

**MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY**

Faculty International

Department of Obstetrics and Gynecology



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

**METHODICAL DEVELOPMENT FOR A PRACTICAL LESSON
IN ELECTIVE DISCIPLINE**

Faculty International, 6th year

Elective discipline "ULTRASOUND DIAGNOSTICS IN OBSTETRICS AND
GYNECOLOGY"

Practical class №7. Topic: «Ultrasound assessment of congenital pathology
markers during pregnancy screenings»

ONMedU, Department of Obstetrics and Gynecology. Practical class № 7. "Congenital pathology markers ultrasound assessment during pregnancy screenings."

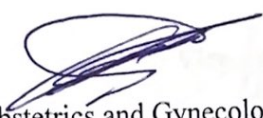
"Confirmed"


Meeting of Gynecology and Obstetrics department
Odessa National Medical University

Protocol №1 from «28» August 2023.

Head of Department, Professor  (Igor GLADCHUK)

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Methodical recommendations for a practical class, Faculty "Medicine", 6th year. Elective
discipline: "Ultrasound diagnostics in obstetrics and gynecology"

Practical class №7

Topic: "Ultrasound assessment of congenital pathology markers during pregnancy screenings."

Learning objective is to understand the hereditary problems relevance and congenital pathology, primarily congenital malformations (CM), as well as chromosomal and monogenic diseases. Identify and learn the main indications for prenatal ultrasound screenings. Learn how to evaluate an ultrasound image during ultrasound diagnosis of pregnancy. Learn the main ultrasound characteristics and markers of congenital pathology during ultrasound screenings. Learn the patient examination plan during the first (11-14 weeks) and second screening (19-22 weeks) of pregnancy, the third screening (30-32 weeks).

Basic Concepts : Ultrasound assessment of congenital pathology markers during pregnancy screenings: basic concepts and indications. Examination process during ultrasound screening: first (11-14 weeks), second (19-22 weeks) and third (30-32 weeks). The main ultrasound characteristics are markers of congenital pathology during ultrasound screenings. An examination plan and parameters for conducting ultrasound screenings are necessary.

Equipment: Professional algorithms, structural and logical schemes, tables, models, video and photo materials of ultrasound results, results of laboratory and instrumental studies, situational problems, patients, medical histories.

I. Organizational measures (greetings, verification of those who are present, announcement of the topic, purpose of the lesson, motivation of higher education seekers to study the topic).

Today, routine ultrasound diagnosis (USD) is an integral part of prenatal monitoring of pregnant women, if resources and opportunities are available. Current technological advances, including the advent of high-frequency transvaginal scanning, have made it possible to achieve such a resolution of ultrasound examination that it became possible to assess and monitor the development of the fetus in detail during screening studies.

Based on the data of the ultrasound methods effectiveness study in the system of prenatal diagnostics, it can be concluded that these methods have a decisive role in the complex of measures to prevent hereditary and

congenital diseases, to prevent the birth of children with severe developmental disabilities, with socially significant fatal genetic and chromosomal diseases.

- **Control of the knowledge reference level (written work, written test, online test, face-to-face interview, etc.).** Knowledge requirements:
 - communication and clinical patient examination skills;
 - the ability to determine the list of necessary clinical and laboratory and instrumental studies and evaluate their results;
 - the ability to prescribe appropriate management tactics in case of suspicious or abnormal ultrasound screening results.

List of didactic units:

- The thickness of the collar space
- Fetal heartbeat
- The thickness of the nasal bone
- Biparietal size
- The level of amniotic fluid

2.2. Questions (test tasks, problems, clinical situations) to check basic knowledge on the subject of the lesson.

Questions:

- Ultrasound assessment of congenital pathology markers during pregnancy screenings: basic concepts and indications.
- Determination of the main parameters during the first ultrasound screening (11-14 weeks).
- Determination of the main parameters during the second (19-22 weeks) ultrasound screening.
- Determination of the main parameters during the third (30-32 weeks) ultrasound screening.
- An examination plan and parameters for conducting ultrasound screenings which are necessary.
- Threshold indicators of screenings and determination of tactics for further management of pregnancy.

