VIA MEDICA

RECOMMENDATIONS

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Practice guidelines of the Polish Society of Gynecologists and Obstetricians — Ultrasound Section for ultrasound screening in uncomplicated pregnancy — 2020

Dariusz Borowski[1], Marek Pietryga[2], Pawel Basta[3], Wojciech Cnota[4], Bartosz Czuba[4], Mariusz Dubiel[5], Tomasz Fuchs[6], Hubert Huras[7], Rafal Iciek[8], Renata Jaczynska[9], Piotr Kaczmarek[10], Przemyslaw Kosinski[11], Sebastian Kwiatkowski[12], Agnieszka Nocun[13], Michal Pomorski[6], Mariola Ropacka-Lesiak[14], Magda Rybak-Krzyszkowska[13], Piotr Sieroszewski[15], Piotr Wegrzyn[16], Marcin Wiechec[17], Miroslaw Wielgos[11], Mariusz Zimmer[6]

[1]Clinic of Fetal-Maternal, Gynecology and Neonatolgy, Collegium Medicum, Nicolaus Copernicus University in Bydgoszcz, Poland
[2]Department of Obstetrics and Women's Diseases, Poznan University of Medical Sciences, Poznan, Poland
[3]Chair of Gynecology and Obstetrics, Department of Gynecology and Oncology, Jagiellonian University Medical College, Cracow, Poland
[4]Department of Obstetrics and Gynecology in Ruda Slaska, Medical University of Silesia, Poland
[5]Department of Maternal-Fetal Medicine and Gynecology, Chair of Obstetrics, Bydgoszcz, Poland
[6]2nd Department of Gynecology and Obstetrics, Wroclaw Medical University, Wroclaw, Poland
[7]Jagiellonian Univeristy Collegium Medicum, Department of Obstertics and Perinatology, Cracow, Poland
[8]Department of Obstetrics and Women's Diseases, Karol Marcinkowski University of Medical Sciences, Poznan, Poland
[9]Clinic of Obstetrics and Gynecology, Institute of Mother and Child, Warsaw, Poland
[10]Operative Gynecology and Oncological Gynecology Clinic, Polish Mother's Memorial Hospital-Research Institute, Lodz, Poland
[11]1st Chair and Department of Obstetrics and Gynecology, Medical University of Warsaw, Poland
[12]Department Obstetrics and Gynecology, Pomeranian Medical University in Szczecin, Poland
[13]Department of Obstetrics and Perinatology, University Hospital in Cracow, Poland
[14]Department of Perinatology and Gynecology, Poznan University od Medical Sciences, Poland
[15]Department of Fetal Medicine and Gynecology, Medical University of Lodz, Poland
[16]Department of Obstetrics and Perinatology, Medical University of Warsaw, Poland
[17]Department of Gynecology and Obstetrics, Faculty of Medicine, Jagiellonian University Medical College, Cracow, Poland

INTRODUCTION

The Ultrasonography Section of the Polish Society of Gynecologists and Obstetricians and Obstetrics is an organization promoting the development of ultrasound prenatal diagnostics and supporting the education of doctors and patients. The aim of the update of existing Guidelines from 2015 is to organize and indicate the optimal scheme of performing ultrasound examinations in uncomplicated pregnancies [1].

These updated Guidelines are in accordance with the Standards of international organizations such as the International Society of Ultrasound in Obstetrics and Gynecology (ISUOG 2010, 2013, 2016, 2019), the American College of Obstetricians and Gynecologists (ACOG) and the Fetal Medicine Foundation (FMF 2013, 2016, 2019).

Ultrasound examination is an essential diagnostic tool during pregnancy. According to the Standards of the Polish Society of Gynecologists and Obstetricians for uncomplicated pregnancy management, this test should be offered to all pregnant women, at least four times during pregnancy. The purpose of the examination is different depending on the stage of pregnancy.

Corresponding author:
Dariusz Borowski
Clinic of Fetal-Maternal, Gynecology and Neonatolgy, Collegium Medicum, Nicolaus Copernicus University in Bydgoszcz, Poland
e-mail: darekborowski@gmail.com

What is the purpose of an ultrasound examination?

The primary goal of ultrasound evaluation during pregnancy is to minimize the occurrence of unfavorable obstetric outcomes that may result from undiagnosed congenital defect in the fetus, fetal immaturity or other intrauterine complications. The task of the doctor performing ultrasound screening is to refer the pregnant woman to a referral center in every case of diagnostic doubts or suspected abnormal fetal development.

At each stage of fetal development, the ultrasound scan has different scope. The purpose of the examination is different in the first trimester of pregnancy as opposed to the second and third trimesters. The post-delivery term examination is also characterized by certain differences. Regardless of the period of pregnancy during which the test is performed, the doctor should present the pregnant woman undergoing the test with a written result of the test with data enabling the identification of both the person under examination and the investigator and a summary with detailed elements of fetal anatomy which have been assessed and biometric measurements. The printout of the ultrasound image is not the result of the examination, but only supplementary documentation which may be part of the results. The patient should also receive comprehensive information about the results.

Who should receive an ultrasound examination?

In accordance with current legislation, ultrasound-based screening should be offered to all pregnant women. Refusal by the patient to undergo the examination should be documented, in writing, preferably with the pregnant woman's signature.

Is ultrasound examination safe?

At present, there are no study results suggesting that ultrasonography has an adverse effect on fetal development. When performing this examination, it is necessary to follow the principle of minimal exposure and time of examination to complete the procedure — **ALARA** (**A**s **L**ow **A**s **R**easonably **A**chievable). In particular, the values of thermal (TI) and mechanical (MI) indexes should be below 1, during the entire study (TI < 1, MI < 1). The safety principles of ultrasound examination are described in detail in separate publications [2].

What are the ultrasound equipment requirements?

Ultrasound for gynecological diagnostics should have the following capabilities: 2D real time, at least 128-step grey scale image, capacity to measure distance (at least two dimensions), circumference and surface area and obstetric software. Additionally, they should be equipped with transabdominal and transvaginal transducers with capacity to print and store images.

What should an ultrasound results include?

An ultrasound examination results should present the following data:

a) patient's first and last name, date of birth and Personal Identification Number (PESEL),
b) place and date of examination, first and last name of the examiner,
c) Information regarding the name of the ultrasound and the type and frequency of the transducers used
d) initial diagnosis written by the referring physician, if not a routine examination
e) date of last menstrual period and gestational age based on last menstrual period
f) If it is difficult to determine the date of last menstrual period, the gestational age should be determined by the crown-rump length (CRL) in the first trimester. In the absence of testing in the first trimester of the pregnancy, the gestational age is determined based on HC measured in the second trimester of pregnancy.
g) The examining doctor information which should consist of a stamp and his/her signature

It should be clearly stated that any deviation from the normal condition of the fetus, the pelvic organ/uterus and any other abnormal symptoms diagnosed during the examination should also be included in the description of the examination. Oral communication of such information is not acceptable without an appropriate note in the result.

