BENEFITS OF ULTRASOUND EXAMINATION

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Annotation. Improvement of research methods largely determines modern advances in clinical diagnostics. A significant leap in this regard was made thanks to the development and implementation of new methods of obtaining medical images, including the ultrasound method. Thanks to the high information content and reliability of the ultrasound method, the diagnosis of many diseases and injuries has risen to a qualitatively new level. Currently, along with computed tomography and other more modern methods, ultrasound diagnostics is used everywhere, being one of the leading diagnostic methods in many areas of clinical medicine. In this regard, there is a growing need for specialists who are fluent in the methods and techniques of ultrasound examination.

Keywords: ultrasound, 3D and 4D images, Doppler effect, duplex scanning of veins

ПРЕИМУЩЕСТВА УЛЬТРАЗВУКОВОГО ИССЛЕДОВАНИЯ

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Аннотация. Совершенствование методов исследования предопределяет современные успехи клинической диагностики во многом. Значительный скачёк

в этом плане был сделан благодаря разработке и внедрению в практику новых способов получения медицинского изображения, в том числе ультразвукового метода. Благодаря высокой информативности и достоверности ультразвукового метода диагностика многих заболеваний и повреждений поднялась на качественно новый уровень. В настоящее время, наряду с компьютерной томографией и другими более современными методами, ультразвуковая диагностика используется повсеместно, являясь одним из ведущих диагностических методов во многих разделах клинической медицины. В связи с этим назревает потребность в специалистах, в совершенстве владеющих методикой и техникой ультразвукового исследования.

Ключевые слова: ультразвуковое исследование, 3D и 4D изображения, эффект Допплера, дуплексное сканирование вен

Introduction. Ultrasound is a common diagnostic method; it does not expose the patient to radiation and is considered harmless. However, ultrasound has a number of limitations. The method is not standardized, and the quality of the study depends on the equipment used for the study and the qualifications of the doctor [2, 8, 11]. Additional limitations for ultrasound are the excess weight of the subject and flatulence, which interfere with the conduction of ultrasonic waves [1, 5]. The ultrasound diagnostic apparatus itself is a device designed to obtain information about the location, shape and structure of organs and tissues and to measure the linear dimensions of biological objects using the ultrasonic location method [1, 17].

Depending on their functional purpose, devices are divided into the following main types: echotomoscopes (devices designed primarily for examining the fetus, abdominal and pelvic organs); echocardioscopes (devices designed to study the heart); echoenceloscopes (devices designed to study the brain); echoophthalmoscopes (devices designed to examine the eye) [3, 18].

Ultrasound is a standard diagnostic method used for screening. In such situations, when the patient does not yet have a disease or complaints, ultrasound should be used for early preclinical diagnosis. If there is already known pathology, it is better to choose CT or MRI as methods of clarifying diagnosis.

The areas of application of ultrasound in medicine are extremely wide. For diagnostic purposes, it is used to identify diseases of the abdominal and kidney organs, pelvic organs, thyroid gland, mammary glands, heart, blood vessels, in obstetric and pediatric practice. Ultrasound is also used as a method for diagnosing emergency conditions requiring surgical intervention, such as acute cholecystitis, acute pancreatitis, vascular thrombosis, etc.

Building on Siemens' extensive experience in diagnostic technology, the new Acuson Class S ultrasound systems are designed to bring ultrasound to a new level of

diagnostic value [1, 9]. An ultrasound diagnostic system of a new expert class is being introduced, which features unique imaging technologies. These ultrasound systems represent a new era in ultrasound technology, offering superior 2D, color, power, spectral Doppler, M-mode, 3D and 4D imaging, the latest technology and superior communication capabilities, all packaged into an aesthetically pleasing and ergonomic platform.

The technology is intended for studying formations of the mammary glands, lymph nodes, and thyroid gland with the aim of early obtaining data on malignancy of pathological structures and forming objective feasibility for performing fine-needle aspiration biopsy.

Currently, 3D and 4D ultrasound methods have become widely used, which differs from 3D in that time is added as a fourth dimension to the length, height and depth of the image. If the three-dimensional image is static, then the four-dimensional image shows the object in motion in real time, allowing recording on various media. With a 4D ultrasound, the picture is completely different: firstly, the image is three-dimensional and colorful, and secondly, the baby's appearance is visible in all details. Volumetric images make it possible to better examine some structures that are difficult to examine in a conventional two-dimensional mode, making it easier for both future parents and doctors of other specialties to understand the image.

