



USE OF PHYSICAL FACTORS IN MEDICINE

Urmanova Gulbaxor Urunbayevna

Associate Professor, Tashkent Pediatric Medical Institute

g.urunbayevna@gmail.com

Abstract. *The development of science and technology, industry and scientific research cannot be imagined without physical factors. Physical factors are widely used, especially in many areas of medicine. This is especially noticeable in diagnostics, treatment, surgical intervention and laboratory studies of various diseases. The movement of blood through the vessels in a living organism is also assessed by physical factors. This article explains the movement of blood through the vessels using some physical factors.*

Keywords: *Doppler, effect, vessel, blood, flow, ultrasound, function, electric current, magnet, frequency, movement.*

Аннотация. *Развитие науки и техники, промышленности и научных исследований невозможно представить без физических факторов. Физические факторы широко используются, особенно во многих областях медицины. Это особенно заметно при диагностике, лечении, хирургическом вмешательстве и лабораторных исследованиях различных заболеваний. Движение крови по сосудам в живом организме также оценивается физическими факторами. В этой статье объясняется движение крови по сосудам с помощью некоторых физических факторов.*

Ключевые слова: *Допплер, эффект, сосуд, кровь, поток, ультразвук, функция, электрический ток, магнит, частота, движение.*

Аннотация. *Фан-техника, саноат ва илмий тадқиқот ишларининг ривожланишини физик факторларсиз тасаввур этиб бўлмайди. Айниқса*



тиббиётнинг кўплаб соҳаларида физик факторлардан кенг фойдаланилади. Айниқса, турли хил қасалликларга таъхис қўйишида, даволашида, жароҳликда, лаборатория ишларида яққол кўриши мумкин. Тирик организмдаги қоннинг томирларда ҳаракати ҳам физик факторлар билан баҳоланади. Мазкур мақола айрим физик факторлар ёрдамида қоннинг томирларда ҳаракатини асослаб беради.

Калим сўзлар: *Doppler, effekt, томир, қон, оқим, ultratovush, функция, электр, магнит, частота, ҳаракат.*

The functions of organs and tissues of a living organism are assessed by physical factors. For example, the movement, fluidity, viscosity, mechanical properties and other characteristics of blood in vessels are studied by hydrodynamics; the spread of blood through vessels is the section on oscillations and waves; the mechanical work performed by the heart is the mechanical section; the generation of biopotentials is explained in the section on electric fields [3,10].

Modern technologies used for diagnostic purposes make it possible to obtain information about a patient's illness by studying the sounds inside the body.

Currently, methods based on the use of electric current, electric field and magnetic field - electrocardiography, phonocardiography, ballistocardiography, rheocardiography and magnetocardiography, magnetobiology and others - expand the capabilities of specialists and facilitate fast and accurate diagnostics.

In medicine, electric current, electric fields, magnetic fields and other physical factors are used in physiotherapy for the modern treatment of various diseases. Modern treatment methods widely use ultraviolet and infrared rays, alpha, beta, gamma and other radiation [3,4,10].



Computed tomography, Roentgen-ray computed tomography, magnetic resonance imaging, multispiral computed tomography and other modern unique methods have become widely used in nuclear medicine.

Based on all of the above, we can say that blood flow in the vessels is also assessed by physical factors. Blood flow is the movement of blood through the cardiovascular system. Blood is a viscous fluid containing plasma and cells. It consists of leukocytes, erythrocytes, thrombocytes and hyalocytes. The properties of the cell significantly affect the nature of the flow [1,10].

Blood flow velocity is the speed at which blood elements move through the bloodstream per unit of time. In practice, specialists distinguish between linear velocity and volumetric blood flow velocity.

Linear blood flow velocity is the distance that a blood particle travels through a vessel in a given time (Fig.1). This is a value that directly depends on the sum of the numbers intersecting at a given point in the vessel. Consequently, the aorta is the narrowest part of the circulatory system and has the highest blood flow velocity, reaching ≈ 0.6 m/s. The "widest" are the capillaries, since their total area is 500 times larger than the area of the aorta, and the blood flow velocity in them is 0.5 mm/s. This ensures excellent exchange of substances between the capillary wall and tissues [2,9].

So, knowing this, in modern clinical practice there are several methods for determining blood flow velocity, let's consider some of them:

Ultrasound method: in this method, a special generator generates ultrasound waves and transmits them to the irradiator. The ultrasound wave passes through the emitter into the blood vessel and is reflected from the moving red blood cells. The returned ultrasound wave is converted by the receiver into electrical oscillations and



amplified. The amplified electrical oscillations are aligned with the oscillations of the incident and returning waves using a special