If a complete examination cannot be performed it should be noted in the examination result, and guidelines should be given on how to proceed and whether a further examination is planned. Elements which were unable or incomplete to visualize should be marked in the examination results. If a complete examination cannot be carried out or there insurmountable technical constraints during pregnancy affecting the quality of the ultrasound examination (*e.g.* due to the pregnant woman's being overweight or obese, defects of the uterus, retroverted uterus, uterine fibroids etc.), this fact should be noted in the examination result, and guidelines should be given on how to proceed and whether a further examination is planned.

When informing pregnant woman/parents about the result of the ultrasound examination, attention should be paid to the limitations of this method and the impossibility of excluding all anatomical defects.

ULTRASOUND EXAMINATION BEFORE 10 WEEKS OF GESTATION

The ultrasound examination during this period of pregnancy should be performed with a transvaginal transducer. This

examination is not mandatory, and we perform it on medical indications. The purpose of the ultrasound examination before 10 weeks of pregnancy, performed on medical indications, is:

a) **image and location of the fertilized egg** — confirmation of the presence of an intrauterine pregnancy or confirmation of a pregnancy with an unknown location. Special attention should be paid to the location of the gestational sac in patients after Caesarean sections due to the risk of pregnancy implantation in the scar after hysterotomy [3–5]. In case of any doubts in this respect, the patient should be referred for examination at the referral center.
b) **Assessment of gestational age** — based on fetal crown-rump length measurement (CRL)
c) **Assessment of the presence of the gestational sac** — measurement of the gestational sac (GS - mean of 3 dimensions), position in the uterine cavity, number of gestational sacs. Until the embryo is visualized and until CRL measurement, with GS values above 20 mm and absent embryo there is a high risk of miscarriage.
d) **Assessment of trophoblast echostructure** for trophoblastic disease in the case of subjective hypertrophy of a chorionic echostructure typical in molar pregnancy (numerous small and disseminated hypoechogenic fields in the chorionic area), serum level of β-hCG determination should be ordered and the pregnant woman should be referred to hospital.
e) **Assessment of the number of embryos, chorions and amnions** — note: in case of a multiple pregnancy, the *chorionicity and amnionicity* should be determined by assessing the visibility of two separate or one common gestational sac.
f) **Assessment of the yolk sac (YS)** — presence of the YS (yes/no), description of possible YS irregularities. Note: If GS is present in the absence of YS or the embryo, attention should be paid to the possibility of ectopic pregnancy (pseudogestational sac).
g) **Assessment of the presence of the embryo** — presence (yes/no), CRL measurement, presence of the FHR (with CRL over 4 mm). Note: Using the transvaginal transducer, the FHR is visible with CRL ≥ 4 mm. In case of absent FHR with CRL< 5mm — the examination should be repeated to confirm the proper development of pregnancy**.**
h) **Using the Doppler technique** in the examination before 10 weeks of pregnancy, including for FHR assessment, is not recommended. It is preferred that FHR is shown in 2D (the so-called B presentation) or M-mode. The presence of bradycardia below 80 beats per minute increases the risk of miscarriage.
i) **Evaluation of the genital organs of the pregnant woman** — uterus together with the cervix (regular, irregular shape), anatomy (normal, abnormal – defects, myomas). We assess the outline and presence of focal lesions, *i.e.* mainly myomas in terms of their location and relationship with the trophoblast. Differential diagnosis of congenital defects of the uterus during pregnancy is limited, but the focus should be on the possible presence of a septate uterus (the septum has a myometrial echostructure and remains in continuity with the uterine wall), a double uterus and a unicornuate uterus with a residual horn. In contrast, the chorionic strands which do not pose a threat to the development of the fetus are hyperechoic and remain in continuity with the trophoblast. The assessment of the cervix should include the possible presence of focal lesions such as myomas or the proliferative process (irregular focal lesions with uneven contours most often hypoechogenic with increased vascularization). The assessment of appendages for focal changes should be based on the system of simple rules, according to the terminology of the IOTA group. The examination technique is described in detail in recommendations for gynecological ultrasounds. Note: Abnormal masses in appendages should be described. If there are uterine myomas, describe their location and take measurements. The recto-uterine pouch should be examined for the presence of free fluid. The thickness of the fluid layer should be measured at cervical level following a perpendicular measurement line, the value of the measurement above 10 mm should be recorded in the result of the test. If there is no deviation from the standard, a detailed description is not necessary, but a statement is sufficient, for example: "uterus and appendages without pathological changes".

ULTRASOUND EXAMINATION BETWEEN 11^{+0}–13^{+6} WEEKS OF PREGNANCY (CRL BETWEEN 45–84 MM)

The ultrasound examination performed at this stage of pregnancy involves several assumptions. The doctor providing prenatal care is obliged to explain to the patient the validity of these examinations. Each patient has the right to receive information about the possibility of performing prenatal tests. Such an obligation is imposed by Art. 38. Point 3 of the Code of Medical Ethics, which states: "A doctor is obliged to inform patients with the possibilities of modern medical genetics, prenatal diagnosis and therapy." In some Patients, these tests may be reimbursed by the National Health Fund (NFZ) within the framework of the Prenatal Screening Program, provided that the Patients meet the criteria for inclusion in the program.

The primary objective is to assess the anatomical structures of the fetus, to search for early structural defects and to assess the size of the fetus and determine the duration

of pregnancy, the date of birth, if this has not been done reliably at an earlier stage. Due to the technological development of ultrasound and the related high resolution and precision of imaging, ultrasound examination between 11 + 0–13 + 6 allows to suspect an increasing number of fetal defects [6–8]. We now estimate that the detection of abnormalities of the fetal anatomy in the first trimester is about 60% [9–11]. If early anatomical defects of the fetus are diagnosed, early prenatal invasive diagnostics can be offered to the pregnant woman to exclude the genetic disorders. The absolute prerequisite for reliable prenatal examination is to obtain ultrasound cross sections images in accordance with the standards and to obtain the best available images under given examination conditions. In connection with the introduction into clinical practice of cell-free fetal DNA in maternal blood (cffDNA) for screening for chromosome aberrations, in selected clinical situations it is recommended to suggest this diagnostic method to the pregnant woman. The evaluation of cell-free fetal DNA in maternal blood is recommended (only if there are no anatomical abnormalities in ultrasound examination) for pregnant women of the indirect risk group of trisomy 21, 18, 13 (1:300–1:1000) [12]. If an abnormal prenatal screening result, structural defect in the fetus or abnormal values of nuchal translucency (above 95th percentile) are found, the pregnant woman should be referred for further evaluation at the referral center with the genetic consultation [13]. Due to the increase in the number of Caesarean sections in Poland (42.2% according to the Euro-Peristat 2015 report), more frequent complications occur in subsequent pregnancies in the form of implantation of a pregnancy in a scar after Caesarean section and as a result of trophoblast growth [14–16].

