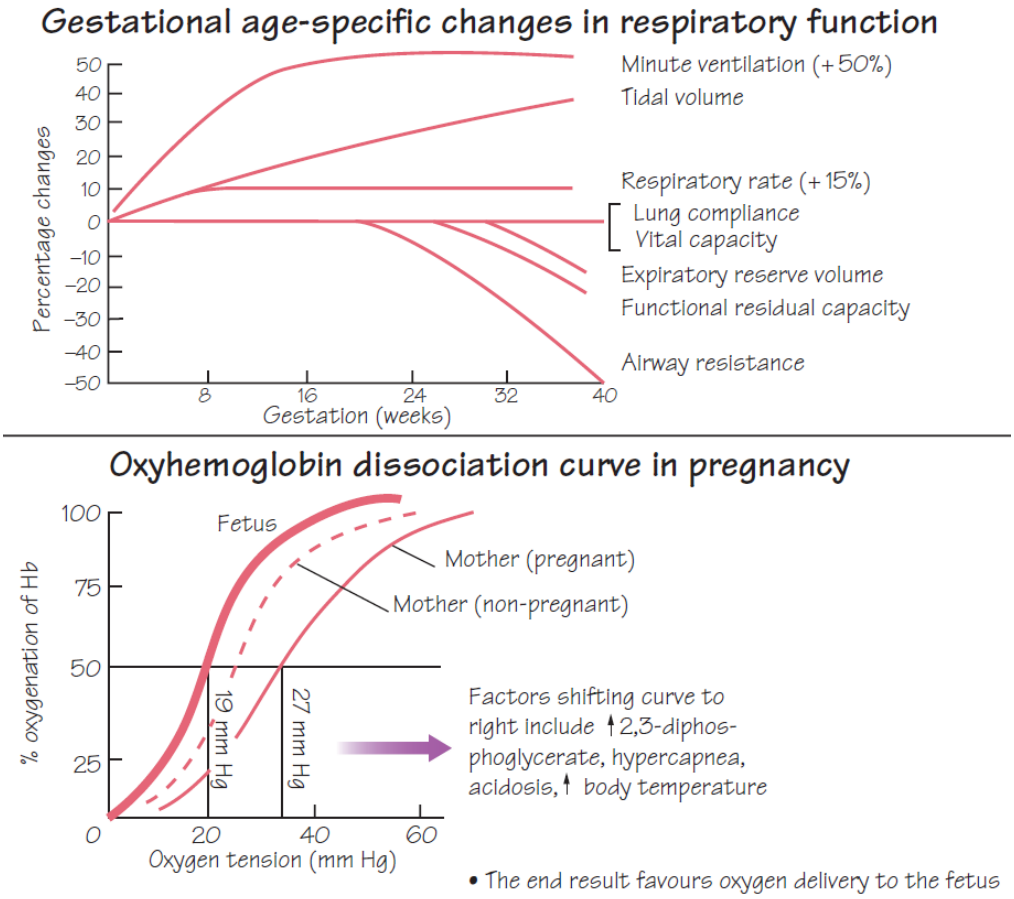
ALIMENTARY SYSTEM CHANGES

Nausea ("morning sickness") occurs in >70% of pregnancies. Symptoms usually resolve by 17 weeks.

Progesterone causes relaxation of gastrointestinal smooth muscle, resulting in delayed gastric emptying and increased reflux.

Pregnancy predisposes to cholelithiasis (gallstones). Most gallstones in pregnancy are cholesterol stones.

Pregnancy is a “diabetogenic state” with evidence of insulin resistance and reduced peripheral uptake of glucose (due to increased levels of placental anti-insulin hormones, primarily human chorionic somatolactotropin or placental lactogen). These mechanisms are designed to ensure a continuous supply of glucose to the fetus.



RENAL SYSTEM CHANGES

Glomerular filtration rate (GFR) increases by 50% early in pregnancy, leading to an increase in creatinine clearance and a 25% decrease in serum creatinine and urea concentrations.

Increased GFR results in an increase in filtered sodium. Aldosterone levels increase two- to threefold to reabsorb this sodium.

Increased GFR also results in decreased resorption of glucose. As such, 15% of normal pregnant women exhibit glycosuria.

Mild hydronephrosis and hydroureter are common sonographic findings that are due to high progesterone levels and partial obstruction from the gravid uterus.

Five percent of pregnant women have bacteria in their urine. Pregnancy does not increase the incidence of asymptomatic bacteriuria, but such women are more likely to develop pyelonephritis (20–30%).

HEMATOLOGIC SYSTEM

Increased intravascular volume results in dilutional anemia. Elevated erythropoietin levels lead to a compensatory increase in total red cell mass, but never fully correct the anemia.

A modest increase in white blood cell count (leukocytosis) can be seen during pregnancy, but the differential count should not change.

Mild thrombocytopenia (<150,000 platelets/mL) is seen in 10% of pregnant women. This is probably dilutional and rarely clinically significant.

Pregnancy represents a hypercoagulable state with increased circulating levels of factors II (fibrinogen), VII, IX, and X. These changes protect the mother from excessive blood loss at delivery, but also predispose to thromboembolism.

IMMUNE SYSTEM CHANGES

Human chorionic gonadotrophin can reduce the immune response of pregnant women. In addition, serum levels of IgG, IgA and IgM decrease from the 10th week of pregnancy, reaching their lowest level at the 30th week and remaining at this level to term. These changes may account for the anecdotal increase in the risk of infection among pregnant women.

WEIGHT GAIN IN PREGNANCY

The better absorption of nutrients from the gut, the reduction of muscle tone and a reduction in thyroid activity produce a quiescence in the maternal metabolism. The body adapts to preserve and nourish the growing fetus. During pregnancy a woman inevitably gains weight. A healthy person may expect to gain 12.5 kg (range 9–15 kg) in pregnancy, of which 9 kg is gained in the last 20 weeks. The ‘ideal’ weight gain is only a guide, and an allowance should be made for individual variations. However, a woman whose prepregnancy weight is in the normal range (body mass index (BMI) 19–24.9) or who is overweight (BMI 25–29.9) should avoid excessive weight gain (more than 15 kg), as she may find it difficult to regain her prepregnancy weight after the birth. This is of concern to many women, who want to be reassured that they will regain their body shape and prepregnancy weight as soon as possible after the baby has been born.

After the birth there is a great variability in weight loss. Six weeks after the birth an average woman weighs 3 kg more than her prepregnancy weight. Six months after the birth she will weigh about 1kg more than she weighed before she became pregnant.

The situation is different for obese and underweight women, both during pregnancy and after birth. An obese woman (BMI >30) should be encouraged to limit her weight gain during pregnancy, as she has an increased risk that pre-eclampsia may occur and that she will have a large baby. She should have a glucose tolerance test

performed to exclude gestational diabetes mellitus, and she should be advised to eat a sensible but not a very low-energy diet.

An underweight woman (BMI <18) should avoid becoming pregnant until she has gained weight, as she has a 20% chance of giving birth to a low-birthweight baby.

Weight gain in pregnancy is caused by several factors:

• The products of conception – the fetus, placenta and amniotic fluid

• The maternal factors – the uterus and breasts, the increased blood volume, the increased stores of fat, water retention.

Fetus, placenta and amniotic fluid: In the first 20 weeks of pregnancy fetal weight gain is slow; in the second 20 weeks it increases more rapidly. The weight gain of the placenta shows the reverse of that of the fetus. The amniotic fluid increases rapidly from the 10th week, being 300 mL at 20 weeks, 600 mL at 30 weeks, and peaking at 1000 mL at 35 weeks. After this a small decline in the total quantity of amniotic fluid occurs.

Maternal factors: The weight of the uterus increases throughout pregnancy. It is more rapid in the first 20 weeks, when myohyperplasia is occurring, than in the second 20 weeks when most of the enlargement is due to stretching of the muscle fibers. The breasts increase in weight throughout pregnancy owing to deposition of fat, increased retention of fluid, and growth of the glandular elements. The blood volume also increases throughout the pregnancy. The amount of fat deposited in adipose tissues depends on the amount of fat and carbohydrate in the diet. A gain of 2.5–3.0 kg of fat is usual, of which 90% is deposited in the first 30 weeks. The fat contains 90–105 MJ of energy, which can be released after birth for various activities, including breastfeeding. In a normal pregnancy the total body fluid increases by 6–8 L, of which 2–4 L is extracellular. Most of the fluid is retained before the 30th week, but a pregnant woman who has no clinical oedema retains 2–3 L of extracellular fluid in the last 10 weeks of pregnancy.

Energy

The resting metabolic rate (RMR) in pregnancy is 10–15% higher than in non-pregnant women. The extra energy required in the 40 weeks of pregnancy for the increased RMR, the growth of the fetus and placenta, the increase in size of the uterus and breasts, and the extra fat is about 250 MJ. This works out at about 0.9 MJ (about 215 kcal) a day – an amount provided by two slices of bread and 100 mL of milk. A pregnant woman does not need to eat for two!

