ABSTRACT

Carotid artery stenosis is one of factors that caused morbidity and death. It is beneficial to asymptomatic patients to be prevented if atherosclerosis can be detected or diagnosed. Presently, the advanced engineering in computational modeling plays an important role and has potential in medical applications including the diagnosis of carotid stenosis. The aim of this study was to use two-dimensional computational fluid dynamic (CFD) model to predict vascular stenosis size based on blood flow velocity measured by Doppler ultrasound. The realistic carotid artery models were obtained and reconstructed from magnetic resonance angiography image. This study assumed that blood was incompressible Newtonian fluid and the artery wall was rigid. The analysis was performed using CFD software. The results showed that velocity ratio increased when the progress of stenosis increased from 30% to 70% in common carotid artery. The velocity ratio and wall shear stress decreased at the internal carotid artery when the stenosis increased. Using the simulated results of velocity ratio, the chart of the relationship between velocity ratio and percentage of stenosis was created. Therefore, this chart would be a screening tool to predict the percentage of stenosis in carotid artery by using the measured ultrasound velocity.

Keywords: carotid artery stenosis, velocity ratio, wall shear stress, ultrasound