Situational tasks:

Task 1.

A 23-year-old pregnant woman consulted a doctor. She has first pregnancy at 7 weeks. The woman's husband is physically healthy, 25 years old. The pedigree is not burdened with hereditary pathology.

Question: What methods of prenatal diagnosis should be considered when examining this patient?

Answer: Prenatal screening at 10-14 weeks and 15-20 weeks.

Tests:

- What fetal conditions can be diagnosed using ultrasound?
 - Reduction defects of the limbs
 - Anencephaly
 - Phenylketonuria
 - Hypothyroidism
 - Achondroplasia
-
- The most effective method for prenatal diagnosis of congenital defects of the locomotor system: A. Ultrasound.
 - Determination of AFP in blood serum of a pregnant woman.
 - Ultrasound examination and determination of AFP.
 - Amniocentesis.
 - Chorionic villi sampling.
-
- A 22-year-old pregnant woman. First pregnancy in 12 weeks. An increase in the thickness of the collar space up to 3.6 mm was revealed during ultrasound. In the blood serum of a pregnant woman, the concentration of PAPP-A is reduced and the concentration of hCG is increased. These could be the signs of:
 - Fetal achondroplasia.
 - Fetal Down's syndrome.
 - Fetal reduction defect of the limbs.
 - Fetal neural tube defects.
 - Fetal enzymopathies.

- Concerning ultrasound of the fetus from 18–20 weeks: A.
The BPD is measured in the axial plane.
 - The lateral ventricles are echobright structures.
 - The medial walls of the lateral ventricles are formed by the septum pellucidum.
 - The third ventricle is normally visualized.
 - The cerebellar hemispheres are seen as round echopoor structures with a reflective vermis in the midline.

- Regarding the fetus:
 - The vertebra are visible as two ossification centres in the body and one in each lamina.
 - Failure of fusion between the premaxillary part of the frontonasal prominence and the maxillary prominence gives rise to cleft lip.
 - The four-chamber view during cardiac ultrasound is the primary screening view for cardiac abnormalities.
 - On ultrasound the lungs become progressively echobright as pregnancy advances.
 - On ultrasound colonic peristalsis is seen in the second trimester.

Answers: 1 – A, B, E; 2 – A; 3 – D; 4 - A, C, E; 5 - B, C, D.

3. Formation of professional abilities and skills (mastery of skills, conducting curation, determining the treatment scheme, conducting laboratory research, etc.).

— **Tasks content (tasks, clinical situations, etc.).**

Interactive task:

The students of the group are divided into 3 subgroups of 4-5 people each. We work in ultrasound diagnostic offices with pregnant patients, we give tasks:

I subgroup – assessment of the patient, anamnesis collection

II subgroup – counseling of the patient based on ultrasound screening data

III subgroup – evaluates the answers correctness of subgroups I and II and makes corrections.

Clinical tasks:

Clinical task 1.

A 28-year-old pregnant woman is at an appointment with a gynecologist. During an ultrasound examination, a pregnancy of 6 weeks, 4 days was diagnosed, which is progressing. From the woman's history, the pregnancy is desirable, the second, the first pregnancy ended in delivery on time, the child was diagnosed with multiple congenital malformations and a normal karyotype.

Task: Determine the doctor's tactics and make a plan for diagnostic studies

Answer: Detailed ultrasound of the fetus and determination of biophysical profile markers during first and second screening procedures.

Tests :

- Ultrasound examination during pregnancy must be carried out obligatory:
 - Is not obligatory.
 - Up to 12 weeks.
 - At 18-19 weeks.
 - At 24-25 weeks. E. At 39-40 weeks.

