MODELING OF COAGULATION PROCESSES IN HUMAN SYSTEMIC HEMODYNAMICS

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The searching for new ways of hemostasis correction is actual, because thrombosis plays an important role during a number of clinical pathologies. In this case the interaction between coagulation process and process of mass transport in the vascular system is one of the most acute problem. In the proposed work a mathematical model, describing the activation of plasma coagulation system with thrombosis regimes in branching vascular networks, is developed.

In the present work the biochemical reaction of blood clotting in each vessel of network was simulated separately. Convective mass transport was described in correspondence with the spatial linking of elements in the vascular network. The model of biochemical process was based on phenomenological equations of activator of coagulation (thrombin), inhibitor and fibrinogen. Fibrin polymerization was described by the momentum technique [1]. In the proposed work simulations were carried out on anthropomorphic vascular network with detailed cerebral part and on simplified network with dichotomous structure.

The numerical experiments allowed us to build parametric diagrams, showing the conditions of vessels thrombosis in the result of occurrence of the coagulation activation source in proximal area. Three typical types of system behavior in response to the activation impulse were found. Scenarios, derived in the numerical calculations, were compared with clinical data of cerebral vessels embolization and manifestations of disseminated intravascular coagulation.

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References

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