ENDOCRINE GLANDS

The endocrine glands play very important role in the physiology of reproduction. At 6–8 weeks, there is transfer of functions of corpus luteum to the placenta — which acts temporarily as a new endocrine organ or powerhouse of hormone production.

Placenta produces a variety of hormones of which protein and steroid hormones are significantly important.

Human chorionic gonadotropin (hCG): hCG is a glycoprotein. Its molecular weight is 36000–40000 daltons. It consists of a hormone non-specific **a** (92 amino

acids) and a hormone specific **b** (145 amino acids) subunit. hCG is chemically and functionally similar to pituitary luteinizing hormone. The a subunit is biochemically similar to LH, FSH and TSH whereas the b subunit is relatively unique to hCG. Placental GnRH may have a control on hCG formation.

Functions: (1) It acts as a stimulus for the secretion of progesterone by the corpus luteum of pregnancy. The rescue and maintenance of corpus luteum till 6 weeks of pregnancy is the major biological function of hCG.

(2) hCG stimulates Leydig cells of the male fetus to produce testosterone in conjunction with fetal pituitary gonadotropins. It is thus indirectly involved in the development of male external genitalia.

(3) It has got immunosuppressive activity which may inhibit the maternal processes of immunorejection of the fetus as a homograft.

(4) Stimulates both adrenal and placental steroidogenesis.

(5) Stimulates maternal thyroid because of its thyrotropic activity.

(6) Promotes secretion of relaxin from the corpus luteum.

Level of hCG at different periods of pregnancy: hCG is produced by the syncytiotrophoblast of the placenta and secreted into the blood of both mother and fetus. The plasma half life of hCG is about 36 hours. By radioimmunoassay, it can be detected in the maternal serum or urine as early as 8-9 days postfertilization. In the early pregnancy, the doubling time of hCG concentrations in plasma is 1.4–2 days. The blood and urine values reach maximum levels ranging 100 IU and 200 IU/mL between 60–70 days of pregnancy. The concentration falls slowly reaching a low level of 10–20 IU/ mL between 100–130 days. High levels of hCG could be detected in—(a) multiple pregnancy (b) hydatidiform mole or choriocarcinoma and relatively high in—(c) pregnancy with a 21-trisomy fetus (Down's syndrome). Plasma lower levels are found in ectopic pregnancies and in spontaneous abortion. hCG disappears from the circulation within 2 weeks following delivery.

Human placental lactogen (hPL): This is also known as human chorionic somatomammotropin (hCS). The hormone is synthesized by the syncytiotrophoblast of the placenta. The hormone is chemically and immunologically similar to pituitary growth hormone and prolactin. hPL in maternal serum is first detected during the 3rd week. The level rises progressively from 5 to 25 μg/mL until about 36 weeks. The plasma concentration of hPL is proportional to placental mass.

Functions: hPL antagonises insulin action. High level of maternal insulin helps protein synthesis. hPL causes maternal lipolysis and promotes transfer of glucose and amino acids to the fetus. As a potent angiogenic hormone, it helps to develop fetal vasculature. It promotes growth of breasts for lactation.

Pregnancy associated plasma protein—A (PAPP-A) is secreted by the syncytiotrophoblast. It acts as an immunosuppressant in pregnancy.

Estrogen: In late pregnancy, qualitatively, estriol is the most important amongst the three major estrogens. The site of its production is in the syncytiotrophoblast. The placenta is an incomplete endocrine organ as it has no capability of independent steroidogenesis like that of ovary. For steroidogenesis, it depends much on the

precursors derived mainly from the fetal and partly from the maternal sources. Fetal adrenal gland and the placenta contain the complementary enzyme system.

Estriol is first detectable at 9 weeks (0.05 ng/mL) and increases gradually to about 30 ng/mL at term. Fetal death, fetal anomalies (adrenal atrophy, anencephaly, Down's syndrome), hydatidiform moles, placental sulfatase or aromatase deficiency are associated with low estriol.

Progesteron: Before 6 weeks of pregnancy, the corpus luteum secretes 17-ydroxyprogesterone. Following the development of trophoblast, progesterone is synthesized and secreted in increasing amount from the placenta. The daily production rate of progesterone in late normal pregnancy is about 250 mg. Low progesterone levels are observed in ectopic pregnancy and in abortion. High values are observed in hydatidiform mole, Rh-isoimmunization. After delivery, the plasma progesterone decreases rapidly and is not detectable after 24 hours.

Functions of the steroid hormones (estrogen and progesterone):

It is indeed difficult to single out the function of one from the other.

— Together they play an important role in the maintenance of pregnancy. Estrogen causes hypertrophy and hyperplasia of the uterine myometrium, thereby increasing the accommodation capacity and blood flow of the uterus. Progesterone in conjunction with estrogen stimulates growth of the uterus, causes decidual changes of the endometrium required for implantation and it inhibits myometrial contraction.

— Development and hypertrophy of the breasts during pregnancy are achieved by a number of hormones. Hypertrophy and proliferation of the ducts are due to estrogen, while those of lobulo-alveolar system are due to combined action of estrogen and progesterone (details — below).

— Both the steroids are required for the adaptation of the maternal organs to the constantly increasing demands of the growing fetus.

— Progesterone maintains uterine quiescence, by stabilizing lysosomal membranes and inhibiting prostaglandin synthesis. Progesterone and estrogens are antagonistic in the process of labor.

— Estrogens sensitizes the myometrum to oxytocin and prostaglandins. Estrogens ripen the cervix.

— Progesterone along with hCG and decidual cortisol inhibits T-lymphocyte mediated tissue rejection and protects the conceptus.

— Together they cause inhibition of cyclic fluctuating activity of gonadotropin–gonadal axis thereby preserving gonadal function.

Relaxin: It is a peptide hormone structurally related to insulin. The main source of production is the corpus luteum of the ovary but part of it may be also produced by the placenta and decidua. It has been claimed that relaxin relaxes myometrium, the symphysis and sacroiliac joints during pregnancy and also helps in cervical ripening by its biochemical effect.

DIAGNOSIS OF PREGNANCY

DURATION OF PREGNANCY: The duration of pregnancy has traditionally been calculated by the clinicians in terms of 10 lunar months or 9 calendar months and 7 days or 280 days or 40 weeks, calculated from the first day of the last menstrual period. This is called menstrual or gestational age. But, fertilization usually occurs 14 days prior to the expected missed period and in a previously normal cycle of 28 days duration, it is about 14 days after the first day of the period. Thus, the true gestation period is to be calculated by subtracting 14 days from 280 days, i.e. 266 days. This is called fertilization or ovulatory age and is widely used by the embryologist.

Symptoms of pregnancy can be divided into three groups: presumptive, probable and definitive.

— Presumptive symptoms and signs: It includes the features mainly appreciated by the women. (1) Amenorrhea (2) Frequency of micturition (3) Morning sickness (4) Fatigue (5) Breast changes (6) Skin changes (7) Quickening.

— Probable signs: (1) Abdominal enlargement (2) Braxton-Hicks contractions (3) External ballottement (4) Outlining the fetus (5) Changes in the size, shape and consistency of the uterus (6) Jacquemier's sign (7) Softening of the cervix (8) Osiander's sign (9) Internal ballottement (10) Immunological test.

— Definitive or absolute signs: (1) Palpation of fetal parts and perception of active fetal movements by the examiner at about 20th week (2) Auscultation of fetal heart sounds (3) Ultrasound evidence of embryo as early as 6th week and later on the fetus.

The following are the *presumptive symptoms and signs* (unrelated to uterus and fetus) of pregnancy:

Amenorrhea during the reproductive period in an otherwise healthy individual having previous normal periods, is likely due to pregnancy unless proved otherwise. However, cyclic bleeding may occur up to 12 weeks of pregnancy, until the decidual space is obliterated by the fusion of decidua vera with decidua capsularis. Such bleeding is usually scanty, lasting for a shorter duration than her usual and roughly corresponds with the date of the expected period. This is termed as placental sign. This type of bleeding should not be confused with the commonly met pathological bleeding, i.e. threatened abortion. Pregnancy, however, may occur in women who are previously amenorrheic — during lactation and puberty.

Fatigue is a frequent symptom which may occur early in pregnancy.

Morning sickness is inconsistently present in about 50% cases, more often in the first pregnancy than in the subsequent one. It usually appears soon following the missed period and rarely lasts beyond the first trimester. Its intensity varies from nausea on rising from the bed to loss of appetite or even vomiting. But it usually does not affect the health status of the mother.

Frequency of micturition is quite troublesome symptom during 8–12th week of pregnancy. It is due to (1) resting of the bulky uterus on the fundus of the bladder because of exaggerated anteverted position of the uterus, (2) congestion of the bladder

mucosa and (3) change in maternal osmoregulation causing increased thirst and polyuria. As the uterus straightens up after 12th week, the symptom disappears.

Breast discomfort in the form of feeling of fullness and 'pricking sensation' is evident as early as 6–8th week specially in primigravidae.