- A highly specific ultrasound marker of fetal chromosomal pathology in the 1st trimester is:
 - The size of the uterus
 - The diameter of the yolk sac
 - The nuchal translucency width
 - Femoral length
 - Humeral length

- A pregnant woman with a 5-6 weeks pregnancy was registered at the ambulatory women's consultation. There are no complaints. Somatic and family anamnesis is uncomplicated. When is it necessary to conduct an ultrasound examination of a pregnant woman?
 - 11-13 weeks, 18-21 weeks
 - when registering

- with each visit to the ambulatory women's consultation
 - before childbirth
 - at the woman's request
- What are the most sensitive sonographic markers of aneuploidies?
 - Nuchal translucency NT
 - Humeral length
 - Absence of nasal bone
 - Nasal bone + NT + PAPP-A + β -hCG + AFP + estriol + maternal age
 - PAPP-A + β -hCG + AFP + estriol **Answers:** 1 – A, 2 – C, 3– A, 4 - D

— Recommendations (instructions) for performing tasks (professional algorithms, orienteering maps for the formation of practical skills and abilities, etc.).

The ultrasound effectiveness depends on the capacity of the ultrasound machine, the specialist's experience, and the level of examination. The international classification of fetal ultrasound levels provides the following:

I level: the study is conducted in a women's consultation on a standard ultrasound machine by an obstetrician-gynecologist who has training in ultrasound diagnostics. Study periods: 14-14, 18-22, 30-34 weeks of pregnancy. A routine anatomy examination and condition of the fetus is carried out.

II level: the study is carried out in the regional medical and genetic center on an ultrasound machine with sufficient enabling capability and additional devices (dopplerography) by highly qualified prenatal diagnostic doctors at any week of pregnancy. A comprehensive examination and verification of fetal development disorders established at the first level is carried out.

III level: the study is carried out in the perinatal center on an ultrasound device with high resolution and additional devices (dopplerography, etc.) by specialized specialists - highly qualified prenatal diagnostic doctors at any week of pregnancy. A comprehensive and specialized fetus condition examination is carried out, verification of developmental disorders established at the first and second levels, determination of the possibility and carrying out of prenatal correction followed by neonatal correction.

In accordance with the recommendations of the European Association for Perinatal Medicine, the following strategy has been adopted:

- every pregnant woman is recommended 3-4 times fetus examination (at the first level);
- the main study to detect malformations is carried out at 18-22 weeks of pregnancy (at the second level);
- high-risk pregnant women should be identified at the first level of ultrasound screening and examined in more detail at the second level;
- pregnant women with ambiguous results obtained at the previous levels should be examined at the third level, especially if there is a suspicion of abnormalities in the development of the heart and brain of the fetus.

According to the Clinical Protocol datas “Normal Pregnancy” (order №1437 from 09.08.2022 MOH of Ukraine):

- Ultrasound during pregnancy is performed exclusively by ultrasound doctors who have received training in prenatal diagnosis, according to the approved form of the protocol (appendices 2, 3).
- It is advisable to carry out prenatal screening - ultrasound in the period of 11+0–13+6 weeks (CRL of the fetus 45-84 mm), with normal fetal anatomy and nuchal translucency < 3.5 mm - taking venous blood of the pregnant woman to study the levels of biochemical markers (free β - human chorionic gonadotropin associated with pregnancy plasma protein-A PAPP-A; optionally - placental growth factor PIGF) - to calculate a woman's individual risk for the presence of widespread chromosomal pathology in the fetus (trisomy 21, 18, 13 chromosomes) and predict the risk of preeclampsia. The main purpose of this ultrasound is to assess the anatomical fetal structures, search for early malformations and minor echo markers, clarify the term of pregnancy and the expected date of delivery.
- In the group of low-risk pregnant women, a second ultrasound is performed at 18-22 weeks for a detailed assessment of the anatomical fetus structure, later malformations exclusion and control over the course of pregnancy.

- When signs of chromosomal pathology in the fetus, congenital fetal malformations are detected, a pregnant woman of medium and high risk groups is consulted by a geneticist for the selection of further examination; according to indications - consultations of other specialists, prenatal consultation to choose the pregnancy tactics and childbirth in accordance with current industry standards in the field of health care.
- The third ultrasound is performed according to indications at 28-32 weeks to assess the state of the fetus and fetometry.