Therefore, if the trophoblast is located on the anterior wall of the uterus, it is recommended to accurately assess the site of hysterotomy. In cases of doubts and suspicion of trophoblast growth in the scar after Caesarean section, the pregnant woman should be immediately referred to the reference center.

In other cases, at this stage of pregnancy we do not assess the location of the trophoblast, and it is particularly unjustified to make a diagnosis or suspicion of extremally low-lying trophoblast.

A detailed assessment of the structure of the fertilized egg includes the following elements (abdominal or transvaginal transducer):

a) number of gestational sacs and fetuses in the uterine cavity
b) fetal heart rate evaluation (FHR)
   Note: during normal pregnancy, the fetal heart rate decreases from about 170 beats per minute at 11 weeks of pregnancy to about 150 beats per minute at 14 weeks.
c) biometrics
   CRL — crown-rump length measurement — assessment/verification of gestational age when CRL< 84 mm. Note: every effort must be made to ensure that the CRL is measured reliably and precisely, because this is the basis for determining the age of the fetus and the date of delivery. CRL measurement should be taken when the fetus is in a neutral position and on its back, in the sagittal section. The value of 45 mm corresponds to 11 weeks + 0 days (according to some nomograms 11 weeks + 2 days) and 84 mm – 13 weeks + 6 days (14 + 1 respectively)
d) fetal anatomy assessment [18–21]
   - skull — shape, cerebral falx, plexuses, proportions of the choroid plexuses and cerebrospinal fluid in the fetal skull
   - facial skeleton — we recommend assessing the profile and presence of eyeballs if possible
   - abdominal walls — umbilical cord insertion visibility position of the stomach - on the left under the diaphragm
   - fetal heart — location, axis and heart rate; if possible, it is good clinical practice to visualize 4 cardiac chambers and a cross-section through the transverse part of the ductal and aortic arches (expected V sign) mapped with colored Doppler.
   - bladder in the sagittal projection (in some normal pregnancies it may be difficult to see)
   - upper and lower limbs — tri-segmental assessment
   - assessment of the chorion, description of possible irregularities
   - chorionicity assessment in multiple pregnancy (LAMBDA or T sign)

The second goal of ultrasound examination at 11 + 0 – 13 + 6 weeks of pregnancy is to assess the risk of the most common chromosome aberrations (trisomy 21, 18, 13) [1]. The risk calculation is based on the history, maternal age, assessment of ultrasound and biochemical markers and should be performed using FMF-certified calculators only.

We recommend providing two risk values: background, which takes into account the age of the pregnant woman and a final result which evaluates all used ultrasound markers and biochemical parameters. It is a mistake to provide the patient with two separate results: the first one based on ultrasound examination alone, and the second one based on the ultrasound and biochemical markers.

In case of blood sampling for biochemical test on the day of ultrasound, the patient should be given a preliminary result of the examination without the risk of genetic defects (evaluation of gestational age, evaluation of fetal anatomy).

The final result of the examination with the genetic risk assessment should only be given after the biochemical test result.

Ultrasound markers include the following basic markers [17]:

a) **FHR** — **F**etal **H**eart **R**ate
b) **NT** — **N**uchal **T**ranslucency.

Principles of assessing fetal NT according to FMF [18, 22]:

a) **Image magnification** — the head and 1/3 of the fetal chest occupy the entire screen.
b) **Neutral fetal head position** — no excessive bending in either direction of the fetal head.
c) **Fetus position** — fetal sagittal section.

Note: The sagittal section is obtained by showing the tip of the nose, nasal bone, nasal skin, hypoechogenic mesencephalon and a rectangular image of the fetal jaw.

d) **Amniotic membrane** — if it is visible, it must be distinguished from the skin of the fetus. Note: To obtain a contrasting NT and amniotic membrane image, reduce the gain to low values.
e) **NT measurement** — at the widest point, markers "inner to inner", horizontal arms of markers placed on the NT limiting lines.

Note: If the umbilical cord runs around the neck of the fetus, it is recommended to first assess the anatomy of the fetus counting on the change of the fetus position. If this is not possible, it is possible to measure above and below the course of the umbilical cord and note the mean value, avoiding the use of such expressions as "umbilical cord around the neck" in the description.

The risk assessment of fetal chromosome aberrations should be performed between 11 + 0 – 13 + 6 (at 45–84 mm CRL). Mother's age, history, NT and FHR in combination with biochemical markers (PAPP-A, free beta-hCG subunit) are components of the so-called combined test, also known as FTS (First Trimester Screening) [1, 22, 23]. Biochemical test which includes at least two of the above-mentioned elements is an indispensable element of a correct risk calculation.

A risk assessment without biochemical markers is an incorrect practice and such a result should be considered as incomplete.

It is not appropriate to replace a biochemical test with a free fetal DNA test, as biochemical markers are not only used to assess the risk of trisomy.

Biochemical tests of the first trimester should be performed only on FMF-certified machines (Delfia, Kryptor, Roche).

The optimal time to collect blood for biochemical tests in the first trimester is 10–11 weeks of pregnancy.

Evaluation of the blood sample should be performed no later than 13 + 6 weeks of pregnancy (CRL — 84 mm).

In the case of abnormal values of collected biochemical markers, they should not be re-tasted unless an error is suspected in the collection, storage or transport of the sample.

Evaluation of additional ultrasound markers of chromosome aberrations [23–25]:

- **NB** — **N**asal **B**one
- Note: we don't measure nasal length in the first trimester of pregnancy. It is evaluated as: present, absent (hypoplastic) or not assessable (under difficult technical conditions).
- **DV PIV** — **D**uctus **V**enosus, PIV)
- **TR** — **T**ricuspid **R**egurgitation

Assessment of additional markers increases the Detection Rate (DR) for trisomy 21 chromosome to 95%, with False Positive Rate (FPR) at 2.5%.

A physician with appropriate audits and an FMF license to assess additional markers (NB, TR, DV PIV) and a Polish Society of Gynecologists and Obstetricians — Ultrasound Section certificate can use additional markers to calculate the risk of genetic defects.

Invasive diagnostics (chorionic biopsy, genetic amniocentesis) should be recommended for pregnant women, who after performing the combined test (pregnant woman's age, FHR, NT, PAPP-A, free beta-hCG), have a risk of chromosome aberrations in the fetus ≥ 1:300.

In the light of recent reports, the additional risk of pregnancy loss (adjusted for specific risk groups) and indications for amniocentesis) after the amniocentesis is about 0.1% [26].

During the first trimester of pregnancy, it is good clinical practice to try to exclude the occurrence of major ultrasound markers of chromosome abnormalities [27].

- hernia of the anterior abdominal wall (omphalocele)
- common atrioventricular canal,
- megacystis,
- congenital diaphragmatic hernia,
- holoprosencephaly,

If they are present, regardless of other markers, the risk of chromosome aberrations in the fetus increases and the pregnant woman should be referred to a referral center for further examination and invasive diagnostics.

