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COMPARATIVE BLOOD FLOW VELOCITY INVESTIGATIONS IN THE PATIENT-SPECIFIC CIRCLE OF WILLIS WITH ANEURYSM: TRANSCRANIAL DOPPLER, COMPUTATIONAL FLUID DYNAMIC

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Summary: The main center of the brain blood distribution is the Circle of Willis (COW). Obtaining information of hemodynamic parameters is very important for diagnosing of cardiovascular diseases, such as aneurysm in cerebral arteries. Non-invasive or semi-invasive Clinical methods for diagnosing any vascular diseases in this area can only measure blood velocity. One of them is Transcranial Doppler. Several factors influence the accuracy of TCD such as arteries wall motion, probe positions and angle and even mistake of operator. The existence of these errors can lead to wrong estimations and affect the treatment planning. Computational fluid dynamic is one of the most important approaches for obtaining exact hemodynamic information. In this study, realistic three-dimensional models have been produced from angiography images. A domain of the blood flow has been simulated by the ANSYS.CFX software. The velocity in the Circle of Willis has been calculated and compared with the velocity obtained from Transcranial Doppler, and the accuracy of the measured parameters has been considered. Results showed that the correspondence between computational fluid dynamics (CFD) and Doppler test (TCD) in different vessels of the circle of Willis are different, and in some arteries it increases. Maximum differences in the arteries are achieved to 80 cm/s and on the opposite side 40 cm/s. Comparison of the results shows that in arteries which are near the surface of the skull and slight inflexion, the accordance between the TCD and the CFD data is appropriate.