During the examination at 9-11 weeks, the viability of the fetus is determined, the number of fetuses in the uterus, the term of pregnancy is specified (this is important for the subsequent results evaluation of biochemical screening at 15-18 weeks of pregnancy), the nuchal translucency is measured, severe anatomical defects are determined, and the nasal bones condition estimated. **Table 1. Normal values of indicators during the first screening:**

The nuchal translucency thickness	Heartbeat rate	The nasal bone thickness
0,8-2,8 mm	146-179 bpm	2-3 mm

Table 2. Ultrasound protocol on 11⁺⁰-13⁺⁶ weeks of pregnancy (CRL 45-84 mm)

Health care facility _____	Assessment of fetal anatomy	Normal	Anomalies	Not visualized
	Head			

Surname, initials of the pregnant woman _____ D.O.B. _____	Form			
	Brain Falx			
	Vascular plexuses			
	Facial skeleton			
	Facial profile			
	Eyeballs			

Date of last menstruation	The abdominal wall - the place where the umbilical cord exits				
Pregnancy period by last menstruation date		Stomach - on the left under the diaphragm			
Date of study					
Ultrasound device model		Heartbeat rate <input type="checkbox"/> yes <input type="checkbox"/> no HRR____bpm.			
Sensor		Heart location			
The doctor who referred the pregnant woman		Heart: 4 cameras and expected «V» feature in Color Doppler			
The doctor who performed the ultrasound					
Number of gestational sacs (eggs/amnions)	Bladder in sagittal projection, mm				
The number of fetuses in the uterine cavity	Left upper extremity				
	Right upper extremity				

Assessment of chorionicity in multiple pregnancy («λ» or «T» feature)	Left lower extremity			
	Right lower extremity			
	of	Chorion: homogeneous / heterogeneous		

Crown rump length (CRL) the fetus _____ mm meets the term _____ weeks of pregnancy	Chorion: entry of umbilical cord vessels <input type="checkbox"/> centralized <input type="checkbox"/> decentralized	
	Basic chromosomal markers	The presence of a valid ultrasound doctor's FMF license <input type="checkbox"/> yes <input type="checkbox"/> no
	the nuchal translucency thickness	
	nasal	<input type="checkbox"/> present <input type="checkbox"/> absent <input type="checkbox"/> cannot be estimated
	venous duct	reverse wave <input type="checkbox"/> present <input type="checkbox"/> absent PI _____ mm
	tricuspid regurgitation	<input type="checkbox"/> present <input type="checkbox"/> absent
Doppler imaging of the uterine arteries (UA) The presence of a valid ultrasound doctor's FMF lice <input type="checkbox"/> yes <input type="checkbox"/> no	PI right UA	
	PI left UA	
	Medium PI both UA	normal / increased
Comments		
Conclusion <input type="checkbox"/> normal and complete examination result <input type="checkbox"/> normal but incomplete examination result	Recommendations	

During the examination at 16-21 weeks, the main attention is paid to the anatomical fetal features, its size, compliance with the term of pregnancy, the presence of anomalies, marker signs of chromosomal pathology, the quantity and quality of amniotic fluid, the state of the placenta and umbilical cord. Ultrasound of chromosomal pathology markers in the second trimester are an increase of nuchal translucency, a decrease in the nasal bone length, an increase in the lateral brain ventricles, a hyperechoic inclusion (focus) in the heart of the fetus, an kidney bowls expansion and others. In addition, it is very important to carefully study the placenta, which involves assessing its size, identifying the presence of cysts or calcium deposits that can lead to dysfunction. These parameters are necessary for further pregnancy monitoring, since the growth and development of the fetus depends on the qualitative placenta's characteristics, it receives all the nutrients through it. Quantitative amniotic fluid assessment is performed, which is a kind of criterion for the normal course of pregnancy. A decrease or increase will indicate the pathology presence and require additional research.