The breast changes are evident between 6–8 weeks. There is enlargement with vascular engorgement evidenced by the delicate veins visible under the skin. The nipple and the areola (primary) become more pigmented specially in dark women. Secondary areola specially demarcated in primigravidae, usually appears at about 20th week. Montgomery's tubercles are prominent. Thick yellowish secretion (colostrum) can be expressed as early as 12th week. Variable degree of striae may be visible with advancing weeks.

Skeen changes: (1) Linear pigmented zone (linea nigra) extending from the symphysis pubis to ensiform cartilage may be visible as early as 20th week (2) Striae (both pink and white) of varying degree are visible in the lower abdomen, more towards the flanks (3) Chloasma: Pigmentation over the forehead and cheek may appear at about 24th week.

"Quickening" (feeling of life) denotes the perception of active fetal movements by the women. It is usually felt about the 20th week, about 2 weeks earlier in multiparae. Its appearance is a useful guide to calculate the expected date of delivery with reasonable accuracy.

The following are the *probable signs* (related to uterus and mum's feelings) of pregnancy:

Progressive enlargement of the lower abdomen by the growing uterus.

Pelvic changes — The pelvic changes are diverse and appear at different periods. Collectively, these may be informative in arriving at a diagnosis of pregnancy.

Jacquemier's or Chadwick's sign: It is the dusky hue of the vestibule and anterior vaginal wall visible at about 8th week of pregnancy. The discoloration is due to local vascular congestion.

Vaginal sign: (a) Apart from the bluish discoloration of the anterior vaginal wall (b) The walls become softened and (c) Copious non-irritating mucoid discharge appears at 6th week (d) There is increased pulsation, felt through the lateral fornices at 8th week called Osiander's sign.

Cervical signs: (a) Cervix becomes soft as early as 6th week (Goodell's sign), a little earlier in multiparae. The pregnant cervix feels like the lips of the mouth, while in the non-pregnant state, like that of tip of the nose. (b) On speculum examination, the bluish discoloration of the cervix is visible. It is due to increased vascularity.

Uterine signs: (a) Size, shape and consistency — The uterus is enlarged to the size of hen's egg at 6^{th} week, size of a goos' egg at 8th week and size of a fetal head by 12th week. The pyriform shape of the non-pregnant uterus becomes globular by 12 weeks.

(b)There may be asymmetrical enlargement of the uterus if there is lateral implantation. This is called Piskacek's sign where one half is firmer than the other half.

As pregnancy advances, symmetry is restored. The pregnant uterus feels soft and elastic.

(c) Hegar's sign: It is present in two-thirds of cases. It can be demonstrated between 6–10 weeks, a little earlier in multiparae. This sign is based on the fact that: (1) upper part of the body of the uterus is enlarged by the growing fetus (2) lower part of the body is empty and extremely soft and (3) the cervix is comparatively firm. Because of variation in consistency, on bimanual examination (two fingers in the anterior fornix and the abdominal fingers behind the uterus), the abdominal and vaginal fingers seem to oppose below the body of the uterus. Examination must be gentle to avoid the risk of abortion.

(d) Palmer's sign: Regular and rhythmic uterine contraction can be elicited during bimanual examination as early as 4–8 weeks. Palmer in 1949, first described it and it is a valuable sign when elicited. To elicit the test, the uterus is cupped between the internal fingers and the external fingers for about 2–3 minutes. During contraction, the uterus becomes firm and well defined but during relaxation, becomes soft and ill defined. While the contraction phase lasts for about 30 seconds, with increasing duration of pregnancy, the relaxation phase increases. After 10th week, the relaxation phase is so much increased that the test is difficult to perform.

Fundal height is increased with progressive enlargement of the uterus. Approximate duration of pregnancy can be ascertained by noting the height of the uterus in relation to different levels in the abdomen.

The following formula is a useful guide for the purpose. Uterus remains a pelvic organ until 12th week, it may be just felt per abdomen as a suprapubic bulge. The height of the uterus is midway between the symphysis pubis and umbilicus at 16th week; at the level of umbilicus at 24th week and at the junction of the lower third and upper two-third of the distance between the umbilicus and ensiform cartilage at 28th week.

The distance between the umbilicus and the ensiform cartilage is divided into three equal parts. The fundal height corresponds to the junction of the upper and middle third at 32 weeks, up to the level of ensiform cartilage at 36th week and it comes down to 32 week level at 40th week because of engagement of the presenting part. To determine whether the height of the uterus corresponds to 32 weeks or 40 weeks, engagement of the head should be tested. If the head is floating, it is of 32 weeks pregnancy and if the head is engaged, it is of 40 weeks pregnancy.

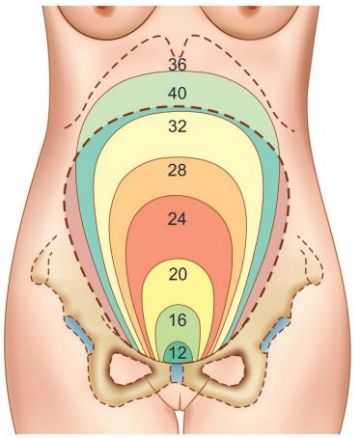


Fig.1: The level of fundus uteri at different weeks. Note the change of uterine shape

External ballottement is usually elicited as early as 20th week when the fetus is relatively smaller than the volume of the amniotic fluid. It is difficult to elicit in obese patients and in cases with scanty liquor amnii. It is best elicited in breech presentation with the head at the fundus.

Internal ballottement can be elicited between 16–28th week. The fetus is too small before 16th week and too large to displace after 28th week. However, the test may not be elicited in cases with scanty liquor amnii, or when the fetus is transversely placed.

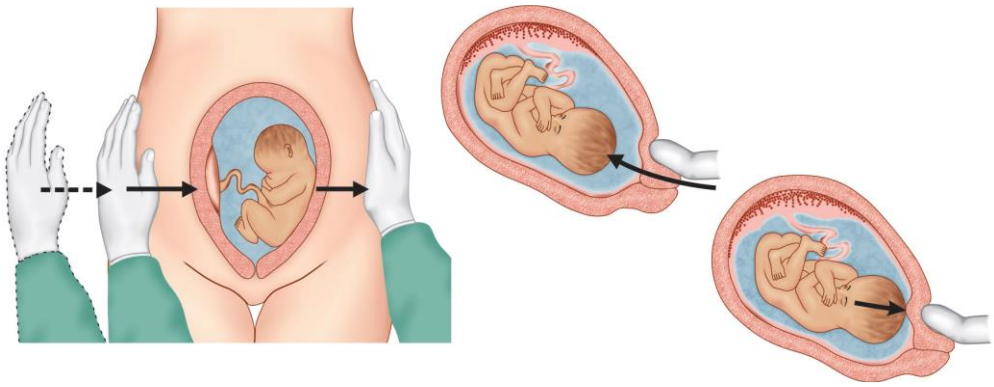


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Fig.2: (A) External ballottement; (B and C) Steps showing how to elicit internal ballottement

Immunological test: Principle: Pregnancy tests depend on detection of the antigen (hCG) present in the maternal urine or serum with antibody either polyclonal or monoclonal available commercially. Selection of time: Diagnosis of pregnancy by detecting hCG in maternal serum or urine can be made by 8 to 11 days after conception. The test is not reliable after 12 weeks.

Other uses of pregnancy tests: Apart from diagnosis of uterine pregnancy, the tests are employed in the diagnosis of ectopic pregnancy, to monitor pregnancy

following in vitro fertilization and embryo transfer and to follow up cases of hydatidiform mole and choriocarcinoma. Test accuracy ranges from 98.6 – 99%. Non-pregnant level is below 1 mIU/mL.

Definitive or absolute signs are related to fetus.

Palpation of fetal parts and perception of active fetal movements by the examiner: Active fetal movements can be felt at intervals by placing the hand over the uterus as early as 20th week. It not only gives positive evidence of pregnancy but of a live fetus. The intensity varies from a faint flutter in early months to stronger movements in later months.

Auscultation: Fetal heart sound (FHS) is the most conclusive clinical sign of pregnancy. With an ordinary stethoscope, it can be detected between 18–20 weeks. The sounds resemble the tick of a watch under a pillow. Its location varies with the position of the fetus. The rate varies from 110–160 beats per minute.

Ultrasonography

Intradecidual gestational sac (GS) is identified as early as 29 to 35 days of gestation. Fetal viability and gestational age is determined by detecting the following structures by transvaginal ultrasonography. Gestational sac and yolk sac by 5 menstrual weeks; Fetal pole and cardiac activity — 6 weeks; Embryonic movements by 7 weeks. Fetal gestational age is best determined by measuring the CRL between 7 and 12 weeks (variation ± 5 days). Doppler effect of ultrasound can pick up the fetal heart rate reliably by 10th week.