A referral to an invasive procedure (chorionic biopsy, amniocentesis, cordocentesis) may be issued by an obstetrician-gynecologist or a perinatologist. Genetic consultation is not necessary to perform an invasive procedure (but it is recommended especially in the case of genetic disease family history).

Ultrasound examination between 11 + 0–13 + 6 also provides the possibility of achieving the third aim of calculating the risk of pre-eclampsia PE [28–30].

Specialists with appropriate FMF certification can perform an extended examination PE risk calculation based on patient history, arterial pressure (MAP), uterine arterial pulsation index (Ut PI), placental growth factor (PlGF) concentration in pregnant blood serum [31].

If PlGF measurement cannot be used, PAPP-A values below 0.4 MoM suggest an increased risk of pre-eclampsia.

The ASPRE study in pregnant women examined the risk of PE preeclampsia using the FMF algorithm between 11 + 0–13 + 6 weeks of pregnancy.

In the high-risk group > 1:100 administration of acetylsalicylic acid (150 mg/day, from 11–14 weeks of pregnancy) reduced the incidence of PE < 37 weeks by 62% (p = 0.004) and PE < 34 weeks by 82% [32].

If a high risk is identified (currently the most common cut-off points are > 1:100 or > 1:150), prophylaxis with 150 mg of acetylsalicylic acid (once a day before sleep) introduced after risk evaluation (week 11–14) and before 16 weeks of pregnancy and continued until 36 weeks is recommended [32].

Each result of the ultrasound examination performed in the first trimester of pregnancy should be completed with a commentary and possible recommendations for further treatment for the referring doctor and the Patient.

ULTRASOUND EXAMINATION IN PREGNANCY WEEKS 18–22 AND 28–32 — FETAL DEVELOPMENT ASSESSMENT

The aim of an ultrasound examination in weeks 18–22 of pregnancy is a detailed assessment of the fetal organs in terms of congenital defects (assessment of the fetal anatomical structure). Weeks 28–32 examination entails first and foremost the assessment of fetal growth and possibly fetal wellbeing assessment is particular clinical situations. In addition, the examinations are to determine the approximate fetal weight and gestational age (in case the date of last menstrual period is not known and/or no ultrasound was performed in the first trimester of pregnancy), based on biometric parameters. It is worth noting that both the multitude and individual variability of parameters (BPD, HC, AC, FL, HL, TCD) on the basis of which the gestational age can be determined, causes that the accuracy of this method, during this period of pregnancy, may be incorrect. In the first half of the second trimester (14–20 weeks), on the basis of the measurement of HC and the cerebellar transverse dimension, the gestational age can be estimated with an accuracy of ± 7, ± 10 days. In the third trimester of pregnancy, the average spread of the estimated gestational age (multiparameter evaluation) is ± 3 weeks — in such situations HC or TCD is recommended to be used for the evaluation of the progress of pregnancy in the third trimester.

It should also be added that if the gestational age had previously been defined based on the CRL in the first trimester of pregnancy, no correction should be made for that age based on biometric measurements carried out in the second and third trimesters of pregnancy to adjust the date of birth.

1. Biometry, determination of estimated fetal weight and gestational age

measurement based on biometric parameters:

BPD – **B**i-**P**arietal **D**iameter,
HC – **H**ead **C**ircumference,
AC - **A**bdominal **C**ircumference,
FL – **F**emur **L**ength,
optionally **HL** - **H**umerus **L**ength
and **TCD** — **T**ransverse **C**erebellar **D**iameter [1, 33].

Bi-parietal diameter (BPD) — the transthalamic plane (recommended)

a) cross-section at the height of the thalami,
b) insonation angle 90°,
c) symmetric hemispheres and calvaria, the cerebellar hemispheres should not be in the plane of the image
d) midline falx with the cavum septi pellucidi.

Note: The calipers should be set according to the reference method used (usually "outer to inner" edge if the calvaria wall). In the transventricular plane, it is recommended to measure the width of the brain's lateral ventricles.

Brain structures visible in particular planes:

Transthalamic plane: anterior horns of the lateral ventricles, CSP, thalami, hippocampus

Transventricular: parallel to the plane described above, anterior and posteriori horns of the lateral ventricles, CSP.

Transcerebellar: anterior horns of the lateral ventricles, cavum septum pellucidum (CPS). thalami, cerebellum, cisterna magna.

Fetal head circumference (HC) — measurement plane analogous to BPD measurement.

Note: use an ellipse, covering the outer outline of the fetal skull.

Abdominal circumference (AC) — measurement plane:

a) cross section in the transverse plane,
b) umbilical vein at the hepatic sinus level,
c) visible gastric bubble, invisible kidneys.

Note: Use an ellipse, covering the external contour of the fetal abdomen.

Femur length (FL) — measurement plane:

a) Measurement in the longest axis,
b) Insonation angle 45–90°.

Note: The markers should be placed on the farthest ends of the bone, excluding cartilage if visible.

Fetal humerus length (HL) — measurement plane:

a) measurement in the longest axis,
b) Insonation angle 45–90°.

Note: The markers should be placed at the farthest ends of the bone, not including cartilage if visible

2. Evaluation of fetal structures and organs — evaluation of fetal anatomy [1, 33–35]

Table I presents the recommended minimum values of fetal anatomy during ultrasound examination between 18–22 weeks of pregnancy.

a) Skull —evaluation of 4 features:

- **Size** — assessment when measuring BPD, HC.

Table 1. Recommended evaluation of the fetus in the second trimester of pregnancy (18–22 weeks of pregnancy)

Head	Skull continuity Cavum septi pellucidi Cerebral falx Thalami Lateral ventricles Cerebellum Cisterna magna	Abdomen	Stomach in the correct position Bowels not expanded Both kidneys present Umbilical cord insertion Bladder
Face	Eyeballs, Face profile Mouth, upper lip alveolar process of the jaw	Skeleton	Spine - no defects (axial, sagittal and coronal plane) Upper and lower limbs — tri-segmental
Neck	Lack of tumors (cystic hygroma, neck teratoma)	Placenta	Position Possible abnormalities
Chest/Heart	Shape of the chest Size, position and axis of the heart Heart rate, 4 chamber view Outflow track from the heart ventricles 3-vessel view 3-vessel-trachea view	Umbilical cord	Number of vessels, insertion
		Gender	Female of male*

*optional, depending on examination conditions and patient's wish

Table 2. Recommended range of fetal heart rate screening [1]