Table 3. Ultrasound protocol at 18-22 and 28-32 weeks of pregnancy

Health care facility	Assessment of fetal anatomy	Normal	Anomalies	Not visualized
Surname, initials of the pregnant woman	Head			
	Form			
	The cavity of the transparent membrane			
D.O.B.	Brain Falx			
	Thalamus			
	Lateral ventricles, standard size up to 10 mm			
Date of last menstruation	Cerebellum			
	Large tank - cisterna magna standard size 2-10 mm			
Pregnancy period by last menstruation date	Face			
	Orbits			

Date of study _____	Face profile			
	Nasal bone (mm) _____			
Ultrasound Device Model _____				
Ultrasound Probe _____				
The doctor who referred the pregnant woman _____				
The doctor who performed the ultrasound _____ _____				

Fetal biometrics			Upper lip, lower lip			
Parameter	mm	week s	Alveolar process of the upper jaw			
Biparietal size			Neck, occipital fold standard size up to 6 mm			
Head circumference			Heart			
Abdominal circumference			HRR_____ bpm			
Femoral length			Position			
Humeral length			Size			

Transverse size of the cerebellum			4 cameras examination			
Fetus weight (gr)						
Placenta Location (wall) _____			3 vessels and trachea examination			
Distance from the inner orifice (mm)_____						
Amniotic fluid (volume) <input type="checkbox"/> normal <input type="checkbox"/> abnormal Index of amniotic fluid (cm) _____ Maximum vertical pocket (cm)_____			Left ventricular ejection of blood Right ventricular ejection of blood			
Fetus movements <input type="checkbox"/> normal <input type="checkbox"/> absent			Abdomen			
Fetus position <input type="checkbox"/> longitudinal <input type="checkbox"/> transverse <input type="checkbox"/> oblique			Stomach			
Fetus presentation <input type="checkbox"/> cephalic <input type="checkbox"/> pelvic			Intestinal loops			
Comments: Conclusion: <input type="checkbox"/> normal and complete examination result <input type="checkbox"/> normal but incomplete examination result _____ _____			Kidneys			
			Bladder			
			Umbilical cord attachment to the placenta			
			The number of umbilical cord vessels	<input type="checkbox"/> 3	<input type="checkbox"/> 2	
			Skeleton			
			Limbs			
			Upper left limb			
			Upper right limb			
Lower left limb						

<hr/> <hr/> <hr/> <hr/> <hr/>	Lower right limb			
	Sex (optionally)	<input type="checkbox"/> male <input type="checkbox"/> female		
Recommendations:				
Signature and seal of the ultrasound doctor				

The extended protocol application of ultrasound research has great importance for obtaining and adequately evaluating examination data during this period. If there are abnormalities, the pregnant woman should be sent to the regional medical genetic center, where a study is carried out using a high-resolution device to identify the detected abnormalities and develop tactics for monitoring the pregnant woman. Not only anatomical features of the fetus, but also functional disorders are evaluated. Special attention is paid to abnormalities of the brain, heart and placenta. In order to determine the defects of these systems, in addition to the usual ultrasound, a highly informative method of color dopplerography is used.

Ultrasound examination in the III trimester is aimed at clarifying the anatomical and functional fetus features, analyzing the state of the heart, placenta, umbilical cord, solving the issue of further monitoring of the pregnant woman, and childbirth tactics.

When studying the growth and development of the fetus in the III trimester of pregnancy, fetometry (measurement of the size of the fetus) is performed. Mandatory scope of fetometry includes biparietal size measurement and head circumference, abdomen circumference diameters, as well as the femur length (the tubular bone length is measured on both sides).

Normative fetometry gestational indicators are given in the table. 2. Based on the specified parameters, it is possible to determine the estimated weight of the fetus.

Table 4. Fetometric parameters in the III trimester:

Pregnancy period, week	Biparietal size, mm	Abdominal circumference, mm	Femur length, mm
29	73	240	55
30	75	248	57
31	78	259	59
32	80	270	61
33	82	278	63
34	84	288	65
35	86	290	67
36	88	300	69
37	89	306	71
38	91	310	73
39	93	324	74
40	94	325	76

— **Requirements for work results.**

- Consult a pregnant woman.
 - Explain the need for screening according to the patient's pregnancy period
 - Evaluate the data of the pregnant woman ultrasound examination based on the screening results.
5. To determine the further tactics of managing a pregnant woman and the need to appoint a laboratory examination.

