

## IMPACT OF PATCHES ON BLOOD FLOW DISORDERS IN CAROTID ARTERY

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**Summary:** The atherosclerotic plaques are surgically removed by endarterectomy of the common and internal carotid artery wall, removal of lesions and suturing the artery again. This is a primary and secondary proactive method to prevent the ischemic stroke. To avoid arterial lumen stenosis, sewing a patch in the incision area is indicated, which will cause a slight expansion of the flow lumen. It has been proven in numerous studies that implantation of a patch statistically significantly reduces the frequency of post-operative cerebral strokes and restenoses. The channel expansion causes a positive tension gradient, enhancing separation of the parietal layer and occurrence of whirlpools. The latter may cause plaque redeposition. The selection of the patch size is not described in detail in literature and is based on the surgeon's experience and intuition. The purpose of the studies is to determine the maximum patch width per surgical incision at which no flow separation will occur.

To determine the geometry of the channel with patch sewn in, an equation was determined to reflect the course of the arterial wall curves by math functions. The artery radius, maximum expansion radius and length of the patch sewn in have been assumed as input parameters that define the boundary conditions necessary for determination of i.a. polynomial coefficients. By gradual increase of the maximum radius a geometry group was determined, which was the starting point for numerical simulations..

The simulations were made with the use of Fluent. The increasing of the maximum radius was continued until the separation of the parietal layer was detected and whirlpools occurred. The results showed that when the maximum radius is 50% greater in relation to the arterial radius, whirlpools occur, which in consequence may lead to plaque redeposition.

The study result will comprise development of software, which, upon introduction of input data related to arterial geometry, patch length and patient's blood parameters (affecting the fluid density and viscosity), shall generate accurate contour of the patch of width causing no flow disorders. The finished patch will also have a marked fold, which is related to the wound suturing technique applied by the surgeons.