Minimum evaluation parameters have been bolded

FETAL HEART SCREENING performed by an obstetrician-gynecologist

- **Determination of the sides of the fetus based on its position in the uterus**
- **Visualization of the stomach**
- Visualization of the aorta descending to the front and left of the fetal spine
- Visualization of the inferior vena cava forward of the aorta and to the right of the fetal spine
- **Visibility of the heart in the chest**
- **Heart size - the area of the heart is about 1/3 of the chest area**
- **Visualization of the heart on the left side of the chest**
- **Determination of heart axis** — 45° ± 20°
- No pericardial fluid
- **Assessment of the heart rate** — preferably in the left ventricle in a four-chamber projection at the ventricular septum at the border of inflow and outflow, which gives the possibility to additionally determine if there is no atrial to ventricular impulse conduction disturbance - (normal sinus rhythm 110–160 beats/min)
- **Visualization of the 4 cardiac chambers (4CHV) with a cross of the heart**
- **Visualization of 3 vessels in the upper mediastinum (3V) — pulmonary trunk, aorta, upper vena cava**
- Visualization of 3 vessels and trachea in the upper mediastinum (3VT) — trachea to the right of the aortic arch and ductal arch
- **Visualization of the outflow tracts from the chambers:**
- LVOT — the left ventricular outflow tract is not divided, septal-vascular continuity is maintained
- RVOT — the right ventricular outflow tract is divided into branches: right and left pulmonary artery and ductus arteriosus
- **Visualization of the crossing of Ao and PA after leaving the respective chambers**

4CHV (4 Chamber View), 3VV (3 Vessel View), 3VTV (3-Vessel-Trachea View), LVOT (Left Ventricle Outflow Tract), RVOT (Right Ventricle Outflow Tract)

- **Shape** — oval, no loss of continuity - except for cranial sutures. Abnormal shape (lemon, strawberry, clover leaves) should be documented.
- **Continuity** — no bone defects, no external visible brain structures.
- **Echogenicity** — homogeneous, only cavities at the cranial sutures. The "excessively" visible brain structures of a fetus may show defects in bone mineralization (*e.g.* hypophosphatasia, osteogenesis imperfecta), similarly to the susceptibility of the skull to transducer compression through maternal abdominal walls [36].

b) Fetal central nervous system — assessment in at least three planes allowing for visualization of the CNS — transventricular, transthalamic and transcerebellar (posterior fossa).

The following should be visualized: lateral ventricles with choroid plexuses, cavum septum pellucidum, cerebral falx, thalami, cerebellum and cistern magna. The posterior horn of the lateral ventricle should be measured.

c) Fetal face — the assessment should include the evaluation of the upper lip (assessment of the presence of cleft), alveolar process of the jaw, eyeballs, face profile, visibility and measurement of nasal bone.

d) Fetal neck — assessment of the presence of possible tumors. The assessment includes examination for lesions such as the cystic hygroma or teratoma in this area and measurement of NF — Nuchal Fold in 18–22 weeks of pregnancy.

e) **Fetal chest** — regular shape, without deformities, both lungs of homogeneous echogenicity, without pathological masses, fluid reservoirs and mediastinal displacement. Hypoechogenic diaphragm line visible on the sagittal section.

f) **Fetal heart** — it is recommended that the fetal heart image is magnified so it occupies 1/3 of the image.

g) **Fetal abdomen** — the position of internal organs in relation to the heart apex should be assessed:

- **Fetal stomach** on the left side, position and shape abnormalities (*e.g.* double bubble image) should be documented.
- **Bowels** should be located in the abdomen. Signs of bowel loop dilatation should be documented.
- **Cord insertion** should form a picture of the letter T with the abdominal wall. The cord insertion should be examined for any disturbances in the anterior abdominal wall (umbilical hernia, gastroschisis). The number of vessels in the umbilical cord should be determined, preferably by doppler ultrasonography, showing the course of the umbilical arteries along the fetal urinary bladder or on the transverse section. The presence of a **single umbilical artery** should be an indication for a thorough reassessment of the fetal anatomy or further diagnosis at the referral center.
- **Fetal gallbladder** is not part of a routine evaluation in the 2nd and 3rd trimester
- **Both kidneys** should be visualized, the expansion of the pelvicalyceal system should be documented (measurement of AP or PA on the transverse section). The measurement of the renal pelvis should be performed on the transversal section of the fetal abdomen at the height of the fetal kidneys with the fetal spine at 6 or 12 o'clock. A measurement above 7 mm should be considered as an indication for verification at the referral center.
- **Fetal urinary bladder** should be visualized, magnification and abnormal shape should be documented (*e.g.* "keyhole" image — posterior urethral valve).
- **Fetal spine** — assessment in the sagittal, axial and coronal planes with assessment of skin continuity. Spina bifida is often accompanied by changes in the fetal CNS anatomy (cerebellum — banana sign, collapsed cisterna magna). Other measurement planes may be helpful in detecting deformations *e.g.* of the vertebrae or sacral agenesis.

h) **Fetal limbs** — minimum evaluation involves three-segmental view of the fetal limbs. It is not recommended to count fingers and toes.

i) **Placenta evaluation** — the minimum evaluation includes determining the position of the placenta and the relation to the cervical internal os in the sagittal projection. Abnormalities in the placenta structure — hematomas, tumors and other pathological masses should be documented. Pregnant women after uterine procedures or with a low-lying placenta should be referred for a follow-up placenta accreta examination. In cases of doubts, the placenta should be reassessed, or the patient should be referred to a higher reference center to evaluate for PAS (placenta accreta spectrum) — the currently recommended term for placental accreta/increta/percreta.

j) **Examination of the cervix, uterus, uterine appendages** — During the second trimester ultrasound examination it is possible to assess the risk of preterm birth by measuring the length of the cervical canal.

k) In case the so-called "amniotic sludge" is found, this fact should be recorded in the result of the examination. Any abnormal masses within the cervix or adnexa should be documented if they may constitute an obstacle to delivery.

l) **Evaluation of amniotic fluid** — may be performed subjectively or using semi-quantitative indicators (AFI, MVP, DP). Pregnant women with abnormal amounts of amniotic fluid should receive a detailed fetal evaluation at a reference center.

m) **Fetal gender evaluation** — may be performed upon request and after the parents' consent. If there are any changes of the nature of *e.g.* testicular hygroma, ovarian cyst or clitoral hypertrophy, this should be included in the test description.

n) In the 3rd trimester examination during pregnancy, the assessment of blood flow in the umbilical artery, middle cerebral artery or uterine arteries is not routinely performed. However, it may be performed if the examining physician, who is qualified to do so, considers this examination to be clinically justified and is able to interpret the results.