Thanks to 3D ultrasound, doctors can evaluate various parts of the fetal body in three projections simultaneously, which is very important for identifying abnormalities in the intrauterine development of the fetus. Three-dimensional examination data provides additional information for diagnosing developmental defects: limbs, face, spinal column.

On a 4D ultrasound, the sex of the child is more clearly visible. Using 4D imaging during pregnancy, you can see the baby's facial expressions. This allows you to find out the emotions that he experiences - smiling, upset, apathetic. This way it is easy to understand how he feels. Bad emotions can arise from more serious problems.

Modern ultrasound machines operate as an automated organ scanner, which increases the reliability of diagnosing various tumors. The breast volume scanner expands the possibilities for diagnosing breast cancer. Such systems are designed to obtain 3D ultrasound images of the breast. Automated breast volume scanning provides a three-dimensional image of the breast, which allows you to examine the breast not only from the front and back, but also from top to bottom and from any side. This is a very reliable screening method for diagnosing breast cancer [2, 10, 15].

Doppler ultrasound allows you to examine blood flow in the main arteries and veins. Ultrasound Dopplerography of the main arteries of the head, or ultrasound Dopplerography of the brachiocephalic arteries, is a hardware method that allows you

to examine the state of blood flow in the vessels and assess existing disturbances in the patency of the vessels of the head.

The method of duplex scanning of the main arteries of the head, or duplex scanning of the brachiocephalic arteries, combines the study of blood flow using the Doppler effect with simultaneous visualization of the vessels and surrounding tissues. In this case, as a result of computer processing of the received signals, both the Doppler spectrum and the color flow cartogram can be displayed on the monitor. Triplex scanning of brain vessels has even greater visualization. All of the listed methods for studying cerebral blood flow are completely painless and have no contraindications [3, 4, 16].

Duplex scanning and Doppler ultrasound of the vessels of the neck and brain are performed in patients suffering from headaches, dizziness, coordination problems, episodes of short-term loss of consciousness and other neurological symptoms, as well as in patients who have suffered transient ischemic attacks or strokes. Duplex scanning of neck vessels is a screening tool for the early diagnosis of atherosclerosis and is indicated for all middle-aged people [2, 7]. Duplex scanning of the vessels of the neck and renal arteries is indicated for people with high blood pressure. Duplex scanning of the arteries of the lower extremities should be performed for people with complaints of pain in the leg muscles when walking, numbness in the legs, and trophic disorders on the skin of the legs. The study allows us to identify the location and nature of damage to the blood vessels of the legs and, as a result, select the correct treatment [2, 14]. Duplex scanning of the veins of the lower extremities should be performed in patients with a pronounced venous network in the legs and swelling of the legs. When examining the veins of the lower extremities, varicose veins and thrombosis of the deep and superficial veins of the lower extremities can be diagnosed [3, 13].

It should be noted that the principles of ultrasound are used in echocardiography. The technique combines ultrasound imaging to study the structure and function of the heart in detail with the simultaneous use of color Doppler mapping to study blood flow in the vessels.

Ultrasound of the vessels of the upper and lower extremities is one of the safest and most effective methods for studying the condition of blood vessels. Modern equipment allows you to examine the vessel under the control of a monitor screen in real time. In this case, the lumen of the vessel is recorded, blood flow parameters are measured and valvular insufficiency of the veins is determined. If a blood clot is present, ultrasound diagnostics allows one to determine its size and monitor its changes during treatment [1, 6, 12].

It should be noted that recently vascular diseases occupy one of the leading places among all diseases characteristic of middle-aged and older people. This is

facilitated by unfavorable environmental factors, a sedentary lifestyle combined with poor nutrition and, of course, smoking.

Ultrasound scanning of blood vessels is recommended in cases where work involves constant standing, if the patient feels heaviness in the arms and legs, numbness, cramps, pain in the limbs, if spider veins appear on the skin or dilated saphenous veins. The described method is completely painless and allows you to identify vascular diseases at the earliest stages and monitor the effectiveness of the treatment used.

Conclusions. Thus, ultrasound has a high diagnostic capability and prognostic value among modern new technologies in the diagnosis of various pathologies. Carrying out ultrasound using high-resolution technologies in the clinic makes it possible to differentiate the severity of the pathological process, determine its dynamics and reliably monitor the effectiveness of treatment.

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