Which new prospects for an efficient prevention and treatment of cardiovascular diseases could be gained by a systemic examination of the cardiovascular system?

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1 Cardiovascular diseases are a disaster of the XXI century

The cardiovascular system (CVS) is an essential component in human health, as the background level of functioning of nearly all organs and systems depends on the blood supply level. It is of a very complicated dynamic mechanism by a type of the closed system of connecting vessels with variable parameters in all its structural segments - heart, vascular walls, as well as intravascular fluid – blood. The system is analogous to water, although almost all its values are variable, from parameters of the pump function (heart) to values of unstable vascular calibers, blood pressure, linear and volumetric velocities, transverse and longitudinal intravascular hydrodynamic pressure depending on the load of the vascular "hemo-supply".

Cardiovascular diseases are an urgent medical and social problem nowadays because of high rates of morbidity, mortality, and disability, indicating the low efficiency of applied methods for vascular diagnosis and treatment.

Today, occupying first place by spreading, cardiovascular diseases cause more than half of all deaths and one third of disability, mainly due to uncompensated cardiovascular conditions - heart attacks and strokes (according to statistics from WHO and Ministry of Health of Ukraine).

3/4 of the population is suffering from cardiovascular pathologies in Ukraine alone and it causes death in 62.5% cases; that is much higher than in developed countries. Recently, the spreading of ischemic heart diseases has increased in Ukraine from 10 000 to more than 20 000 per 100 000 of the population. And more than 5 million patients with hypertonic disease are registered in Ukraine.

2 Multi-problems concerning diagnosis and treatment

Despite of considerable efforts of scientists, there is no tendency to decreasing of morbidity and mortality indexes of cardiovascular diseases (CVDs) today. In fact, the world has not enough efficient technologies for preventive examination of the cardiovascular system. They must not be for palliative adaptation to the sickly state, but for restoration of the system to the level of autoregulation and self-control.

Some important factors have not been included in basic and applied research. Let us name the most important:

1. **Static examinations predominate.** Local CVS examination does not consider interconnections between dynamics of segments and general dynamics of the vascular system on various regional levels. Thus the corresponding treatment has only palliative nature and is not directed to needs of the initial and secondary prevention of cardiovascular diseases.
2. **There is no systemic approach to the examination of CVS as an entire system of vascular "hemo-supply" with multiple intersystem connections.** A role of arterial and venous dampers is ignored for blood redistribution in various regional reservoirs.
3. **There is no systemic approach, when the organism is considered to be a controlled system,** to peculiar features of hydrohemodynamic laws in vivo for providing functioning of interdependent segments of the closed CVS: heart - major arteries - peripheral arteries – arterioles – capillaries – venules – peripheral veins – major veins - heart. That is why one-moment examination of CVS requires quite new technological approaches with detection of polyvector characteristics of all levels and concretization of an injured area and influence of the area on functioning of the whole system.
4. **The venous system is not examined enough** as it is considered to be in a shadow and less accessible for life-time functional examination
5. **There is a lack of profound examinations of correlation of hemodynamic characteristics of major and peripheral arteries, veins and capillaries for providing coordinated CVS functioning**
6. **Current diagnostic and treatment measures are not sensitive enough for early disorders in CVS functioning.**
7. **One-sided CVS examination.** There is a gap between local medical examination and a global approach under mathematical modeling of CVS according to cybernetics because of the lack of local indicators for the vascular system condition. One cannot

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make global conclusions about the functioning of the entire system by one CVS parameter. Such an approach to the CVS investigation is too expensive, thus causing "rejuvenation" and progression of CVDs. When we analyzed the CVD statistics in Ukraine, Europe, and the world, we observed the following tendency – 20 years ago people older than 40-50 years had CVDs, while today the age is older than 30 years. There are rare cases of stroke among teenagers and even sudden death during physical lessons in schools, which had never been observed before

8. **Lack of a single approach in vivo to blood as a biological and biochemical non-Newton liquid** causes physicians to be mistaken about the properties of blood – it is perceived as an ordinary liquid.

9. **Usage of absolute values** as a statement of incorrect functioning of the system not taking into account parameters of reactivity and adaptation of CVS in conditions of disorder of internal homeostasis and changes of environmental parameters (meteorological factors), neglecting integral parameters when estimating CVS functioning causes a principally wrong static (but not dynamic) approach in analyzing the functioning of the dynamic blood circulation system.

10. **Lack of profound examinations of correlation between immunodeficiency states** and development of any vascular pathology causes accompanying conditions for progression and spreading of cardiovascular diseases.

3 Conclusion

The current level of examination of the cardiovascular system requires new analytical approaches to processing of various vector characteristics of all local segments and regional levels of the CVS with concretization on the injured area and local influence of the area on the functioning of the entire system. Any treatment course ultimately requires a CVS monitoring to analyze hemodynamic changes of adaptive or pathological reorganization in the vascular bed. We invite everyone concerned to participate in the discussion of the above mentioned problems. And we gladly will keep up the discussion.

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