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CLIENT-ORIENTED MODELS FOR MEDICINAL ANGIOTHERAPY AND ANGIOCORRECTION IN LEVELING OF ARTERIOVENOUS BALANCE AND HYDRO-HEMODYNAMIC CONFLICT AT CARDIOVASCULAR DISORDERS IN VARIOUS REGIONAL VASCULAR RESERVOIRS

КЛІЄНТОРІЄНТОВАНІ МОДЕЛІ МЕДИКАМЕНТОЗНОЇ АНГІОТЕРАПІЇ ТА АНГІОКОРЕКЦІЇ У ВИРІВНЮВАННІ АРТЕРІО-ВЕНОЗНОЇ РІВНОВАГИ І ГІДРОГЕМОДИНАМІЧНОГО КОНФЛІКТУ ПРИ СЕРЦЕВО-СУДИННИХ РОЗЛАДАХ В РІЗНИХ РЕГІОНАЛЬНИХ СУДИННИХ БАСЕЙНАХ

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Every year, the value and significance of the study of the cardiovascular system increases, since cardiovascular diseases (CVD) have not shown a downward trend during the last half century, despite the appearance of many new diagnosing methods for the cardiovascular system (CVS). Analysing the peculiarities of CVD research and the constant growth of morbidity and disability of the population after vascular diseases, the progressive rejuvenation of CVD [1, 2], we came to the conclusion that the problem of adequate diagnosis and CVD treatment requires a systemic approach and deep immersion in the basics of hydrohemodynamics, blood rheology, Ultrasound physics and optics for intravital visualization of blood flow in certain regional reservoirs [3, 4, 5].

According to the dynamics, the cardiovascular system is the most dynamic in the human body, and its function consists in delivering blood to the most distant segments of the body, ensuring metabolism and gas exchange.

Therefore, the study of the vascular system is not just a statement of the fact of structural changes – bends, tortuosity, plaques, blood clots, etc., but a search for the reason why the blood does not flow adequately to the needs of a certain organ or system. CVD study requires visualizing and evaluating methods of blood filling and blood flow in vivo. Ultrasound and optical capillaroscopy are optimal for the dynamic study of blood flow, which enables to visualize blood filling, blood flow, the level of perfusion in one or another organ, as well as to assess the deficiency of blood supply.

Therefore, there is a need for creation of a certain field in medicine – applied angiology, which would diagnose, analyze, investigate hemodynamically significant problems and substantiate the approaches of finding treatment tactics and methodology of influence on the hemodynamically marked deficiency of blood supply to a certain organ.

Studying the cardiovascular system, we model the situation according to the theory of the blood flow [6], which is based on the model of arteriovenous and arteriolovenular balance with adequate pumping function of the myocardium as a pump in the CVS, and the unique feature of the vascular blood vessel, unlike the water pipeline, is the presence of a microcirculatory bed for ensuring the processes of metabolic and gas exchange [7].

Mathematical modelling of CVS disorders involves the analysis of the existing situation in each specific patient and its comparison with pathological hemodynamic patterns that are typical for certain situations. The models for angiodystonia, venous stasis of the hypo- and hypertensive type, a decrease in the pumping function of the right and left sections of the myocardium, intracranial hypertension, disorders of elastic-tonic properties, etc. enable us to model the matrix of combined hemodynamic pathology and carry out evaluations of possible options of client-oriented combined influence on the identified pathological hemodynamic patterns with the aim of their normalization [8].

Next, there is a process of forming a treatment plan in order to achieve the optimal possible goal – recovery of the patient from existing dyshemia and stabilization of his condition involving autoregulation of the cardiovascular system.

We have been practicing such approaches to diagnosis, analysis and optimal selection of treatment for more than 25 years, and the obtained clinical results of the successful treatment of many psychoneurological diseases indicate the need to separate clinical angiology into a certain branch of medicine.

In applied angiology, we distinguish between personalized in-vivo diagnostics – angiodiagnostics and treatment – angiocorrection and angiotherapy.

Angiotherapy involves a set of measures aimed at improving blood flow and blood filling in one or another organ due to vascular medicine, which enables to get out of a critical situation of blood supply deficiency and restore adequate perfusion in one or another organ as quickly as possible. At the same time, angiocorrection aimed at restoring the elastic-tonic characteristics of arteries and veins, arteriovenous balance and hydrohemodynamic balance both at the macroangiological level and at the level of microcirculation, which is extremely important for the long-term and balanced work of the blood flow [9].

Considering the CVS model from the view of a mechanical or electronic model of the functioning of a living organism, it is worth noting that the CVS itself as a model of a vascular blood flow is an example of a purely mechanical system in the human body, which is based on the intravascular pressure gradient as the driving force of blood movement in the hemoduct.

Thus, mathematical modelling of both systemic hemodynamics and cardiodynamics, as well as regional hemodynamics in various vascular reservoirs (brain, lungs, liver, kidneys, limbs, etc.) is extremely important for some unconventional approach to the CVD treatment, and today it is absolutely necessary to overcome those challenges of the present day, associated not only with age-related vascular diseases, but with new challenges – post-Covid vascular syndrome with occlusive microthromboangiopathy and sub-decompensated hydrohemodynamic conflict at the level of microcirculation block [10].

Applied personalized angiotherapy and angiocorrection are impossible without a thorough approach to the diagnosis of the state of the cardiovascular system in CVD with an emphasis on personalized models both for the matrix of pathological hemodynamically expressed patterns and for the optimal effect on the restoration of all changed hemodynamic parameters and bringing the entire circulatory system to independent adequate work as normally, as well as during physical or other loads.

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