



Ultrasound Examination as an Important Part of Clinical Diagnostics

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Abstract: Ultrasonography has advantages over other imaging modalities in terms of availability and comfort, safety, and diagnostic potential. Recent advances of clinical diagnosis are largely determined by the improvement of research methods. Significant leap in this regard was made by the development and introduction of fundamentally new ways of medical imaging, including ultrasound method. Extremely valuable is the ability of ultrasound to visualize the internal structure of the solid organ that was not available in the traditional X-ray. Due to the high information content and reliability of the ultrasonic method of diagnosis of many diseases and injuries has risen to a new level. The author has carried out an analysis of numerous literary sources and concluded that ultrasound has a high diagnostic capability and prognostic value of advanced new technologies in the diagnosis of various pathologies. Ultrasonography using a high-resolution technology in the clinic allows us to differentiate the severity of the pathological process, determine its dynamics and reliably monitor the effectiveness of treatment.

Keywords: ultrasound, clinical diagnostics, ultrasound, imaging.

Introduction. Modern advances in clinical diagnostics are largely determined by the improvement of research methods. A significant leap in this issue was made thanks to the development and implementation of fundamentally new methods of obtaining medical images, including the ultrasound method. Extremely valuable is the ability of echography to visualize the internal structure of parenchymal organs, which was not available with traditional x-ray examination [1]. 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 [17]. In recent years, due to the very wide distribution of ultrasound equipment, it has become available to any, even very small medical institutions [13]. In this regard, there is a growing need for specialists who are fluent in the methods and techniques of ultrasound examination (US). With its outstanding diagnostic benefits, notably high resolution and capability of real time assessment, orthopedic ultrasound is often referred to as the “orthopedic surgeon’s stethoscope”. Its high resolution enables detection of tendon tears, tiny calcifications, and foreign bodies. Calcification in soft tissue and destructive and reparative hypertrophic changes on bone surfaces are more readily apparent, and at an earlier stage, than with plain X-rays, CT or MRI. Ultrasonography thus enhances early detection of pathologies. Ultrasound is a widely used 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 on which the study is carried out and the qualifications of the doctor [2,3,4]. Additional restrictions for ultrasound - excess weight of the

subject and/or flatulence - interfere with the conduction of ultrasonic waves. An ultrasound diagnostic apparatus (ultrasound scanner) 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 [8,12]. Depending on the functional purpose, devices are divided into the following main types: ETS - echotomosopes (devices designed primarily for examining the fetus, abdominal and pelvic organs); ECS-echocardiscopes (devices designed to study the heart); EES-echoenceloscopes (devices designed to study the brain); EOS-echo-ophthalmoscopes (devices designed to examine the eye) [18,19,20]. Ultrasound is a standard diagnostic method used for screening. In such situations, when the patient does not yet have diseases 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. The new Acuson class S ultrasound systems, created on the basis of Siemens' extensive experience in the field of diagnostic technologies, are designed to bring ultrasound research to a new level of diagnostic significance [11,13,15,16]. 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. 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. For example, an apathetic depressed state can cause asphyxia - insufficient oxygen supply, which entails a number of 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 [5,6,7,9,10]. Ultrasound examination with the Doppler effect allows you to explore the bloodstream in the main arteries and veins. Ultrasonic Doppler Main Arteries Head (WSDG Mag), or Ultrasonic Doppler Brachiocephalous Arteries (UDG BCA) - this is a hardware method that allows you to explore the condition of blood flow in vessels and evaluate the impaired impact of the head vessels. For greater informative of the WSDG, the magician is carried out in combination with the study of intracranial vessels - transcranial doppler (TCD). The combination of UDG Mag and TCD is the most optimal screening method for the diagnosis of cerebrovascular diseases (brain strokes), which is the priority direction of the Republic of Kazakhstan [16]. The duplex scanning method of the main arteries of the head (DS Mag), or duplex scanning of brachiocephallastic arteries (DS BCA), combines the study of blood flow using

the Doppler effect with Simultaneous visualization of vessels and surrounding tissues. At the same time, as a result of computer processing of the received signals, the monitor can be displayed both the Doppler spectrum and the flow card of the flow. A triplex scan of the brain vessels has even greater visualization. All listed methods of studying cerebral blood flow are completely painless and have no contraindications. Duplex scanning and Doppler ultrasound of the vessels of the neck and brain are performed in patients suffering from headaches, dizziness, poor coordination, episodes of short-term loss of consciousness. Literature Reviews *Medicine and Ecology* 13, 2013, 1 Clinical medicine knowledge and other neurological symptoms (numbness and weakness in the arms and legs, speech disorders), 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. 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. 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. It should be noted that the principles of ultrasound are used in echocardiography (EchoCG). 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 [14]. 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. 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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