Routine sonography at 18–20 weeks permits a detailed survey of fetal anatomy, placental localization and the integrity of the cervical canal. Gestational age is determined by measuring the biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL). It is most accurate when done between 12 and 20 weeks (variation ± 8 days). BPD is measured at the level of the thalami and cavum septum pellucidum. BPD is measured from outer edge of the skull to the inner edge of the opposite side.

Fetal organ anatomy is surveyed to detect any malformation. Fetal viability is determined by real-time ultrasound. Absence of fetal cardiac motion confirms fetal death.

Gestational age estimation by BPD, HC, AC and FL in third trimester is less accurate (variation ± 3 weeks). Fetal AC at the level of the umbilical vein is used to assess gestational age and fetal growth profile (IUGR or macrosomia). Fetal weight estimation can be done using tables. Amniotic fluid volume assessment is done to detect oligohydramnios (AFI < 5) or polyhydramnios (AFI > 25). Placental anatomy: Location (fundus or previa), thickness (placentomegaly in diabetes) or other abnormalities are noted. Fetal life, number, presentation and organ anatomy as done in the first and second trimester are surveyed again.

Magnetic Resonance Imaging (MRI): MRI can be used for fetal anatomy survey, biometry and evaluation of complex malformations. Radiologic evidence of fetal skeletal shadow may be visible as early as 16th week.

CHRONOLOGICAL APPEARANCE OF SPECIFIC SYMPTOMS AND SIGNS OF PREGNANCY

AT 6–8 WEEKS: Symptoms — Amenorrhea, morning sickness, frequency of micturition, fatigue, breast discomfort. Signs: Breast enlargement, engorged veins visible under the skin; nipples and areola more pigmented. Internal examination reveals — positive Jacquemier's sign, softening of the cervix, bluish discoloration of the cervix and Osiander's sign; positive Hegar's and Palmer's sign. Uterine enlargement varies from hen's egg to medium size orange. Immunological tests will be positive. Sonographic evidence of gestational ring.

AT 16TH WEEK: Symptoms — Except amenorrhea, all the previous symptoms disappear. Signs: Breast changes — pigmentation of primary areola and prominence of Montgomery's tubercles, colostrum. Uterus midway between pubis and umbilicus, Braxton-Hicks contractions, uterine souffle, internal ballottement. Sonographic diagnosis.

AT 20TH WEEK: Symptoms — Amenorrhea, quickening (18th week). Signs: Appearance of secondary areola (20th week), linea nigra (20 weeks), uterus at the level of umbilicus at 24 weeks, Braxton-Hicks contractions, external ballottement (20th week), fetal parts (20 weeks), fetal movements (20 weeks), FHS (20 weeks), internal ballottement (16–28 weeks). Sonographic diagnosis.

SIGNS OF PREVIOUS CHILD BIRTH

The following are the features which are to be considered in arriving at a diagnosis of having a previous birth.

✓ Breasts become flabbier; nipples are prominent whoever breast-fed their infant; primary areolar pigmentation still remains and so also the white striae.

✓ Abdominal wall is laxer and looser. There may be presence of silvery white striae and linea alba.

✓ Uterine wall is less rigid and the contour of the uterus is broad and round, rather than ovoid.

✓ Perineum is lax and evidence of old scarring from previous perineal laceration or episiotomy may be found.

✓ Introitus is gaping and there is presence of carunculae myrtiformes.

✓ Vagina is roomier.

✓ Cervix: Nulliparous cervix is conical with a round external os. In parous women, it becomes cylindrical and the external os is a transverse patulous slit and may admit the tip of the finger. However, as a result of operative manipulation even a nulliparous cervix may be torn and resembles a multiparous cervix.

ESTIMATION OF GESTATIONAL AGE AND PREDICTION OF EXPECTED DATE OF DELIVERY

Gestational age is about 280 days calculated from the first day of the last normal menstrual period (LMP). Accurate LMP is the most reliable parameter for estimation of gestational age. But in significant number of cases (20–30%), the patients either fail to remember the LMP or report inaccurately. The matter becomes complicated when the conception occurs during lactation amenorrhea or soon following withdrawal of contraceptive pills (ovulation may be delayed for 4–6 weeks) or in cases with bleeding in early part of pregnancy. The following parameters either singly or in combination are useful in predicting the gestational age with fair degree of accuracy.

PATIENT'S STATEMENT

— Date of fruitful coitus: If the patient can remember the date of the single fruitful coitus with certainty, it is quite reliable to predict the expected date of delivery with accuracy of 50% within 7 days on either side. 266 days are to be added to the date of the single fruitful coitus to calculate the expected date.

— Naegele's formula: Provided the periods are regular, it is very useful and commonly practiced means to calculate the expected date. Its prediction range is about 50% with 7 days on either side of EDD. If the interval of cycles is longer, the extra days are to be added and if the interval is shorter, the lesser days are to be subtracted to get the EDD.

Calculation of the expected date of delivery (EDD)

This is done according to Naegele's formula (1812) by adding 9 calendar months and 7 days to the first day of the last normal (28 day cycle) period. Alternatively, one can count back 3 calendar months from the first day of the last period and then add 7 days to get the expected date of delivery; the former method is commonly employed.

Example: The patient had her first day of last menstrual period on 1st January. By adding 9 calendar months it comes to 1st October and then add 7 days, i.e. 8th October, which becomes the expected date of delivery. For IVF pregnancy date of LMP is 14 days prior to date of embryo transfers (266 days).

— Date of quickening: A rough idea about the probable date of delivery can be deduced by adding 20 weeks in primigravidae and 22 weeks in multiparae to the date of quickening.

PREVIOUS RECORDS: The required weeks are to be added to make it 40 weeks.

— Size of the uterus prior to 12 weeks more precisely corresponds with the period of amenorrhea.

— Height of the uterus above the symphysis pubis in relation to the landmarks on the abdominal wall.

— Auscultation of FHR at the earliest by 18–20 weeks using ordinary stethoscope and that using Doppler principle at 10th week. Palpation of fetal parts at the earliest by 20th week.
— Recording of positive pregnancy test using immunological principle at first missed period by earliest.
— Ultrasonographic findings at the earliest are: (a) Gestation sac — at 5 weeks. (b) Measurement of crown rump length (CRL) detected at 7 weeks, approximates 10 mm; at 10 weeks – 34 mm (CRL in cm + 6.5 = weeks of pregnancy). Crown — Rump Length (CRL) is most accurate. (Variation ± 5 days). Second trimester by BPD, HC, AC and FL measurement. Most accurate when done between 12 and 20 weeks (variation ± 8 days). Third trimester — Less reliable, variation ± 16 days.
— Lightening: Following the appearance of the features suggestive of lightening, the labor is likely to commence within 3 weeks.

ESTIMATION OF FETAL WEIGHT

- Height of the uterus above the symphysis pubis in centimeters multiplied by abdomen circumference measured on the level of umbilicus in either case gives the weight of the fetus in grams. Example — Height of the uterus above the symphysis pubis = 34 cm and the abdomen circumference = 95 cm. The weight of the fetus will be 34 × 95 = 3230 g. However, the approximate size of the fetus is modified by the amount of liquor amnii and thickness of the abdominal wall.
- Sonography: Fetal weight has been estimated by combining a number of biometric data, e.g. BPD, HC, AC and FL. Tables (Hadlock, Shepard) are currently in use (computer software). Estimated fetal weight likely to be within 10 percent of actual weight.

THE FETUS-IN-UTERO

The fetus lies inside the uterus in a closed sac filled with liquor amnii. It has enough freedom of movement until the later months of pregnancy, when it becomes relatively fixed. Till then, periodic examination is essential to note its lie, presentation, position and attitude. Incidental idea can be gained about the size of the fetus or amount of liquor amnii.

LIE: The lie refers to the relationship of the long axis of the fetus to the long axis of the centralized uterus or maternal spine, the commonest lie being longitudinal (99.5%). The lie may be transverse or oblique; sometimes the lie is unstable until labor sets in, when it becomes either longitudinal or transverse.

PRESENTATION: The part of the fetus which occupies the lower pole of the uterus (pelvic brim) is called the presentation of the fetus. Accordingly, the presentation may be cephalic (96.5%), podalic (3%) or shoulder and other (0.5%). When more than one part of the fetus present, it is called compound presentation.

PRESENTING PART: The presenting part is defined as the part of the presentation which overlies the internal os and is felt by the examining finger through the cervical opening. Thus, in cephalic presentation, the presenting part may be vertex (commonest), brow or face, depending upon the degree of flexion of the head.

Similarly, the fetal legs in a breech presentation may be flexed (complete breech), extended (frank breech) or a foot may be present (footling). However, the term presentation and presenting part are often used synonymously and expressed more commonly in clinical practice according to the latter definition.

ATTITUDE: The relation of the different parts of the fetus to one another is called attitude of the fetus. The universal attitude is that of flexion. During the later months, the head, trunk and limbs of the fetus maintain the attitude of flexion on all joints and form an ovoid mass that corresponds approximately to the shape of uterine ovoid. The characteristic flexed attitude may be modified by the amount of liquor amnii. There may be exceptions to this universal attitude and extension of the head may occur (deflexed vertex, brow or face presentation, according to the degree of extension), or the legs may become extended in breech. The course of labor in such circumstances may be modified accordingly.

