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To whom it may concern

## REVIEW REPORT

for the dissertation of  
Vladimir Vladimirovich Potapov

Topic: «Changes of tensiometric and rheometric blood serum parameters in the peri-operational period of patients who underwent cardiac operations»,

submitted for the degree of Candidate of Medical Science,  
specialty 14.01.20 - Anesthesiology and Intensive Care.

The dissertation of V.V. Potapov is dedicated to a very modern medical issue, not only in the area of intensive care but also related to the cardiac surgery. Cardiovascular diseases are among the most frequent causes of death worldwide. Every patient with such a pathology, independent of the genesis, receives medication that affects the blood coagulation system (anti-aggregants and anti-coagulants) in order to prevent any thrombus formation. Irrespective of a continuous administration of anti-aggregants and indirect anti-coagulants, the patients are still at risk of thrombus formation in bypasses and valves. This situation requires in turn new ways of solving the problems of the hemostasis system.

Except the activation of the hemostasis system in the area of damaged endothelium, the cause of intra-vascular formation of thrombi includes also the slow blood flow. In its turn, the blood flow rate depends on the condition of hemo-rheology parameters in the microcirculation system, i.e. they do not refer to Newtonian fluids.

There are many publications on the rheological properties of blood and the functional state of endothelium in the vascular microcirculatory bloodstream system. The viscosity of serum and blood plasma are of key significance in the microcirculation system. There are many factors causing changes of the hemo-rheological parameters responsible for the increase of the viscosity of serum and blood plasma. This depends on the increased amounts of small and large molecular plasma proteins (fibrinogen, for example). Hemodynamically, the hyper-viscosity syndrome

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might cause ischemia and thrombosis. In addition, the blood hyper-viscosity reduces the microcirculation thus affecting the delivery of oxygen to the tissues.

It is worth mentioning that the author of this dissertation has chosen the physical, colloid and organic chemistry sciences as the basis for his research. The topic of the research is of high priority because, despite the advances in cardiac surgery, the practicing doctors have often problems with their decision on individual tactics for patient treatments. Therefore, additional methods of diagnostics are required, which are better based on natural sciences rather than empirical knowledge.

The dissertation has a standard format and consists of introduction, materials and research methods, results of the performed research, conclusion, evaluation of the results and practical recommendations. The dissertation is written in a good formal language.

The design of the research is clear and precise, and meets the scientific state of the art requirements. The working hypothesis is formulated in a clear way, and respective evaluations are presented.

Considering that the early complex diagnostics enables quick assignment and individualization of the intensive care for critical patients, it becomes clear that the formulated objective is justified - to enhance the efficiency of diagnostics of the adverse outcome risk factors after cardiac operations with artificial blood circulation as scientific background.

The thesis has evidently sufficient scientific novelty. Based on studies of surface tension and dilatational surface viscoelasticity of serum and blood plasma, it establishes interrelations between these parameters of serum and blood plasma and laboratory parameters of a systematic inflammatory response for patients with acquired valvular and ischemic cardiac diseases, who underwent operations using artificial blood circulations. Based on the results of the performed research, an early diagnostic method is elaborated and introduced into clinical practice. It is suitable of detecting the development of a chronic cardiac insufficiency. It was revealed that certain changes in surface tension and dilatational viscoelasticity parameters of the blood serum can be used for early diagnostics of the acute coronary syndrome and for predicting the risk of development of adverse coronary phenomena during the post-operative period. The data on diffusional mass transfer of infusion preparations and their contribution to the general rheology of the blood have been obtained, which, apparently, are a matter of scientific interest.

A statistical analysis was performed which complies with the requirements of a fact-based evaluation of the studied parameters.

The results presented in the dissertation can serve for publications and presentations at international conferences, which are not available presently due to the Corona pandemic.

Considering that the research was completed during the peri-operational period at critical patients, the thesis does absolutely match with the code of the thesis committee for the specialty 14.01.20. - Anesthesiology and Intensive Care

The research performed by V.V. Potapov represents an individual complete academic paper where state-of-art of innovative methods for the evaluation of patients' condition and for the performance of therapies are applied.

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In summary, the evaluation of the thesis allows to conclude that the originality, scientific novelty and practical significance of the dissertation presented by Vladimir V. Potapov entitled «Changes of tensiometric and rheometric blood serum parameters in the peri-operational period of patients who underwent cardiac operations» complies with the requirements of Para. 2.1. of the Provision of Conferment of the Science Degrees applicable to the candidate's dissertations and its author deserves the conferment of the degree of Candidate of Medical Science in specialty 14.01.20. - Anesthesiology and Intensive Care.



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\_\_\_\_\_ Reinhard Miller