V. FETAL ULTRASOUND EXAMINATION AFTER DELIVERY DATE

After 280 days of pregnancy, the risk of intrauterine fetal death is greater, especially in cases of fetuses with previously undiagnosed growth restriction (SGA) [37]. According to the current recommendations, after delivery date, each patient should have an ultrasound examination, which primary goal is [38]:

1. Evaluation of the fetal position and presentation,
2. Evaluation of fetal heart activity and beats per minute,
3. Biometry and determination of the estimated fetal weight — if the stage of delivery makes it possible and since the last evaluation was more than 7 days ago. Measurement based on the following biometric

Table 3. Ultrasound examination report form in 18–22 and 28–32 weeks of pregnancy

First name, Surname:……..……..... Date of birth:……..……..... PESEL (Personal Identification Number) .....… LMP/gestational age based on LMP…….....…… Date of examintion:…….. Machine…….…….. Transduer…….....…. Referring physician…..... Examining physician…….....…..			FETAL ANATOMY EVALUATION		normal	abnormal	not visualized
			HEAD				
			Shape				
			Cavum septi pellucidi				
			Midline falx				
			Thalami				
			Lateral ventricles, Vp standard up to 10 mm				
			Cerebellum				
			Cisterna magna – standard 2–10 mm				
			FACE				
			Orbits				
			Face profile				
			Nasal bone, NB…(mm)				
FETAL BIOMETRY			Upper lip and lower lip				
Parameter	mm	week	Alveolar process of the jaw				
BPD			NECK, NF standard up to 6 mm				
HC			HEART				
AC			Heart activity	……..ud/min			
FL			Axis				
HL			Size				
TCD			4-chamber view				
Fetal weight (g)			3-vessel-trachea view				
PLACENTA: Position (wall)…….……. Distance from os (mm)……			Left ventricular outflow				
			Right ventricular outflow				
			ABDOMEN				
			Stomach				
AMNIOTIC FLUID (volume) □ normal □ abnormal AFI (cm)…… MVP (cm)……			Bowels				
			Kidneys				
			Urinary bladder				
FETAL MOVEMENTS □ normal □ absent			Abdominal cord insertion				
			Number of cord vessels		□ 2	□ 3	
			SKELETON				
FETAL LIE □ longitudinal □ cephalic □ breech □ transverse □ oblique			LIMBS				
			Left upper limb				
			Right upper limb				
			Left lower limb				
			Right lower limb				
COMMENT:			GENDER (optional)		□ M	□ Ż	
			RECOMMENDATIONS:				
CONCLUSIONS: □ normal and complete exam result □ normal but incomplete exam result							

parameters: BPD — Bi-Parietal Diameter, HC — Head Circumference, AC — Abdominal Circumference, and FL — Femur Length using the Hadlock equations to estimate fetal weight,

4. Assessment of the volume of amniotic fluid (AFI or MVP),
5. Assessment of the position of the placenta and its relation to the internal cervical os,
6. In justified cases — further evaluation including the fetal biophysical profile (BPS, Manning test) and/or umbilical arterial Doppler and middle cerebral artery Doppler with qualitative assessment of the flow spectrum and semi-quantitative assessment, including determination of the PI - Pulsatility Index, with reference to reference values.

It should be emphasized that the ultrasound examination after the expected delivery date carries the highest risk of error. In the case of finding fetal presentation other than cephalic, too low or too high fetal weight, or reduced volume of amniotic fluid, it is necessary to refer the patient to an obstetric-gynecological hospital to plan the delivery.

ULTRASOUND EXAMINATION OF MULTIFETAL PREGNANCY

Multiple pregnancy cannot be considered a physiological pregnancy and is associated with an increased risk of premature delivery, pre-eclampsia, complications related to fetal growth and death. For this reason, obstetric care for this type of pregnancy is usually provided in referral centers.

This type of pregnancy is diagnosed by ultrasound examination performed in the first trimester. During the examination, chorionicity and amnionicity (number of chorions and amnions) are determined. Assessment of chorionicity from the ultrasound examination shall be documented by a sonographic image

If the pregnant woman reports after the 14th week of pregnancy or if chorionicity cannot be determined and both fetuses are of the same sex, it should be treated as a monochorionic twin pregnancy.

The rules of ultrasound examination in a patient with a dichorionic twin pregnancy:

1. The diagnosis of a dichorionic pregnancy by ultrasound in the first trimester of pregnancy is based on the following findings: two separate sacs with embryos and a lambda sign;
2. ultrasound examination in multiple pregnancies should be performed:
   a) in the first trimester of pregnancy (11–13 weeks + + 6 days) — with an assessment of the risk of genetic defects for each fetus separately,
   b) in the second trimester of pregnancy (18–22 weeks) — with evaluation of the anatomy of each fetus and with transvaginal measurement of the cervical length
   c) in the third trimester of pregnancy examination should be performed in weeks 28, 32, 36 — to assess the growth of the fetuses (if a mass discrepancy is greater than or equal to 25% is found, the patient should be referred for care to a third degree perinatal care center),
   d) before delivery — to determine fetal presentation;

The rules of ultrasound examination in a patient with a monochorionic twin pregnancy:

Due to the frequent occurrence of specific complications associated with fetal growth and the risk of fetal intrauterine death, the care of monochorionic twins must be performed at a third-degree level of perinatal care. In addition to ultrasound examinations, fetal echocardiography should always be ordered in this type of pregnancy.

1. care of a patient with monochorionic diamniotic pregnancy:
   a) The diagnosis of a monochorionic diamniotic pregnancy results from an ultrasound examination in the first trimester finding a single gestational sac with two embryos and two amniotic sacs, with the insertion of the amniotic membrane separating the embryos to the chorion having the shape of the letter "T",
   b) ultrasound examination in a monochorionic diamniotic pregnancy should be performed: — in the first trimester of pregnancy (11–13 weeks + 6 days) — with an evaluation of the risk of genetic defects (the same for both fetuses) and fetal biometry,
   c) from week 16 of pregnancy, every 2 weeks for the detection of TTTS or sIUGR, taking into account assessment of: fetal biometry, volume of amniotic fluid in both sacs, symptom of free-floating intertwin membrane, filling of both fetal urinary bladders and vascular flows by Doppler (umbilical arteries, middle cerebral arteries, venous ducts).

In the case of complications, the frequency and scope of ultrasound examinations should be decided individually.

   d) before delivery — to determine the biometrics and presentation of the fetuses;
2. care of a patient with monochorionic-monoamniotic twin pregnancy:
   a) the diagnosis of a monochorionic-monoamniotic pregnancy is based on the finding of a single gestational sac with two closely spaced embryos and no embryo separating membrane in the first trimester of pregnancy; the absence of the separating membrane should be confirmed in subsequent ultrasound examinations; it is also important to exclude the presence of conjoined twins,
   b) ultrasound examinations in a monochorionic-monoamniotic pregnancy shall be performed: — in the

first trimester of pregnancy (11–13 weeks + 6 days), with an assessment of the risk of genetic abnormalities (the same for both fetuses), exclusion of conjoined twins and an assessment of cords insertion,

c) from the 16th week of pregnancy — every 2 weeks with the assessment of fetal growth and vascular flows by Doppler evaluation (umbilical arteries, middle cerebral arteries, venous ducts).

d) in the second trimester of pregnancy (18–22 weeks) — with evaluation of the anatomy of each fetus and transvaginal measurement of the cervical length,

e) in hospital conditions from the 26th week — with an assessment of the fetal hemodynamics: Doppler examination of vascular flows (umbilical arteries, middle cerebral arteries, venous ducts) — should be performed at least twice a week.