DENOMINATOR: It is an arbitrary bony fixed point on the presenting part which comes in relation with the various quadrants of the maternal pelvis. The following are the denominators of the different presentations—occiput in vertex, mentum (chin) in face, frontal eminence in brow, sacrum in breech and acromion in shoulder.

POSITION: It is the relation of the denominator to the different quadrants of the pelvis. For descriptive purpose, the pelvis is divided into equal segments of 45° to place the denominator in each segment. Thus, theoretically, there are 8 positions with each presenting part.

Anterior, posterior, right or left position is referred in relation to the maternal pelvis, with the mother in erect position. However, some have retained the conventional description of four vertex positions. Vertex occupying the left anterior quadrant of the pelvis is the commonest one and is called left occipitoanterior (LOA). This is the first vertex position. Similarly, right occipitoanterior (ROA) is the second vertex; right occipitoposterior (ROP) third vertex and left occipitoposterior (LOP) is the fourth vertex position.

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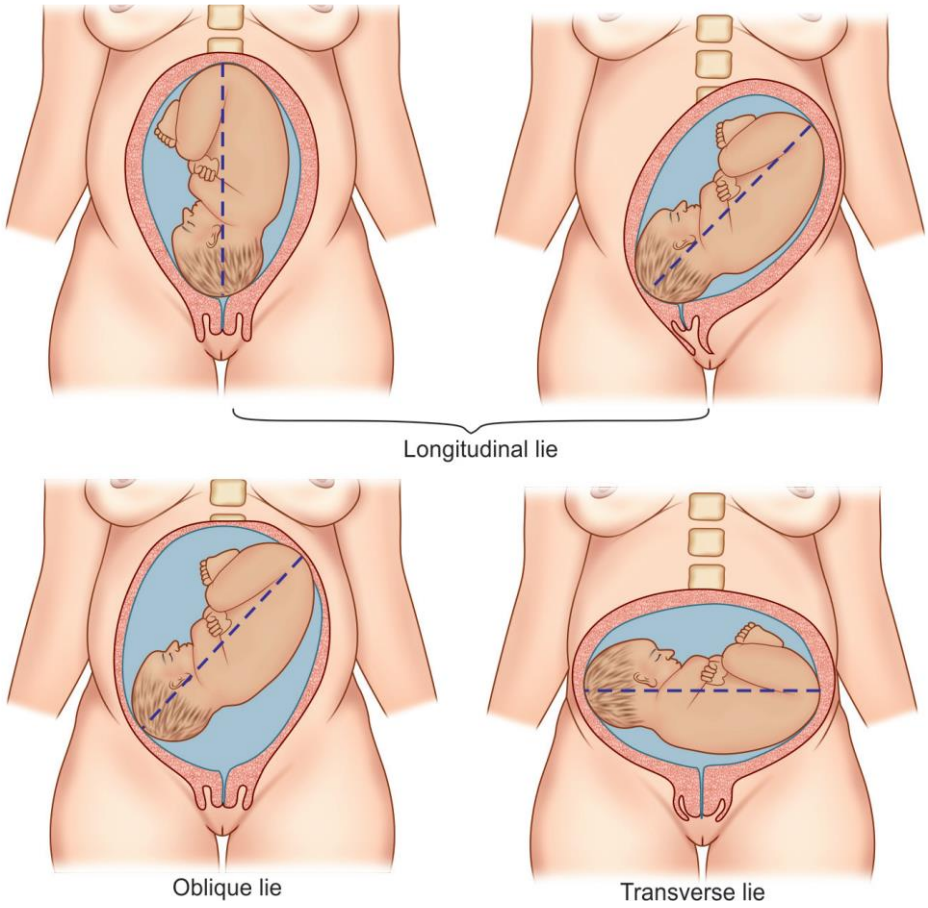

Fig. 3: Fetal lie. (B), the fetus seems to lie in oblique position in relation to the maternal spine but remains in longitudinal lie in relation to uterine axis. Correction of the uterine obliquity rectifies apparent oblique lie of the fetus (A)

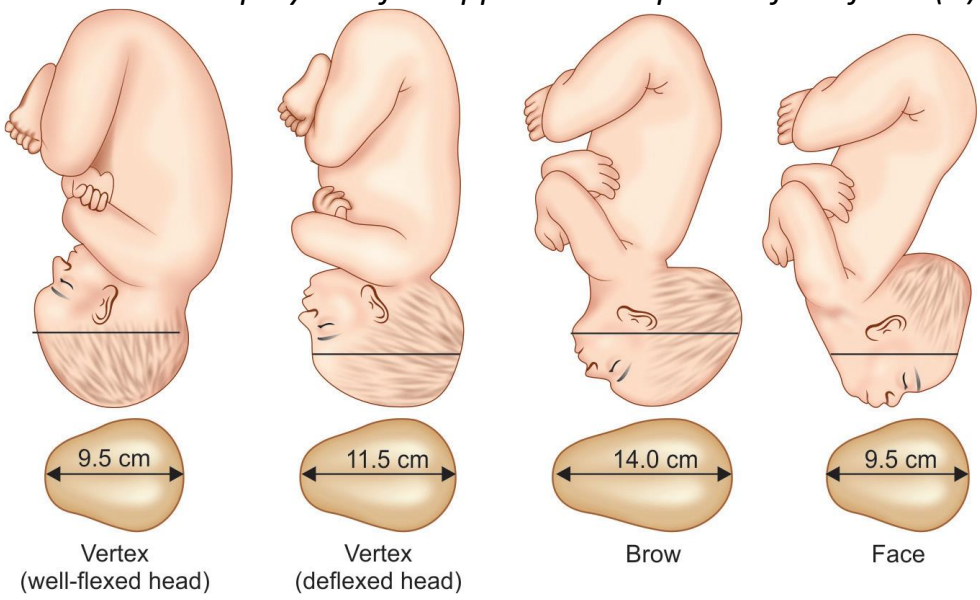

Fig. 4: Varieties of cephalic presentations in different attitude

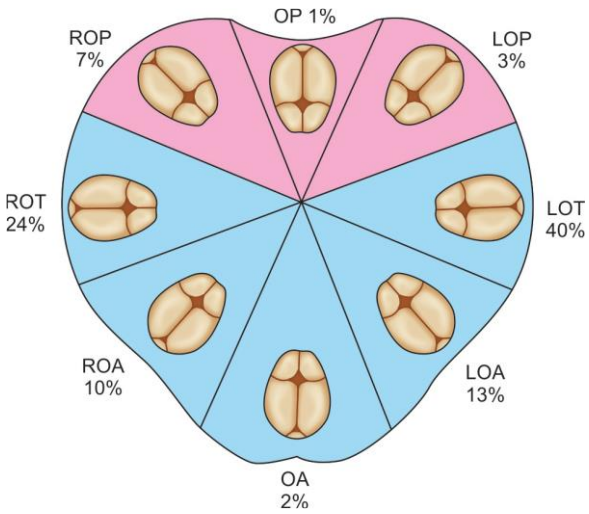

Fig.5: The position and relative frequency of the vertex at the onset of labor

The fetus in the attitude of flexion assumes a shape of an ovoid with its long vertico-podalic axis measuring about 25 cm at term. The fetus accommodates comfortably along the long axis of the ovoid shape of the uterine cavity at term. Hence, there is preponderance of longitudinal lie.

The cephalic presentation, being the absolute majority amongst the longitudinal lie, can be explained by: (1) Gravitation—the head being heavier comes down to the bottom. (2) Adaptation — the smallest circumference of the flexed head is about 27.5 cm and the circumference of the breech with both thighs flexed is about 32.5 cm. Thus the cephalic and the podalic poles can be comfortably accommodated in the narrow lower pole and the wider fundal area of the uterus respectively.

METHODS OF OBSTETRICAL EXAMINATION

ABDOMINAL EXAMINATION: A thorough and systemic abdominal examination beyond 28 weeks of pregnancy can reasonably diagnose the lie, presentation, position and the attitude of the fetus. It is not unlikely that the lie and presentation of the fetus might change, specially in association with excess liquor amnii and hence periodic checkup is essential.

Abdominal examination

Preliminaries: Verbal consent for examination is taken. The patient is asked to evacuate the bladder. She is then made to lie in dorsal position with the thighs slightly flexed. Abdomen is fully exposed. The examiner stands on the right side of the patient.

