ULTRASOUND EXAMINATION DURING PREGNANCY AND PRE-NATAL SCREENING

WHAT IS AN ULTRASOUND EXAMINATION?

Ultrasound examination is a medical procedure. The ultrasonic sensor transmits high frequency ultrasonic waves (3.5-7 MHz). The waves pass through the tissues of the human body at different densities differently and are reflected to the sensor. The signals are converted into an image on the screen, where it is possible to monitor the moving fetus and abdominal organs (uterus, ovaries) in real time.

The image on the screen is black and white and flat, more modern devices can also display a three-dimensional or color image.

HOW AND WHERE DOES THE ULTRASOUND EXAMINATION TAKE PLACE?

An ultrasound examination is referred by the midwife or gynecologist of the pregnant woman. The examination is performed by a specially trained gynecologist. The test is performed vaginally or on the abdomen, depending on the length of the pregnancy. During the examination, the woman is lying on the examination table. The examination room is dark and quiet. In addition to the doctor performing the examination, there is also an assistant in the room. The Women's Clinic of Lääne-Tallinn Central Hospital is the residency practice base of the Faculty of Medicine of the University of Tartu, therefore a resident doctor may be present at the examination.

The gynecologist will explain the findings of the examination during or after the procedure. The pregnant woman can come to the ultrasound examination with a partner, however, we do not recommend taking small children to the examination. The examinations take place in rooms B105 and B106.

The possible error in the length of the pregnancy for all ultrasound examinations is 7-14 days.

Ultrasound examinations are performed on all pregnant women during the first trimester of pregnancy (11th to 14th week of pregnancy) and during the second trimester of pregnancy (19th to 21st week of pregnancy).

WHAT IS SCREENING?

Screening is a relatively simple disease detection test at the population level by regular repeat testing, with the aim to lower the incidence of the disease and/or mortality and improve quality of life.

Our hospital performs the **OSCAR** (**O**ne **S**top **C**linic for **A**ssessment on **R**isk) screening test for the first trimester of pregnancy.

HOW IS THE EXAMINTION CARRIED OUT?

On the 9th-12th week, the pregnant woman will be referred for a blood test, including PAPP-A and free β-HCG, which will be used in the risk assessment of the first trimester screening.

This is followed by an ultrasound examination on the 11th-14th week of pregnancy (first trimester of pregnancy), where:

- the size of the pregnancy is specified;
- the anatomical structures of the fetus, the amount of amniotic fluid, the structure of the placenta and its location are assessed;
- For the purpose of screening for chromosomal diseases, the femoral neck region, called the 'occipital fold', and other markers of chromosomal diseases (nasal bone, venous duct blood flow and cardiac blood flow with Doppler) are assessed.

At the end of the examination, the values of the different markers are combined and used to calculate the likelihood of chromosomal disease during a given pregnancy. The risk assessment is given as a ratio. This is not a diagnostic test, but it assesses the likelihood of fetal chromosomal disease. If the probability is greater than 1: 100, a fetal chromosome test is recommended.

WHAT IS FETAL CHROMOSOME TEST?

Fetal chromosome test requires the production of cellular material of fetal origin using chorionic biopsy or amniocentesis.

HOW ARE CHROMOSOME TESTS CARRIED OUT?

In chorionic biopsy, material is obtained from the developing placenta. Chorionic biopsies are usually performed between 11th and 14th week of pregnancy. Prior to the procedure, an ultrasound examination is performed to determine the duration of pregnancy, the number of fetuses, position and heart rate, the amount of amniotic fluid, and the location of the placenta. Prior to the procedure, the woman's abdomen is cleaned, the ultrasound sensor is covered with a sterile cover, and sterile gloves and accessories are used. The procedure is performed under ultrasound control, using a local anesthetic (Lidocaine) for pain relief.

After the procedure, there may be an increase in uterine muscle tone and blood flow from the vagina. In most cases, these symptoms go away on their own within a few days.

In amniocentesis, or amniotic fluid, the material is obtained from the amniotic fluid surrounding the fetus. A suitable time for amniocentesis is the 15th-19th week of pregnancy. An ultrasound is also performed prior to the procedure to determine the duration of pregnancy, number of fetuses, position and heart rate, amniotic fluid volume, and the location of the placenta. Before the procedure, the woman's abdomen is cleaned, sterile accessories are used for the procedure. Under ultrasound examination, 15 to 20 ml of amniotic fluid is drawn through the anterior abdominal wall into a syringe with a needle and sent for examination. Puncture is not more painful than taking venous blood, so painkillers are not usually used.

After the procedure, there may be pain in the lower abdomen reminiscent of menstrual pain; however, it usually disappears on its own.

Cells derived from the chorion and the amniotic fluid are replicated in a special nutrient solution, and in 1-2 weeks, if there are enough of these cells, it is possible to prepare chromosome preparations and examine them under a microscope. It takes another week to stain and analyze the preparations. The final answer will be ready in 2-3 weeks.

FETAL CELL-FREE DNA ANALYSIS FROM MOTHER'S BLOOD OR NIPT (NON-INVASIVE PRENATAL TESTING OR NON-INVASIVE PRE-NATAL TEST)

During pregnancy, fetal cells and DNA fragments enter the mother's bloodstream. DNA carries fetal genetic information. Non-invasive prenatal testing is a study that analyzes fetal cells or fragments of fetal cell-free DNA in the mother's blood. Fetal cell-free DNA is used to assess whether or not the fetus has the chromosomal disease sought. This test can also be used to identify the sex of the fetus.

The detection rate for NIPT in trisomy 21 or Down's syndrome is > 99%, and in trisomy 18 or Edwards' syndrome it is 98%.

Although the NIPT is relatively accurate, it is not a diagnostic test. In the case of a positive test (analysis has shown a high risk of chromosomal disease or syndrome), a chorionic biopsy or amniotic fluid test is required to confirm the diagnosis.

Today, there are several companies providing chromosome tests in the world that use different trade names (eg Panorama, Harmony, MaterniT21 Plus, Verifi).

The Verifi® test is used as a non-invasive prenatal test at the Pelgulinna Maternity Hospital in collaboration with Verinata Health, Inc.

The test can be performed as early as from the 9th-10th weeks of pregnancy. The test is chargeable.

PREECLAMPSIA SCREENING

Preeclampsia is an increase in blood pressure during pregnancy and the production of a protein in a urine sample.
The following are more at risk from developing preeclampsia:

- first-time mothers;
- pregnant women over the age of 40;
- pregnant women with a time gap between pregnancies being 10 years or more;
- pregnant women whose close relatives (mother, sister) have had preeclampsia;
- pregnant women who have had preeclampsia during a previous pregnancy;
- overweight pregnant women (BMI over 30 kg/m^2 at the first appointment);
- women with multiple pregnancies;
- pregnant women with a history of disease (hypertension, diabetes, chronic kidney disease).

A combined test for early prognosis of preeclampsia can be used in the first trimester of pregnancy, on the 11th to 13th week. The risk assessment can be performed in conjunction with a first trimester serum and ultrasound examination. The parameters to be assessed are: woman's age, height, weight, race, smoking, mean arterial blood pressure, serum placental growth factor (PLGF) and ultrasound-measured blood flow pulsatility index in uterine arteries.

The risk assessment predicts 90% of cases of early preeclampsia (before 34 weeks of gestation). In case of increased risk (<1:100), daily use of acetylsalicylic acid (aspirin) 150 mg is recommended until the 36th week of pregnancy. Prophylactic treatment started before the 16th week of pregnancy reduces the likelihood of early (before the 34th week of pregnancy) preeclampsia by 60%.