— **Control materials for the final stage of the lesson: problems, tasks, tests, etc.**

Situational tasks:

Lady K., who is pregnant again, came to the obstetric hospital after being referred for a women's consultation. She has been registered for pregnancy since the 10th week. Second pregnancy, 30 weeks. The first pregnancy ended in a timely delivery. The first half of the pregnancy was complicated by the threat of termination, maintenance therapy was carried out in the gynecological department. When admitting no complaints; Blood pressure 120/70 mm Hg, pulse 78 beats/min, satisfactory properties. There

are no swellings. Obstetric status: the uterus is in normal tone, corresponds to the pregnancy term, abdominal circumference (AB) 89 cm, height of the uterine fundus (BDM) 30 cm. The fetus position is longitudinal, the head is palpated above the entrance to the pelvis. The fetal heartbeat is clear, rhythmic, 136 beats/min, heard to the right near the navel. Movement of the fetus feels good. In the general blood analysis: hemoglobin (Hb) — 110 g/l, leukocytes — $9 \times 10^9/l$, erythrocyte sedimentation rate (ESR) — 29 mm/h. In the urine analysis: relative density — 1015, protein — 0.003 g/l, leukocytes 0–2 in the field of vision, erythrocytes 1–2 in the field of vision.

Questions:

- Diagnosis.
- Specify reliable signs confirming pregnancy.
- How many times and at what time an ultrasound examination should be performed during a normal pregnancy?
- At what gestational age is prenatal maternity leave issued? What is its duration? 5. What examinations should be carried out during a visit to the women's clinic consultations at 30 weeks. pregnancy?

Answer:

- Second pregnancy, 30 weeks. Longitudinal position of the fetus, cephalic presentation, second position, anterior view.
- Listening to the heartbeat of the fetus, palpation of the abdomen with position determination, presentation, fetus position and type, fetal movements determination.
- The first ultrasound — at the 11th week of pregnancy. + 1 day to 13 weeks. + 6 days of pregnancy. The second — at 18–21 weeks of pregnancy. Conducting the third ultrasound is determined individually.
- Prenatal maternity leave is granted to pregnant women at 30 weeks. The duration of prenatal maternity leave is 70 days.
- During a visit to the women's consultation at 30 weeks. during pregnancy: examination and palpation of the mammary glands; examination of the lower extremities for the presence of varicose veins; auscultation of fetal heart rate; measure blood pressure, pulse, body temperature and enter the data into the gravidogram; general urinalysis or rapid test for the presence of protein, blood for antibodies with Rh-negative blood.

KROK-2 testing (2019):

1. A 27-year-old repeatedly pregnant woman was registered in a women's consultation for 11-12 weeks. There is a history of frequent angina, chronic pyelonephritis. The first pregnancy was complicated by fetal growth retardation syndrome. Which of the following examinations should be performed first?

- Ultrasound examination of the pelvic organs *
- Research on SARS-infection
- Determination of the level of estrogens
- Bacteriological examination of urine
- Determination of serum iron content

4. **Summing up** (criteria for evaluating learning outcomes).

On-going control: oral survey, testing, practical skills performance assessment, situational clinical tasks solution, activity assessment in class, etc.

The structure of the current assessment during practical session:

- Evaluation of theoretical knowledge on the lesson's subject:
 - methods: survey, solving a situational clinical problem;
 - The maximum score is 5, the minimum score is 3, the unsatisfactory score is 2.
- Evaluation of practical skills and manipulations according to the lesson subject:
 - methods: assessment of practical skills correct performance;
 - The maximum score is 5, the minimum score is 3, the unsatisfactory score is 2.
- Evaluation of work with a patient according to the lesson subject:
 - methods: assessment of: a) communication skills during communicating with the patient, b) the correctness of prescribing and evaluating laboratory and instrumental studies, c) compliance with the differential diagnosis algorithm, d) substantiation of the clinical diagnosis, e) drawing up a treatment plan;

- The maximum score is 5, the minimum score is 3, the unsatisfactory score is 2.