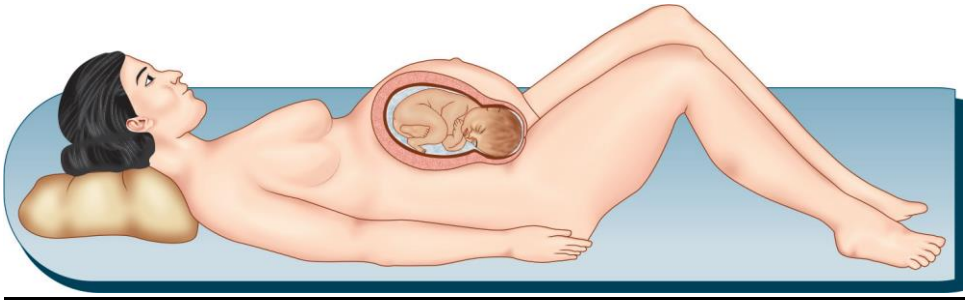

Fig.6: Position of the woman during obstetric examination

Inspection: To note (1) whether the uterine ovoid is longitudinal or transverse or oblique (2) contour of the uterus—fundal notching, convex or flattened anterior wall, cylindrical or spherical shape (3) undue enlargement of the uterus (4) skin condition of abdomen for evidence of ringworm or scabies and (5) any incisional scar mark on the abdomen.

Palpation: *Symphysis fundal height (SFH)*: The uterus is to be centralized if it is deviated. The upper border of the fundus is located by the ulnar border of the left hand and this point is marked. The distance between the upper border of the symphysis pubis upto the marked point is measured by a tape in centimeter. After 24 weeks, the SFH measured in cm corresponds to the number of weeks up to 36 weeks. A variation of ± 2 cm is accepted as normal.

Fig. 7: Symphysis fundal height (SFH)

There are conditions where the height of the uterus may not correspond with the period of amenorrhea. The conditions where the height of the uterus is more than the period of amenorrhea are: (1) mistaken date of the last menstrual period (2) twins (3)

polyhydramnios (4) big baby (5) pelvic tumors— ovarian or fibroid (6) hydatidiform mole and (7) concealed accidental hemorrhage. The condition where the height of the uterus is less than the period of amenorrhea are: (1) mistaken date of the last menstrual period (2) scanty liquor amnii (3) fetal growth retardation and (4) intrauterine fetal death.

Obstetric grips (Leopold maneuvers)

Palpation should be conducted with utmost gentleness. Clumsy and purposeless palpation is not only uniformative but may cause undue uterine irritability. During Braxton-Hicks contraction or uterine contraction in labor, palpation should be suspended.

Fundal grip (First Leopold): The palpation is done facing the patient's face. The whole of the fundal area is palpated using both hands laid flat on it to find out which pole of the fetus is lying in the fundus: (a) broad, soft and irregular mass suggestive of breech, or (b) smooth, hard and globular mass suggestive of head. In transverse lie, neither of the fetal poles are palpated in the fundal area.

Lateral or umbilical grip (Second Leopold): The palpation is done facing the patient's face. The hands are to be placed flat on either side of the umbilicus to palpate one after the other, the sides and front of the uterus to find out the position of the back, limbs and the anterior shoulder. The back is suggested by smooth curved and resistant feel. The 'limb side' is comparatively empty and there are small knob like irregular parts. After the identification of the back, it is essential to note its position whether placed anteriorly or towards the flank or placed transversely. Similarly, the disposition of the small parts, whether placed to one side or placed anteriorly occupying both the sides, is to be noted. The position of the anterior shoulder is to be sought for. It forms a well marked prominence in the lower part of the uterus above the head. It may be placed near the midline or well away from the midline.

Pawlik's grip (Third Leopold): The examination is done facing towards the patient's face. The overstretched thumb and four fingers of the right hand are placed over the lower pole of the uterus keepingthe ulnar border of the palm on the upper border of the symphysis pubis. When the fingers and the thumb are approximated, the presenting part is grasped distinctly (if not engaged) and also the mobility from side to side is tested. In transverse lie, Pawlik's grip is empty.

Pelvic grip (Fourth Leopold): The examination is done facing the patient's feet. Four fingers of both the hands are placed on either side of the midline in the lower pole of the uterus and parallel to the inguinal ligament. The fingers are pressed downwards and backwards in a manner of approximation of finger tips to palpate the part occupying the lower pole of the uterus (presentation). If it is head, the characteristics to note are: (1) precise presenting area (2) attitude and (3) engagement.

To ascertain the presenting part, the greater mass of the head (cephalic prominence) is carefully palpated and its relation to the limbs and back is noted. The attitude of the head is inferred by noting the relative position of the sincipital and occipital poles. The engagement is ascertained noting the presence or absence of the sincipital and occipital poles or whether there is convergence or divergence of the finger tips during palpation. This pelvic grip using both the hands is favored as it is most comfortable for the woman and gives most information.

Auscultation

Auscultation of distinct fetal heart sounds (FHS) not only helps in the diagnosis of a live baby but its location of maximum intensity can resolve doubt about the presentation of the fetus. The fetal heart sounds are best audible through the back (left scapular region) in vertex and breech presentation where the convex portion of the back is in contact with the uterine wall. However, in face presentation, the heart sounds are heard through the fetal chest.

As a rule, the maximum intensity of the FHS is below the umbilicus in cephalic presentation and around the umbilicus in breech. In different positions of the vertex, the location of the FHS depends on the position of the back and the degree of descent of the head. In occipitoanterior position, the FHS is located in the middle of the spinoumbilical line of the same side. In occipitolateral position, it is heard more laterally and in occipitoposterior position, well back towards the mother's flank on the same side.

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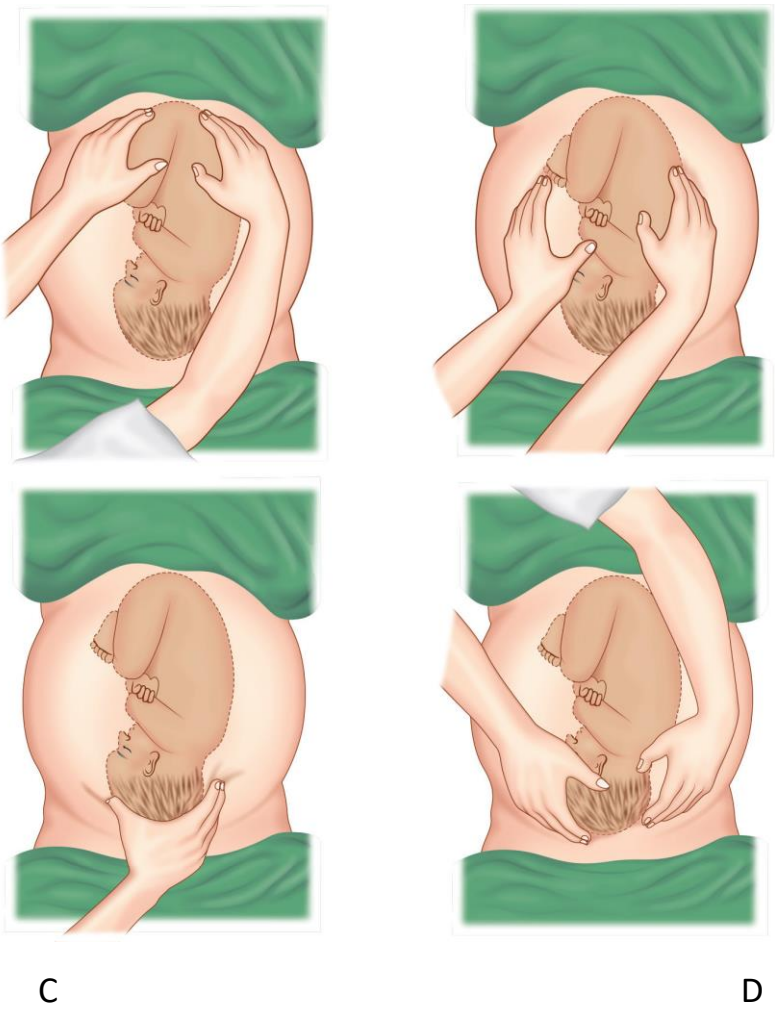

C D

Fig.8: Obstetric grips (Leopold maneuvers): (A) Fundal grip (first Leopold); (B) Lateral grip (second Leopold); (C) Pawlik's grip (third Leopold); (D) Pelvic grip (fourth Leopold)

INTERNAL EXAMINATION: The diagnosis of the presentation and position of the fetus may not be accurate by internal examination during pregnancy when the cervix remains closed. However, during labor, accurate information may be obtained by palpation of the sagittal suture and fontanelles through the open cervix. Stress for strict aseptic precautions during vaginal examination needs no emphasis.

ULTRASONOGRAPHY: The diagnosis of the lie, presentation and position may be difficult in the presence of marked obesity, irritable uterus, excessive liquor amnii and deeply engaged head, specially in primigravidae. Ultrasonography can locate the head and the body.

ENGAGEMENT

When the greatest horizontal plane, the biparietal, has passed the plane of the pelvic brim, the head is said to be engaged.

Diagnosis: First pelvic grip: (1) Both the poles (sinciput and occiput) are not felt per abdomen. However, the sincipital pole can be felt with difficulty even though the

head is engaged (2) Divergence of the examining fingers of both the hands while trying to push downwards on the lower abdomen. Convergence of the fingers while palpating the lateral aspects of the fetal head indicates that the head is not yet engaged.

