



Ultrasonography and its Role in Clinical Diagnosis

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Received 18th Jan 2022,
Accepted 9th Feb 2022,
Online 3rd Mar 2022

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Abstract: Modern advances in clinical diagnostics are largely determined by the improvement of research methods. A significant leap forward in this matter was made thanks to the development and implementation of fundamentally new methods of obtaining medical images, including the ultrasound method. The ability of echography to visualize the internal structure of parenchymal organs is extremely valuable, which was not available with traditional X-ray examination. 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 branches of clinical medicine. In recent years, due to the very widespread use of ultrasound equipment, it has become available for any, even very small medical institutions. In this regard, there is a growing need for specialists who are fluent in the methodology and technique of ultrasound examination (ultrasound).

Keywords: sonography, ultrasound diagnostics, echography, 3D, 4D.

Ultrasound is a widespread diagnostic method; it does not expose the patient to radiation exposure 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. Additional restrictions for ultrasound - excessive weight of the subject and / or flatulence - interfere with the conduct of ultrasound 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 by the method of ultrasonic location.

Depending on the functional purpose, the devices are divided into the following main types: ETS - echotomoscopes (devices intended mainly for examining the fetus, abdominal organs and small pelvis); EKS - echocardioscopes (devices for examining the heart); EES - echoenceloscopes (devices for examining the brain); EOS - echo-ophthalmoscopes (devices for examining the eye).

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

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

The new Acuson S-class ultrasound systems, built on Siemens' rich expertise in diagnostic technology, are designed to take ultrasound imaging to a new level of diagnostic value. An ultrasound diagnostic system of a new expert class is introduced into use, in which unique imaging technologies are presented. These ultrasound systems represent a new milestone in ultrasound technology, offering superior 2D, color, power, spectral Doppler, M-mode, 3D and 4D imaging, the latest technology and superior communication capabilities, combined in an aesthetic and ergonomic platform.

The technology is intended for the study of the formations of the mammary glands, lymph nodes, thyroid gland in order to obtain early data on the malignancy of pathological structures and the formation of an objective feasibility for conducting fine-needle aspiration biopsy (TAB).

Ultrasound during pregnancy is a planned event that is included in the mandatory program for the management of pregnancy. Fetal ultrasound is a kind of acquaintance with the baby. An ultrasound scan is performed 2-3 times throughout pregnancy: at 10-14, 16-21 and 32-37 weeks.

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

Thanks to 3D ultrasound, doctors can assess different parts of the fetus in three projections at the same time, which is very important for identifying fetal anomalies. Three-dimensional research data provide additional information for the diagnosis of malformations: limbs, face, spinal column.

On 4D ultrasound, the sex of the child is more clearly visible. With a 4D image during pregnancy, you can see the facial expressions of the baby. This allows you to find out the emotions that he is experiencing - smiling, upset, apathetic. Thus, it is easy to understand how he is feeling. Bad emotions can arise from more serious problems. For example, lethargy and depression can be the cause of asphyxia - insufficient oxygen supply, which entails a number of problems.

Modern ultrasound machines operate in the mode of an automated organ scanner, which increases the reliability of the diagnosis of various tumors. The breast volume scanner expands the diagnostic capabilities of breast cancer. Such systems are designed to obtain a 3D ultrasound image of the breast. Automated scanning of the breast volume 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. It is a very reliable screening method for diagnosing breast cancer.

Doppler ultrasound examines blood flow in major arteries and veins. Doppler ultrasound of the great arteries of the head (USG MAG), or ultrasound dopplerography of the brachiocephalic arteries (USG

BCA) is a hardware method that allows you to study the state of blood flow in the vessels and assess the existing violations of the patency of the vessels of the head. For greater informational content, USG MAG is performed in combination with the study of intracranial vessels - transcranial dopplerography (TCD). The combination of USG MAG and TKD is the most optimal screening method for diagnosing cerebrovascular diseases (cerebral strokes), which is a priority area of the Ministry of Health of the Republic of Kazakhstan. The method of duplex scanning of the main arteries of the head (DS MAG), or duplex scanning of the brachiocephalic arteries (DS BCA), combines the study of blood flow using the Doppler effect with simultaneous visualization of blood vessels and surrounding tissues. In this case, as a result of computer processing of the received signals, both the Doppler spectrum and the color cartogram of the flow can be displayed on the monitor. Triplex scanning of cerebral vessels has even greater visualization. All of the above methods for studying cerebral blood flow are completely painless and have no contraindications.

Duplex scanning and ultrasound Doppler sonography of the vessels of the neck and brain are performed in patients suffering from headaches, dizziness, impaired coordination, episodes of short-term loss of consciousness and other neurological symptoms (numbness and weakness in the arms and legs, speech disorders), as well as in patients who have undergone transient ischemic attacks or strokes. Duplex scanning of neck vessels is a screening 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 is necessary for people with complaints of pain in the muscles of the legs when walking, numbness in the legs, trophic disorders on the skin of the legs. The study allows you to identify the localization and nature of the lesion of the vessels of the legs and, as a result, to choose the right treatment. Duplex scanning of the veins of the lower extremities should be performed in patients with pronounced venous network in the legs and leg edema. When examining the veins of the lower extremities, it is possible to diagnose varicose veins, thrombosis of deep and superficial veins of the lower extremities.

It should be noted that the principles of ultrasound are used in echocardiography (EchoCG). The technique combines ultrasound imaging for a detailed study of the structure and functioning of the heart 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 examining the state of the vessels. Modern equipment makes it possible to examine the vessel under the control of a monitor screen in real time. In this case, the lumen of the vessel is recorded, the parameters of the blood flow are measured, and the valvular insufficiency of the veins is determined. In the presence of a thrombus, ultrasound diagnostics allows you to establish its size and monitor its changes during treatment.

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 factors in the environment, sedentary lifestyle combined with poor diet and, of course, smoking.

Ultrasound scanning of blood vessels is recommended in cases where the work is associated with constant stay on the legs, if the patient feels heaviness in the arms and legs, numbness, cramps, pain in the extremities, if spider veins appear on the skin or saphenous veins are dilated. The described method is completely painless and allows detecting vascular diseases at the earliest stages and monitoring the effectiveness of the treatment used.

Thus, ultrasound examination has a high diagnostic capability and prognostic value among modern new technologies in the diagnosis of various

pathologies. Ultrasound examination using high-resolution technologies in the clinic allows differentiating the severity of the pathological process, determining its dynamics and reliably monitoring the effectiveness of treatment.

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