Current assessment criteria for practical training:

Mark	Evaluation criteria
«5»	The student is fluent in the material, takes an active part in discussing and solving a situational clinical problem, confidently demonstrates knowledge of ultrasound screening diagnostics in obstetrics and the correct appointment of laboratory and instrumental research, expresses his opinion on the subject of the lesson, and demonstrates clinical thinking.
«4»	The student is well versed in material, participates in the discussion and solution of a situational clinical problem, demonstrates knowledge of ultrasound screening diagnostics and the correct appointment of laboratory and instrumental studies with some errors, expresses his opinion on the subject of the lesson, demonstrates clinical thinking.
«3»	The student isn't well versed in material, is unsure of participating in the discussion and solution of the situational clinical problem, demonstrates knowledge of ultrasound screening diagnostics and the correct appointment of laboratory and instrumental studies with significant errors.
«2»	The student isn't well versed in material, does not participate in the discussion and solution of the situational clinical problem, does not demonstrate knowledge of ultrasound screening diagnostics and the correct appointment of laboratory and instrumental research.

List of recommended literature.

Main:

- ISUOG Practice Guidelines: use of Doppler ultrasonography in obstetrics // *Ultrasound Obstet. Gynecol.* — 2013. — Vol. 41. —P. 233—239. <http://dx.doi.org/10.1002/uog.12371>; PMID:23371348
- Callen P.W. *Ultrasonography in Obstetrics and Gynecology* / P.W. Callen. — Elsevier Health Sciences, 2011. — 1180 p.
- Fisher J. First-trimester screening: dealing with the fall-out. *Prenat Diagn* 2011; 31: 46–49.
- Renna MD, Pisani P, Conversano F, Perrone E, Casciaro E, Renzo GC, Paola MD, Perrone A, Casciaro S. Sonographic markers for early diagnosis of fetal malformations. *World J Radiol.* 2013 Oct 28;5(10):356-71. doi: 10.4329/wjr.v5.i10.356. PMID: 24179631; PMCID: PMC3812447.
- Abuhamad, Alfred. *Ultrasound in obstetrics and gynecology: a practical approach.* 2014.

Additional:

- Bricker L. Routine ultrasound in late pregnancy (after 24 weeks' gestation) / L. Bricker, J.P. Neilson, T. Dowswell // *Cochrane Database Syst Rev.* — 2009. — CD001451.
- Walker MC, Willner I, Miguel OX, Murphy MSQ, El-Chaar D, Moretti F, et al. (2022) Using deep-learning in fetal ultrasound analysis for diagnosis of cystic hygroma in the first trimester. *PLoS ONE* 17(6): e0269323. <https://doi.org/10.1371/journal.pone.0269323>
- Bernard J-P, Cuckle HS, Stirnemann JJ, Salomon LJ, Ville Y. Screening for fetal spina bifida by ultrasound examination in the first trimester of pregnancy using fetal biparietal diameter. *Am J Obstet Gynecol* 2012; 207: 306.e1–5.
- Cicero S, Curcio P, Papageorghiou A et al: Absence of nasal bone in fetuses with trisomy 21 at 11-14 weeks of gestation: an observational study. *Lancet* 2001; 358:1665
- International Society of Ultrasound in Obstetrics and Gynecology official statement on the Safe use of Doppler in the 11 to 13+6 week fetal ultrasound examination. *UOG: Volume 37, Issue 6, Date: June 2011, Page: 628*

- Dias T. Systematic introduction of obstetric ultrasound skills into practice / T. Dias, L. Ruwanpura // Sri Lanka JOG. — 2011. — Vol. 33. — P. 154—157.
- AIUM practice guideline for the performance of an antepartum obstetric ultrasound examination. J Ultrasound Med 2003; 22:1116.

Internet resources for preparation:

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