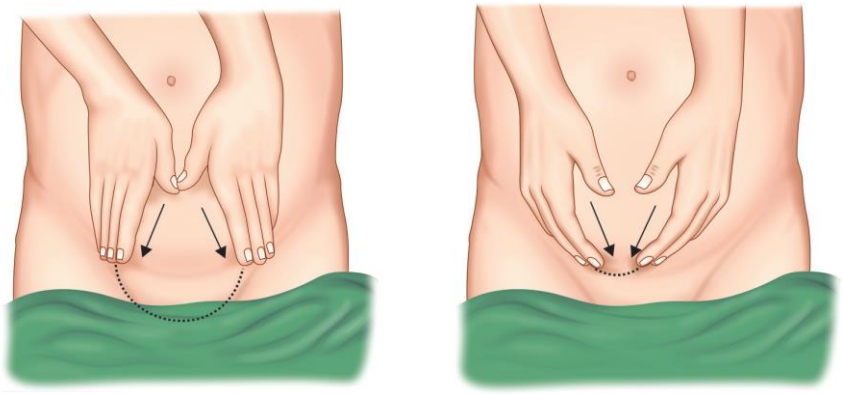

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Fig.9: Abdominal palpation to determine engagement of the head: (A) Divergence of fingers—engaged head, (B) Convergence fingers—not engaged

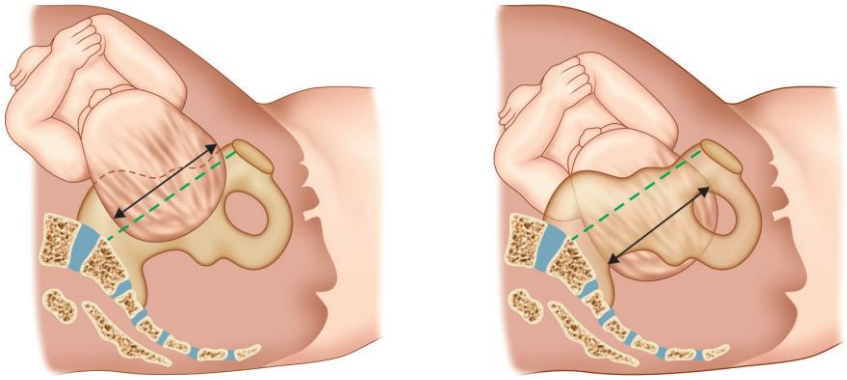

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Fig. 10: The relationship of the biparietal diameter to the pelvic brim and that of lower pole of the head to the ischial spines in: (A) Non-engaged head; (B) Engaged head

Vaginal Examination: Lower pole of the unmoulded head is usually at or below the level of the ischial spines.

Significance: Engagement of the head always excludes disproportion at the brim, as the head is the best pelvimeter. The traditional concept that in primigravidae, the engagement occurs by 38 weeks is not corroborative in clinical practice. In majority, the engagement occurs between 38–42 weeks or even during first stage of labor. In multigravidae, however, the engagement occurs late in first stage of labor after the rupture of the membranes. However, if the head fails to engage in primigravidae even at 38th week, the causes are to be sought for. Common causes are: (1) Deflexed head placing the larger diameter to engage (2) Cephalopelvic disproportion or big head or a

combination of both (3) Polyhydramnios (4) Poor formation or yielding of lower uterine segment—preventing the head to sink into the pelvis, (5) Hydrocephalus (6) Placenta previa (7) Pelvic tumors— ovarian or fibroid (8) High pelvic inclination (9) Functional — when no cause can be detected (20%).

Fixed head: The word 'fixed' should not be used to designate an engaged head. Whereas, an engaged head is fixed but conversely, the fixed head is not necessarily engaged. When an egg is placed on the egg cup, it remains fixed yet the maximum diameter does not pass through the rim. Similarly the head may be fixed to the brim but that does not mean that the maximum diameter of the head (biparietal) will pass through the brim.

Vaginal examination

Time: Vaginal examination is done in the antenatal clinic when the patient attends the clinic for the first time before 12 weeks. It is done (1) to diagnose the pregnancy (2) to corroborate the size of the uterus with the period of amenorrhea and (3) to exclude any pelvic pathology. Internal examination is, however, omitted in cases with previous history of abortion, occasional vaginal bleeding in present pregnancy. Ultrasound examination has replaced routine internal examination. It is more informative and without any known adverse effect.

Procedures: Vaginal examination is done in the antenatal clinic. The patient must empty her bladder

prior to examination and is placed in the dorsal position with the thighs flexed along with the buttocks placed on the footend of the table. Hands are washed with soap and a sterile glove is put on the examining hand (usually right).

Steps:

Inspection: By separating the labia—using the left two fingers (thumb and index), the character of the vaginal discharge, if any, is noted. Presence of cystocele or uterine prolapse or rectocele is to be elicited.

Speculum examination: This should be done prior to bimanual examination especially when the smear for exfoliative cytology or vaginal swab is to be taken. A bivalve speculum is used. The cervix and the vault of the vagina are inspected with the help of good light source placed behind. Cervical smear for exfoliative cytology or a vaginal swab from the upper vagina, in presence of discharge, may be taken.

Bimanual: Two fingers (index and middle) of the right hand are introduced deep into the vagina while separating the labia by left hand. The left hand is now placed suprapubically. Gentle and systematic examination are to be done to note:

(1) Cervix: Consistency, direction and any pathology.

(2) Uterus: Size, shape, position and consistency. Early pregnancy is the best time to correlate accurately uterine size and duration of gestation.

(3) Adnexae: Any mass felt through the fornix. If the introitus is narrow, one finger may be introduced for examination. No attempt should be made to assess the pelvis at this stage.

MATERIALS FOR ACTIVATION OF STUDENTS DURING THE LECTURE: QUESTIONS, SITUATIONAL TASKS, ETC.

QUESTIONS:

- Fundamentals of reproduction: gametogenesis, ovulation, fertilization, implantation.
- Principal events in embryonic and fetal development.
- Development, structure and function of the placenta and fetal membranes.
- Genital tract changes during pregnancy, endocrinology of pregnancy.
- Duration of pregnancy, presumptive, probable and definitive symptoms of pregnancy, chronological appearance of specific signs and symptoms of pregnancy.
- Signs of previous child birth.
- Methods of estimation of gestational age and due date of labor.
- Methods of estimation of fetal weight.
- Obstetrics terminology: lie, presentation, position and attitude of the fetus in the uterus.
- Methods of obstetrical abdominal examination: inspection, palpation, auscultation.

TEST TASKS

Direction: For each of the multiple choice questions select the lettered answer that is the one best response in each case.

1. Worldwide, which of the following is the most common problem during pregnancy?
(A) diabetes
(B) preeclampsia
(C) heart disease
(D) urinary tract infection (UTI)
(E) iron-deficiency anemia

2. A patient presents with a positive pregnancy test, the exact date of the start of her last normal menses, and the date of her luteinizing hormone (LH) surge from a urine kit. Her expected date of delivery can most correctly be calculated by which of the following?
(A) adding 254 to the date of the start of the last menstrual period (LMP)
(B) counting 10 lunar months from the time of ovulation
(C) counting 280 from the first day of the LMP
(D) counting 40 weeks from the last day of the LMP
(E) adding 256 to the date of the elevated urinary LH when detected by home testing

3. A friend mentions to you she just had a positive pregnancy test and wonders if you can tell her when she is likely due. The LMP was June 30. Her expected date of labor is approximately which of the following?
(A) March 23
(B) April 7
(C) March 28
(D) April 23
(E) March 7

4. A patient presents to your clinic complaining of nausea and vomiting. She is currently ingesting combined oral contraceptive pills (OCP) and has used them for over a year. When you tell her she has a positive pregnancy test, she reports that her last bleeding on the OCPs was 8 weeks ago. In such a situation, determination of the most accurate estimated date of delivery can then be made by which of the following?
(A) eliciting when breast tenderness or morning sickness began
(B) assessing uterine size by physical examination
(C) counting 280 days from the first positive serum pregnancy test
(D) asking the patient when she first felt pregnant
(E) obtaining fetal biometry by ultrasound prior to 20 weeks' gestation

5. Fundal height, part of the obstetric examination, is taken from the top of the symphysis pubis to the top of the fundus. How is it measured?
(A) by calipers, approximating the week of gestation
(B) in inches, approximating the lunar month of gestation
(C) in centimeters and divided by 3.5, approximating the lunar months of gestation
(D) in centimeters, approximating the weeks of gestation beyond 22 weeks
(E) by calipers in centimeters, prognosticating the fetal weight

6. Using your knowledge of normal maternal physiology, which of the following would you employ if a patient at 38 weeks became faint while lying supine on your examination table?
(A) aromatic ammonia spirit (smelling salts)
(B) turning the patient on her side
(C) oxygen by face mask
(D) intravenous (IV) drugs to increase blood pressure
(E) IV saline solution

7. A 19-year-old primigravida with unsure LMP presents to initiate prenatal care. You attempt to estimate gestational age. The uterine fundus is palpable at the level of the pubic symphysis, and fetal heart tones are audible by electronic Doppler. On the basis of this information, what is the approximate gestational age?
(A) 8 weeks
(B) 12 weeks
(C) 16 weeks
(D) 20 weeks
(E) 24 weeks

8. Which of the following nutrients is most likely to be deficient during pregnancy?
(A) iron
(B) vitamin D
(C) vitamin A
(D) calcium
(E) folic acid

9. The relation of the fetal parts to one another determines which of the following?
(A) presentation of the fetus
(B) lie of the fetus
(C) attitude of the fetus
(D) position of the fetus
(E) intention of the fetus

10. A healthy 30-year-old primigravida presents at 34 weeks' gestation. She reports that she has been experiencing abdominal discomfort that increases after eating, especially when in the recumbent position. A series of tests is performed. She has normal vital signs, an unremarkable examination, a fundal height of 33 cm, and a negative urinalysis. Which one of the following represents abnormal test results?

