ULTRASOUND AND ITS APPLICATION IN MEDICINE

Akhrorov Ma'ruf Nasimjonovich
Samarkand State Medical University, assistant.
Oktamov Ramziddin Sherzodovich
Samarkand State Medical University, student.
akhrorov81@gmail.com

ANNOTATION: *The above examples of the use of ultrasound in medicine and biology do not include all the research in this field, because the field of application of ultrasound is diverse and has great prospects for its expansion. Also, the introduction of ultrasound holography into medicine and its use gives hope for the emergence of new diagnostic methods. The ultrasonic location method uses continuous and pulsed radiation. In the first case, standing waves formed by the interference of the returning and falling waves from the boundary of two environments are observed. In the second case, the returned pulse is observed, and the time of the ultrasound to and from the examined object is measured. Knowing the speed of ultrasound propagation, it is determined at what depth the object is located.*

Key words: *ultrasound, frequency, environment, absorption, scattering, vibration, heating, tissue, internal organ, examination, effect.*

INTRODUCTION. Vibrations and waves with a frequency of more than 20 kHz are called ultrasound (UT). The upper limit of ultrasound frequencies can be considered to be approximately 10 9-1010 Gs. Since this limit is defined by the distance between molecules, it depends on the aggregate state of the substance through which the ultrasound is propagating.

REVIEW OF LITERATURE AND METHODOLOGY. In the generation of ultrasound, devices called irradiators are used. Electromechanical irradiators based on the inverse piezoelectric effect are very common. The reverse piezoelectric effect is the mechanical deformation of objects under the influence of an electric field. The main part of such an irradiator is a plate made of materials with good piezoelectric properties (quartz, segnet salt, ceramic materials based on barium titanate). Electrodes in the form of a conductive layer are placed on the surface of the plate. If the electrodes are supplied with an alternating electric voltage from the generator, the plate vibrates due to the inverse piezo effect and emits mechanical vibrations with a frequency corresponding to the frequency of the electric field.

RESULTS. The greatest radiation effect of mechanical waves occurs only if the condition of resonance formation is fulfilled. For example, the resonance frequency for a 1 mm thick quartz plate is 2.87 MHz, for segnet salt is 1.5 MHz, and for barium titanate is 2.75 MHz. It is possible to make an ultrasound receiver on the basis of piezoelectric effect (correct piezoelectric effect). In this case, crystal deformation occurs under the influence of a mechanical wave (ultrasound waves), which generates a variable electric field due to the piezo effect; the corresponding alternating voltage can be measured.

The use of ultrasound in medicine is related to its unique properties in its distribution and character. According to its physical nature, ultrasound is a mechanical (elastic) wave like sound. However, the wavelength of ultrasound is much smaller than the wavelength of sound. For example, the wavelength in water is 1.4 m (1 kHz sound), 1.4 mm (Mgs Ut) and 1.4 μm (1GHz Ut). Diffraction of waves depends on the ratio of wavelengths and the size of the object from which the wave is diffracted. "An opaque 1m object cannot be a barrier for a 1.4m sound wave, but it can be an obstacle for an ultrasound with a wavelength of 1.4mm, but the object an "ultrasound shadow" is formed behind it. Therefore, in some cases, this allows us to consider these waves as light, as in explaining the incident and return phenomenon of ultrasound, without taking into account the phenomenon of diffraction of ultrasound (as in explaining the incident and return of light).

The return of ultrasound from the boundary of two media depends on the ratio of wave resistances of these media. For example, ultrasound is very well reflected in the periosteum of the muscle, from the border of the bone, from the surfaces of internal organs, etc. Therefore, it is possible to determine the size and dimensions of non-homogeneous bodies (glands), cavities, internal organs, etc. (ultrasound location method). Knowing the speed of ultrasound propagation, it is determined at what depth the object is located.

The wave resistance of biological media is 3000 times greater than that of air. Therefore, if UT-radiators are placed on the human body, the ultrasound will return from the thin air column formed between the irradiator and the human body without going inside the body. To prevent the formation of an air layer, a thin layer of oil is applied to the surface of the radiator.

The speed of propagation of ultrasound waves and their absorption depends on the state of the medium; based on this, ultrasound is used to study the molecular properties of substances. This type of research belongs to the background of molecular acoustics. The intensity of the waves is directly proportional to the square of the circular frequency, based on this, it is possible to create waves with large intensities from relatively small amplitude waves. Acceleration of particles under the influence of ultrasound waves can be very large, which indicates the emergence of large impact forces, and when biological objects are irradiated with ultrasound, such forces are also applied to particles.

DISCUSSION. The main effects of physical processes occurring in biological objects in connection with the influence of ultrasound are as follows:

— microvibrations at the cellular and subcellular level;

- breakdown of biomacromolecules;

—injuring biological membranes and changing their locations, changing membrane permeability;

— heat effect;

- destruction of cells and microorganisms.

Medical-biological applications of ultrasound can be divided into two main directions: monitoring and diagnostic methods, and the second is exposure methods.

Using the Doppler effect of ultrasound, the nature of the movement of the heart valves is studied and the blood flow rate is measured. For diagnostic purposes, the densities of overgrown and injured bones are calculated based on the speed of ultrasound. The second direction includes ultrasound physiotherapy. Exposure to the patient with ultrasound is performed using a special radiation head of the device. Ultrasounds with a frequency of 800 KGs and an average intensity of 1 W/cm2 are often used for therapeutic purposes.

CONCLUSION. The primary mechanism of action of ultrasound therapy is its mechanical and thermal effect on tissue. In operations, ultrasound is used as an "ultrasound scalpel" capable of cutting both soft and bony tissues. The ability of ultrasound to break up objects in liquids and form emulsions is used in the pharmaceutical industry for drug preparation. It is used in the treatment of diseases such as upper respiratory tract disease, bronchial asthma, etc. Currently, a new method of grafting damaged or transplantable bone tissue (ultrasound osteosynthesis) has been created is used. The use of ultrasound for the blind is interesting. With the help of the ultrasonic location created by the small device "Orientir", it is possible to find objects up to 10 m away and determine their nature. The above examples of the use of ultrasound in medicine and biology do not include all the research in this field, because the field of application of ultrasound is diverse and has great prospects for its expansion. Also, the introduction of ultrasound holography into medicine and its use gives hope for the emergence of new diagnostic methods.

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