CONCLUSIONS

For the safety and the highest quality of services provided, the ultrasound examination should be performed by an individual with appropriate qualifications, confirmed by appropriate documents issued by national and international organizations and subjecting their results to periodic control and audit.

At the time of this update, the documents confirming the above skills and qualifications are:

1. documents confirming the specialization in obstetrics and gynecology,
2. certificates issued by the Ultrasound Section of the Polish Society of Gynecologists and Obstetricians
   - Basic certificate of the Ultrasound Section of the Polish Society of Gynecologists and Obstetricians,
   - Certificate of Prenatal Screening of the Ultrasound Section of the Polish Society of Gynecologists and Obstetricians,
   - Certificate of Fetal Heart Examination of the Ultrasound Section of the Polish Society of Gynecologists and Obstetricians,
3. Certificates issued by international organizations, *i.e.*:
   - FMF certificate of competence in measurement of nuchal translucency (NT),
   - FMF certificates in other ultrasound markers (NB, TR and DV and uterine artery),
   - Diploma in Fetal Medicine — issued by FMF.

Since 2012, the Ultrasound Section of the Polish Society of Gynecologists and Obstetricians has been conducting courses and workshops, as well as theoretical and practical exams in order to select specialists in prenatal diagnosis and fetal echocardiography.

The Ultrasound Section of the Polish Society of Gynecologists and Obstetricians additionally recommends:

1. Conducting the examination in conditions that allow to the sonographer to concentrate (limited of the number of people present at the study, keeping silence in the office).
2. The presence of children in the examination room during examination is not recommended

The rules described above also apply to the performance of ultrasound examinations according to the recommendations of the Polish Society of Gynecologists and Obstetricians in the period between 11–14 weeks of pregnancy, 18–22 weeks of pregnancy, 27–32 weeks of pregnancy, and immediately after week 40 referred to in the Annex to the Regulation of the Minister of Health of 16 August 2018 (item 1756): Organisational Standard of Health Care for Entities Providing Perinatal Care Services [39].

The guidelines are accompanied by a guide containing images showing the normal scans obtained during ultrasound examination.

BIBLIOGRAPHY

1. Pietryga M, Borowski D, Brązert J, et al. Polskie Towarzystwo Ginekologiczne. Polish Gynecological Society--Ultrasound Section Guidelines on ultrasound screening in uncomplicated pregnancy-2015. Ginekol Pol. 2015; 86(7): 551–559, indexed in Pubmed: 26376536.
2. Abramowicz J. Benefits and risks of ultrasound in pregnancy. Semin Perinatol. 2013; 37(5): 295–300, doi: 10.1053/j.semperi.2013.06.004.
3. Stirnemann JJ, Chalouhi GE, Forner S, et al. First-trimester uterine scar assessment by transvaginal ultrasound. Am J Obstet Gynecol. 2011; 205(6): 551.e1–551.e6, doi: 10.1016/j.ajog.2011.06.104, indexed in Pubmed: 21893310.
4. Naji O, Wynants L, Smith A, et al. Predicting successful vaginal birth after Cesarean section using a model based on Cesarean scar features examined by transvaginal sonography. Ultrasound Obstet Gynecol. 2013; 41(6): 672–678, doi: 10.1002/uog.12423, indexed in Pubmed: 23371440.
5. Jachymski T, Moczulska H, Guzowski G, et al. Conservative treatment of abnormally located intrauterine pregnancies (cervical and cesarean scar pregnancies): a multicenter analysis (Polish series). J Matern Fetal Neonatal Med. 2018; 33(6): 993–998, doi: 10.1080/14767058.2018.1514009.
6. Timor-Tritsch IE, Fuchs KM, Monteagudo A, et al. Performing a fetal anatomy scan at the time of first-trimester screening. Obstet Gynecol. 2009; 113(2 Pt 1): 402–407, doi: 10.1097/AOG.0b013e3181954b23, indexed in Pubmed: 19155913.
7. Abu-Rustum RS, Daou L, Abu-Rustum SE. Role of first-trimester sonography in the diagnosis of aneuploidy and structural fetal anomalies. J Ultrasound Med. 2010; 29(10): 1445–1452, doi: 10.7863/jum.2010.29.10.1445, indexed in Pubmed: 20876898.
8. Timor-Tritsch IE, Bashiri A, Monteagudo A, et al. Qualified and trained sonographers in the US can perform early fetal anatomy scans between 11 and 14 weeks. Am J Obstet Gynecol. 2004; 191(4): 1247–1252, doi: 10.1016/j.ajog.2004.03.007, indexed in Pubmed: 15507948.
9. Syngelaki A, Chelemen T, Dagklis T, et al. Challenges in the diagnosis of fetal non-chromosomal abnormalities at 11-13 weeks. Prenat Diagn. 2011; 31(1): 90–102, doi: 10.1002/pd.2642, indexed in Pubmed: 21210483.
10. Syngelaki A, Hammami A, Bower S, et al. Diagnosis of fetal non-chromosomal abnormalities on routine ultrasound examination at 11-13 weeks' gestation. Ultrasound Obstet Gynecol. 2019; 54(4): 468–476, doi: 10.1002/uog.20844, indexed in Pubmed: 31408229.
11. Karim JN, Roberts NW, Salomon LJ, et al. Systematic review of first-trimester ultrasound screening for detection of fetal structural anomalies and factors that affect screening performance. Ultrasound Obstet Gynecol. 2017; 50(4): 429–441, doi: 10.1002/ uog.17246, indexed in Pubmed: 27546497.
12. Rekomendacje Zespołu Ekspertów Polskiego Towarzystwa Ginekologicznego oraz Polskiego Towarzystwa Genetyki Człowieka w zakresie