(A) alkaline phosphatase double that of the reference range
(B) hemoglobin of 90 g/L
(C) serum albumin of 35 g/L
(D) serum creatinine level of 80 mmol/L
(E) WBC count of 11, 000/mL

11.The placenta is essential in the growth and development of a healthy fetus. It allows transport of certain things, facilitates transports of others, and is hormonally active. Which of the following statements regarding the placenta is true?
(A) High-molecular-weight substances and protein-bound substances cross readily
(B) In the placenta, fetal blood is in lacunae that bathe maternal capillaries
(C) Infectious organisms cannot cross the placenta from mother to fetus
(D) The placenta fulfills some of the functions of lung, kidney, and intestine for the fetus
(E) The placenta produces only hCG

12. During normal pregnancy a lowered hemoglobin is a physiologic finding. What is its major cause?
(A) low iron stores
(B) blood lost to the placenta and fetus
(C) increased plasma volume
(D) increased cardiac output resulting in greater red-cell destruction
(E) decreased reticulocytosis

13. A 29-year-old primigravida at 36 weeks' gestation complains of dizziness and nausea when reclining to read in bed before retiring at night. Suspecting that her symptoms are the result of normal physiologic changes of pregnancy, you recommend which of the following?
(A) elevation of both her feet while lying in bed
(B) improved room lighting
(C) mild exercise before retiring to bed
(D) rolling toward the right or left hip while reading
(E) small late night snack

14. The relationship of the long axis of the fetus to the long axis of the mother is called which of the following?
(A) lie
(B) presentation
(C) position
(D) attitude

(E) axis of the conjugate

15. A patient has a profuse, thin, acellular cervical mucus with a high degree of stretchability and a palmleaf crystallization pattern upon drying. Which of the following situations is compatible with this finding?
(A) second trimester of pregnancy
(B) preovulatory estrogen surge
(C) on combination birth control pills
(D) being postmenopausal
(E) the secretory phase of the menstrual cycle

16. The average woman can expect to retain as much as 7 L of water during a normal gestation. What is a major reason for this retention?
(A) decreased venous pressure in the lower fourth of the body
(B) increased plasma oncotic pressure
(C) increased capillary permeability
(D) marked increase in the maternal serum sodium
(E) a physiologic cardiac failure resulting in edema, fluid retention, and enlargement of the heart

17. During pregnancy, blood tests for diabetes are more apt to be abnormal than in the nonpregnant state. Also, nondiabetic women may develop gestational diabetes during the last half of the pregnancy. This is due in part to which of the following?
(A) decreased insulin production
(B) increased food absorption from the GI tract
(C) increased placental lactogen
(D) decreased hepatic secretion of insulin-binding globulin
(E) hemoconcentration

18. During which of the following conditions would the serum prolactin level be greatest?
(A) sleep
(B) ovulation
(C) parturition
(D) menopause
(E) suckling

19. The three principle estrogens in women in decreasing order of potency are
(A) estriol, estradiol, estrone
(B) estrone, estriol, estradiol

(C) estradiol, estrone, estriol
(D) estradiol, estriol, estrone
(E) estriol, estrone, estradiol

20. Which of the following is NOT a presumptive symptom/sign of pregnancy?
(A) cessation of menses
(B) quickening
(C) nausea and vomiting
(D) breast changes
(E) darkening of the skin on the palms of the hands

Answer key

1	E	11	D
2	C	12	C
3	B	13	D
4	E	14	A
5	D	15	B
6	B	16	C
7	B	17	C
8	A	18	C
9	C	19	C
10	B	20	E

EQUIPMENT AND EDUCATIONAL AND METHODOLOGICAL SUPPORT OF THE LECTURE:

- Obstetric models and obstetric instruments (pelvimeter, obstetric stethoscope, centimeter tape).
- Professional algorithms, structural-logical schemes, tables, videos.
- Results of laboratory and instrumental researches, situational tasks, patients, medical histories.
- Multimedia equipment (computer, projector, screen), TV.

RECOMMENDED LITERATURE

Basic:

1. Gladchuk I.Z. Obstetrics: student`s book / Gladchuk I.Z., Ancheva I.A. . – Vinnitsia: Nova Knyha, 2021. – 288 p.
2. Obstetrics and Gynecology: in 2 volumes. Volume 1. Obstetrics: textbook / V.I. Gryshchenko, M.O. Shcherbina, B.M. Ventskivskyi et al. (2nd edition). – «Medicina», 2018. – 392 p.
3. Hiralal Konar DC Dutta's Textbook of Obstetrics (9th Ed.) / Hiralal Konar (Ed.). – Jp Medical Ltd, 2018. – 700 p.

4. F. Gary Cunningham Williams Obstetrics (26th Edition) / F. Gary Cunningham, Kenneth Leveno, Jodi Dashe, Barbara Hoffman, Catherine Spong, Brian Casey. – McGraw Hill / Medical, 2022. – 1328 p.
5. Jeremy Oats, Suzanne Abraham Llewellyn-Jones Fundamentals of Obstetrics and Gynaecology (10th Ed) / Jeremy Oats, Suzanne Abraham. – Elsevier, 2016. – 384 p.

Additional:

1. The PROMPT-CIPP Editorial Team. (2019). PROMPT-CIPP Course Participant's Handbook: Care of the Critically Ill Pregnant or Postpartum Woman (Critical Car Prompt Practical Obstetric Multi-professional Training). – Cambridge University Press; 1st edition, 2019. – 136 p.
2. L. A. Magee The FIGO Textbook of Pregnancy Hypertension. An evidence-based guide to monitoring, prevention and management. / L. A. Magee, P. Dadelszen, W. Stones, M. Mathai (Eds). – The Global Library of Women's Medicine, 2016. – 456 p.
3. Edwin Chandraharan Handbook of CTG Interpretation: From Patterns to Physiology / Edwin Chandraharan. – Cambridge University Press; 1st edition, 2017. – 256 p.
4. Louise C. Kenny, Jenny E. Myers Obstetrics by Ten Teachers (20th ed) / Louise C. Kenny, Jenny E. Myers. – CRC Press, 2017. – 342 p.
5. J. Studd Current Progress in Obstetrics and Gynaecology. Vol 4. / J. Studd, Seang Lin Tan, F. Chervenak. – TreeLife Media (A Div of Kothari Medical), 2017. – 419 p.
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7. J. Studd Current Progress in Obstetrics and Gynaecology. Vol 6. / J. Studd, Seang Lin Tan, F. Chervenak. – TreeLife Media (A Div of Kothari Medical), 2022. – 309 p.
8. Mark Landon Obstetrics: Normal and Problem Pregnancies, 8th Edition / Mark Landon, Henry Galan, Eric Jauniaux, Deborah Driscoll, Vincenzo Berghella, William Grobman, et al. – Elsevier, 2021. – 1280 pp.
9. Mark B. Landon Gabbe's Obstetrics Essentials: Normal & Problem Pregnancies, 1st Edition / Mark B. Landon, Deborah A. Driscoll, Eric R. M. Jauniaux, Henry L. Galan, William A. Grobman, Vincenzo Berghella. – Elsevier, 2019. – 496 pp.
10. Ian M. Symonds, Sabaratnam Arulkumaran Essential Obstetrics and Gynaecology, 6th Edition / Ian M. Symonds, Sabaratnam Arulkumaran. – Elsevier, 2020. – 480 pp.
11. Myra J. Wick Mayo Clinic Guide to a Healthy Pregnancy, 2nd Edition / Myra J. Wick. – Mayo Clinic Press, 2018. – 520 p.

INTERNET SOURCES:

- https://www.cochrane.org/
- https://www.ebcog.org/
- https://www.acog.org/
- https://www.uptodate.com
- https://online.lexi.com/
- https://www.ncbi.nlm.nih.gov/
- https://pubmed.ncbi.nlm.nih.gov/
- https://www.thelancet.com/
- https://www.rcog.org.uk/
- https://www.npwh.org/