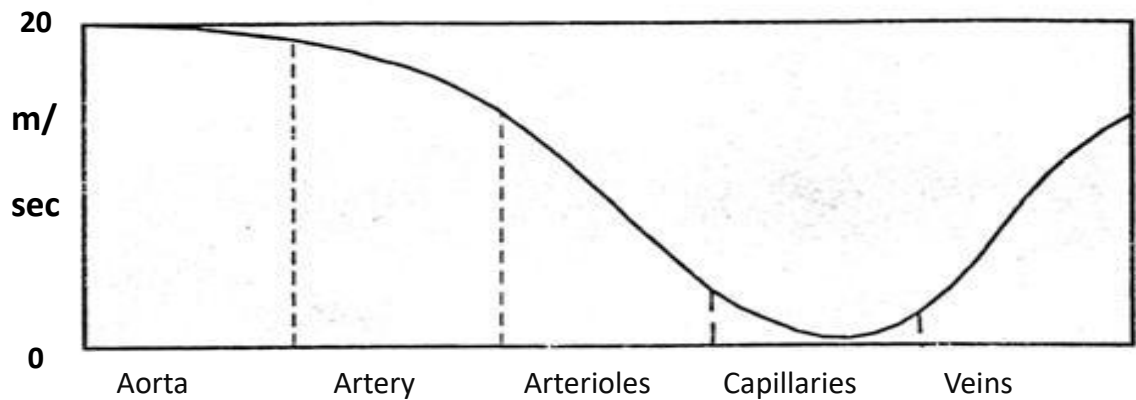


Fig.1. Linear blood flow velocity in the cardiovascular system.

device, and the speed of movement of the red blood cells is determined by the difference in the resulting frequencies [8,11].

The Doppler method is an ultrasound method based on the Doppler effect, in which the speed of red blood cells in large blood vessels changes depending on their location relative to the axis: red blood cells "near the axis" move at high speed, and "near the wall" - at low speed. In this case, ultrasound waves are reflected from different types of red blood cells. Thus, the Doppler shift occurs not at one frequency, but in a range of frequencies. Thus, the Doppler effect allows us to determine not only the average blood flow velocity, but also the blood flow velocity in different layers. In this case, the oscillations of the incident and reflected waves are balanced accordingly [6,7].

The physical essence of the Doppler effect is that the frequency of ultrasound waves changes when the ultrasound source moves. The waves are reflected from blood particles, and this change directly depends on the speed of blood flow.

Blood flow velocity, along with arterial pressure, is the main physical quantity characterizing the state of systemic circulation. The possibility of noninvasive,



objective and dynamic direct measurement of blood flow in small vessels remains one of the urgent tasks of modern angiology and related specialties.

Based on the above, it can be said that the Doppler effect is widely used to study the speed of blood movement in each layer, the functional state of the walls and valves of the heart (the Doppler echocardiography method), and the speed of movement of various organs [5,12,13].

In modern medical practice, high-frequency ultrasound Dopplerography opens up broad possibilities for determining the viability of critically ischemic, burned and frozen tissues. At the same time, opportunities for early detection of pathological conditions associated with hemodynamic disorders of the cerebral and carotid arteries appear.

The electromagnetic method of determining the blood flow velocity is based on the flow of moving particles in a magnetic field. Although blood is an electrically neutral system, it consists of positive and negative ions. If a magnetic field is applied to one side of a blood vessel, positive charges accumulate near one side of the blood vessel wall, and negative charges accumulate near the other side. This distribution of charges across the cross-section of the vessel creates an electric field. This physical phenomenon is called the Hall effect. Thus, with this method, it is possible to determine the blood flow velocity, knowing the magnetic field and the phase difference. In this method, the use of an alternating magnetic field is practically convenient. This creates an alternating Hall voltage. In this case, it is preferable to use an alternating magnetic field to reconstruct the image. Currently, Hall sensors or sensors - devices based on the Hall effect - are widely used in medicine and other fields [5,12,13].



Dopplerography is an ultrasound examination method based on the Doppler effect. Ultrasound waves are reflected from moving objects with a changed frequency. This frequency shift is proportional to the speed of movement of the structures being examined. If the movement is directed toward the sensor, the frequency increases, if away from the sensor, it decreases.

Dopplerometry - this method is based on the passage of ultrasound waves through a vessel, and as a result of the reflection of the waves from moving red blood cells and white blood cells, the frequency of the waves changes, that is, it increases in proportion to the speed of blood flow.

Doppler echocardiography allows measuring not only the average linear velocity of blood flow in the heart and vessels, but also the velocity at various points in the cross section of large vessels. The linear velocity of blood flow in the vessels of the systemic circulation is distributed accordingly. For example, the maximum in the aorta is 0.2–0.5 m/s, and the minimum in the capillaries is 0.0003 m/s. The blood flow velocity in the veins increases compared to the capillaries. In large vessels, it reaches 0.1–0.15 m/s. The linear velocity of blood flow in small vessels is distributed similarly [3,10].

So, based on the above, we can conclude that the achievements of electricity, electric fields, magnetic fields, atomic and nuclear physics are priceless. Roentgen-ray diagnostics and methods of directed atomic radiation have a significant impact on the development of medicine.



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