przesiewowego badania genetycznego wykonywanego na wolnym płodowym DNA. Ginekol Pol. 2015; 86: 966–969.
13. Bardi F, et al. Is there still a role for nuchal translucency measurement in the changing paradigm of first trimester screening? Prenatal Diagnosis. ; 2019: 1–9.
14. Stirnemann JJ, Chalouhi GE, Forner S, et al. First-trimester uterine scar assessment by transvaginal ultrasound. Am J Obstet Gynecol. 2011; 205(6): 551.e1–551.e6, doi: 10.1016/j.ajog.2011.06.104, indexed in Pubmed: 21893310.
15. Naji O, Wynants L, Smith A, et al. Predicting successful vaginal birth after Cesarean section using a model based on Cesarean scar features examined by transvaginal sonography. Ultrasound Obstet Gynecol. 2013; 41(6): 672–678, doi: 10.1002/uog.12423, indexed in Pubmed: 23371440.
16. Stirnemann J, Mousty E, Chalouhi G, et al. Screening for placenta accreta at 11-14 weeks of gestation. Am J Obstet Gynecol. 2011; 205(6): 547.e1–547.e6, doi: 10.1016/j.ajog.2011.07.021.
17. Nicolaides K. Screening for fetal aneuploidies at 11 to 13 weeks. Prenat Diagn. 2011; 31(1): 7–15, doi: 10.1002/pd.2637.
18. Chaoui R, Benoit B, Mitkowska-Wozniak H, et al. Assessment of intracranial translucency (IT) in the detection of spina bifida at the 11-13-week scan. Ultrasound Obstet Gynecol. 2009; 34(3): 249–252, doi: 10.1002/uog.7329, indexed in Pubmed: 19705402.
19. Lachmann R, Chaoui R, Moratalla J, et al. Posterior brain in fetuses with open spina bifida at 11 to 13 weeks. Prenat Diagn. 2011; 31(1): 103–106, doi: 10.1002/pd.2632, indexed in Pubmed: 21188735.
20. Ushakov F, Sacco A, Andreeva E, et al. Crash sign: new first-trimester sonographic marker of spina bifida. Ultrasound Obstet Gynecol. 2019; 54(6): 740–745, doi: 10.1002/uog.20285, indexed in Pubmed: 30977215.
21. Salomon LJ, Alfirevic Z, Bilardo CM, et al. ISUOG practice guidelines: performance of first-trimester fetal ultrasound scan. Ultrasound Obstet Gynecol. 2013; 41(1): 102–113, doi: 10.1002/uog.12342, indexed in Pubmed: 23280739.
22. Kagan KO, Cicero S, Staboulidou I, et al. Fetal nasal bone in screening for trisomies 21, 18 and 13 and Turner syndrome at 11-13 weeks of gestation. Ultrasound Obstet Gynecol. 2009; 33(3): 259–264, doi: 10.1002/uog.6318, indexed in Pubmed: 19248005.
23. Maiz N, Wright D, Ferreira AF, et al. A mixture model of ductus venosus pulsatility index in screening for aneuploidies at 11-13 weeks' gestation. Fetal Diagn Ther. 2012; 31(4): 221–229, doi: 10.1159/000337322, indexed in Pubmed: 22614037.
24. Maiz N, Valencia C, Kagan KO, et al. Ductus venosus Doppler in screening for trisomies 21, 18 and 13 and Turner syndrome at 11-13 weeks of gestation. Ultrasound Obstet Gynecol. 2009; 33(5): 512–517, doi: 10.1002/uog.6330, indexed in Pubmed: 19338027.
25. Kagan KO, Wright D, Valencia C, et al. Screening for trisomies 21, 18 and 13 by maternal age, fetal nuchal translucency, fetal heart rate, free beta-hCG and pregnancy-associated plasma protein-A. Hum Reprod. 2008; 23(9): 1968–1975, doi: 10.1093/humrep/den224, indexed in Pubmed: 18544579.
26. Salomon LJ, Sotiriadis A, Wulff CB, et al. Risk of miscarriage following amniocentesis or chorionic villus sampling: systematic review of literature and updated meta-analysis. Ultrasound Obstet Gynecol. 2019; 54(4): 442–451, doi: 10.1002/uog.20353, indexed in Pubmed: 31124209.
27. Kagan KO, Staboulidou I, Syngelaki A, et al. The 11-13-week scan: diagnosis and outcome of holoprosencephaly, exomphalos and megacystis. Ultrasound Obstet Gynecol. 2010; 36(1): 10–14, doi: 10.1002/uog.7646, indexed in Pubmed: 20564304.
28. Sotiriadis A, Hernandez-Andrade E, Costa Fd, et al. ISUOG Practice Guidelines: role of ultrasound in screening for and follow-up of pre-eclampsia. Ultrasound Obstet Gynecol. 2018; 53(1): 7–22, doi: 10.1002/uog.20105.
29. Poon LC, Shennan A, Hyett JA, et al. The International Federation of Gynecology and Obstetrics (FIGO) initiative on pre-eclampsia: A pragmatic guide for first-trimester screening and prevention. Int J Gynaecol Obstet. 2019; 145 Suppl 1: 1–33, doi: 10.1002/ijgo.12802, indexed in Pubmed: 31111484.
30. Tan MY, Wright D, Syngelaki A, et al. Comparison of diagnostic accuracy of early screening for pre-eclampsia by NICE guidelines and a method combining maternal factors and biomarkers: results of SPREE. Ultrasound Obstet Gynecol. 2018; 51(6): 743–750, doi: 10.1002/uog.19039, indexed in Pubmed: 29536574.
31. Rolnik DL, Wright D, Poon LC, et al. Aspirin versus Placebo in Pregnancies at High Risk for Preterm Preeclampsia. N Engl J Med. 2017; 377(7): 613–622, doi: 10.1056/NEJMoa1704559, indexed in Pubmed: 28657417.
32. Prejbisz A, Dobrowolski P, Kosiński P, et al. Management of hypertension in pregnancy: prevention, diagnosis, treatment and longterm prognosis. Kardiol Pol. 2019; 77(7-8): 757–806, doi: 10.33963/KP.14904, indexed in Pubmed: 31322138.
33. Pietryga M, Brązert J. Podstawy praktycznej ultrasonografii w ginekologii i położnictwie. Exemplum, Poznań 2009.
34. Carvalho JS, Allan LD, Chaoui R, et al. ISUOG Practice Guidelines (updated): sonographic screening examination of the fetal heart.Ultrasound Obstet Gynecol. 2013; 41(3): 348–359, doi: 10.1002/uog.12403, indexed in Pubmed: 23460196.
35. Salomon LJ, Alfirevic Z, Berghella V, et al. Practice guidelines for performance of the routinemid-trimester fetal ultrasound scan. Ultrasound Obstet Gynecol. 2011; 37(1): 116–126, doi: 10.1002/uog.8831.
36. ACR–ACOG–AIUM practice guideline for the performance of obstetrical ultrasound. Brown BS. The prenatal ultrasonographic diagnosis of osteogenesis imperfecta lethalis. J Can Assoc Radiol. 1984, 35, 63–66. http://www. acr.org/guidelines.
37. Divon MY, Haglund B, Nisell H, et al. Fetal and neonatal mortality in the postterm pregnancy: the impact of gestational age and fetal growth restriction. Am J Obstet Gynecol. 1998; 178(4): 726–731, doi: 10.1016/s0002-9378(98)70482-x, indexed in Pubmed: 9579434.
38. Lindqvist PG, Pettersson K, Morén A, et al. Routine ultrasound examination at 41 weeks of gestation and risk of post-term severe adverse fetal outcome: a retrospective evaluation of two units, within the same hospital, with different guidelines. BJOG. 2014; 121(9): 1108–15; discussion 1116, doi: 10.1111/1471-0528.12654, indexed in Pubmed: 24593288.
39. Rozporządzenie Ministra Zdrowia z dnia 16 sierpnia 2018 r.w sprawie standardu organizacyjnego opieki okołoporodowej, Dziennik Ustaw Rzeczypospolitej Polskiej, Warszawa, dnia 11 września 2018 r. Poz. 1756.