

## NUMERICAL STUDY OF CAROTID BIFURCATION ANGLE EFFECT ON BLOOD FLOW DISORDERS

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**Summary:** The plaques depositing in the carotid artery, in addition to their biological-chemical source, have a mechanical cause related to blood flow geometry and nature. The flow of fluid through a divergent channel may lead to separation of the parietal layer. In consequence, this may cause occurrence of whirlpools that affect deposition of solid particles near the arterial walls.

The paper presents study results of the impact of the common carotid artery bifurcation angle on the flow disorders. The studies were carried out using numerical methods. Based on actual images, geometry was made of the diffuser channel with bifurcation and predetermined angle.

The analysis of the flow field results was based on the following flow parameters: kinetic energy of turbulence, velocity profiles, Reynolds number and boundary layers thickness. The simulation results showed that for bifurcation angles exceeding 60 degree the whirlpools near the bulb start to occur – at that time almost a double increase of the parameter values takes place, related to flow disorders. The whirlpools become increasingly larger and grow proportionally to the value of the bifurcation angle. Thanks to the studies carried out, three areas have been shown, in which plaques may deposit, due to disadvantageous geometry. Based on the simulation results, arteries have been divided into three groups of risk. It has been proven that the bifurcations exceeding 50 degree significantly disturb the flow and the points of whirlpool occurrence represent frequent points of plaque depositions.

The results obtained in the studies justify why the patients with greater bifurcation angle are more susceptible to occurrence of plaques in the arteries. The results of the presented study conform to the cases observed in practice – the largest group of patients with arterial plaques diagnosed has an artery with bifurcation angle above 50 degree. Based on the above prerequisites, the mechanical justification has been obtained why people with large carotid artery bifurcation angle are more exposed to the development of the atherosclerotic plaque. The studies represent the starting point for a geometrical base of carotid arteries with geometry inducing plaque deposition.