COMPONENTS OF THE ULTRASOUND DIAGNOSTIC SYSTEM

JIYANBAYEV OTABEK ESHDAVLATOVICH

Head of the Department of engineering and technical personnel for medical techniques and innovative technologies

Annotation. *Three types of ultrasound scanning are used: linear (parallel), convexic and sectorial. Accordingly, sensors or transducers of ultrasonic devices are called linear, convex and sector. The selection of the sensor for each study is carried out taking into account the depth and nature of the position of the organ.*

Ultrasonic Wave Generator

The ultrasonic wave generator is a sensor that simultaneously plays the role of a receiver of reflected echo signals. The generator operates in pulse mode, sending about 1000 pulses per second. In the intervals between the generation of ultrasonic waves, the piezo sensor captures the reflected signals.

Ultrasonic sensor

A complex sensor consisting of several hundred small piezocrystalline transducers operating in the same mode is used as a detector or transducer. A focusing lens is mounted in the sensor, which makes it possible to create a focus at a certain depth[1].

Types of sensors

All ultrasonic sensors are divided into mechanical and electronic. In mechanical systems, scanning is carried out due to the movement of the emitter (it either rotates or swings). In electronic systems, the scan is performed electronically. The disadvantages of mechanical sensors are noise, vibration produced when the emitter moves, as well as low resolution. Mechanical sensors are obsolete and are not used in modern scanners.

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account the depth and nature of the position of the organ.

Linear sensors

Linear sensors use a frequency of 5-15 Mhz. The advantage of the linear sensor is the complete correspondence of the organ under study to the position of the transducer itself on the surface of the body. The disadvantage of linear sensors is the difficulty of ensuring in all cases a uniform fit of the surface of the transducer to the patient's skin, which leads to distortions of the resulting image along the edges. Also, linear sensors, due to their higher frequency, make it possible to obtain an image of the studied area with high resolution, but the scanning depth is quite small (no more than 11 cm). They are used mainly for the study of superficially located structures — the thyroid gland, mammary glands, small joints and muscles, as well as for the study of blood vessels.

Convexic sensors

The convexic sensor uses a frequency of 1.8-7.5 MHz. It has a shorter length, so it is easier to achieve uniformity of its fit to the patient's skin. However, when using convex sensors, the resulting image is several centimeters wider than the size of the sensor itself. To clarify the anatomical guidelines, the doctor must take this discrepancy into account. Due to the lower frequency, the scanning depth reaches 20-25 cm. It is usually used to examine deeply located organs — the organs of the abdominal cavity and retroperitoneal space, the genitourinary system, hip joints.

Sector sensors (Phased array)

The sector sensor operates at a frequency of 1.5-5 Mhz. It has an even greater discrepancy between the size of the transducer and the resulting image, therefore it is used mainly in cases where it is necessary to get a large view at depth from a small area of the body. It is most advisable to use sector scanning in the study, for example, through intercostal spaces. A typical application of a sector sensor is echocardiography, a study of the heart.

Gel for ultrasonic emission

At the time of the ultrasound examination, full contact of the device sensors with the patient's body at the micro level must be ensured. Special gels are used for these purposes. The usual composition of the gel: glycerin, sodium tetraborate, styrene

copolymer with maleic anhydride, purified water[1-2].

Methods of ultrasound examination

The reflected echo signals are fed into an amplifier and special reconstruction systems, after which they appear on the screen of a television monitor in the form of images of body sections having various shades of black and white. It is optimal to have at least 64 color gradients of the black-and-white scale. With positive registration, the maximum intensity of the echo signals appears on the screen in white (echopositive areas), and the minimum — in black (echonegative areas). With negative registration, the opposite situation is observed Figure 1.. The choice of positive or negative registration does not matter. The image obtained during the study may be different depending on the operating modes of the scanner.

The following modes are distinguished:

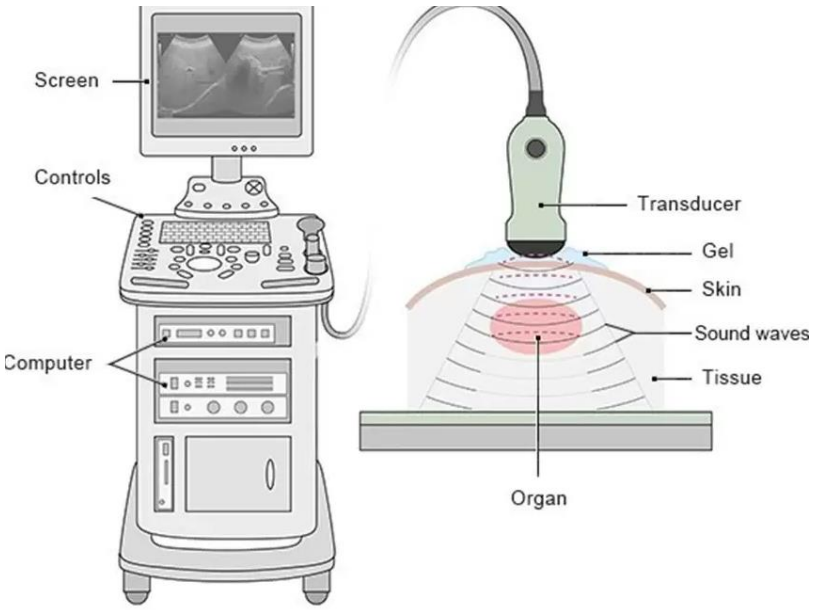

Figure 1.basics of using ultra sound device

A-mode. The technique provides information in the form of a one-dimensional image, where the first coordinate is the amplitude of the reflected signal from the boundary of media with different acoustic resistance, and the second is the distance to this boundary. Knowing the speed of propagation of the ultrasonic wave in the tissues of the human body, it is possible to determine the distance to this zone by dividing in half (since the ultrasonic beam passes this path twice) the product of the pulse return time by

the ultrasound speed.

B-mode. The technique provides information in the form of two-dimensional seroscale tomographic images of anatomical structures in real time, which allows us to assess their morphological state.

M-mode. The technique provides information in the form of a one-dimensional image, the second coordinate is replaced by a temporary one. The vertical axis shows the distance from the sensor to the located structure, and the horizontal axis shows the time Figure 1.. The mode is used mainly for heart examination. Provides information about the shape of curves reflecting the amplitude and speed of movement of cardiac structures[2].

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