Abstract

The current work is done to see which artery has more chance of having cardiovascular diseases by measuring value of pressure gradient in the common carotid artery (CCA) and ascending aorta according to age and gender. Pressure gradient is determined in the CCA and ascending aorta of presumed healthy volunteers, having age between 10 and 60 years. A real 2D model of both aorta and common carotid artery is constructed for different age groups using computational fluid dynamics (CFD). Pressure gradient of both the arteries are calculated and compared for different age groups and gender. It is found that with increase in diameter of common carotid artery and ascending aorta with advancing age pressure gradient decreases. The value of pressure gradient of aorta is found less than common carotid artery in both cases of age and gender.

References

1. Ballermann J. B., Dardik A., Eng E, Liu A, 1998,'Shear stress and the endothelium,'
Kidney International, Vol. 54, Suppl. 67, pp. S-100 –S-108.

2. Brar P., Vashisth S., 2015, 'Piezoelectric sensor to non-invasively detect age associated changes in human carotid pulse', Int. J. Biomedical Engineering and Technology, Vol. 19, No. 1, pp. 40–52.

3. Chan W. Y., Ding Y., Tu J. Y., 2007, “Modelling of non–newtonian blood flow through a stenosed artery Incorporating a fluid structure interaction,” Anziam J, Vol. 47, pp.-C507-C523.

4. Duncan D.D., Bargeron C.B., Borchart S.E., 1990, 'The effect of compliance on wall shear in casts of a human aortic bifurcation,' J Biomech Eng, Vol. 112, pp. 183-188.

5. Johnston B.M., Johnston P. R., Corney S. and Kilpatrick D., 2004, 'Non-Newtonian blood flow in human right coronary arteries: steady state simulations,' Journal of Biomechanics, Vol. 37, No. 5, pp. 709-720.

6. Jonas L., Johan R. and Mats K., 2011, 'Wall shear stress in a subject specific human aorta Influence of fluid-structure interaction', International Journal of Applied Mechanics, Vol. 3, No. 4, pp. 759-778.

7. Khan M., Vashisth S., Vijay R., Salhan K. A., 2015, 'Computer based real time systems for analysing cardiovascular response to orthostatic stress', Journal of Institute of Biocybernetics and Biomedical Engineering, Published by Elsevier, Vol 35, pp-232-239.

8. Khan M., Vashisth S., Vijay R., Salhan K. A., 2012, 'Online acquisition and wireless transmission of carotid pulse waveforms to analyse posture related changes,' Int. J. Biomedical Engineering and Technology, Vol. 10, No. 3, pp. 255-265.

9. Nichols W.W., O Rourke M.F., 1990, 'Aging, high blood pressure and disease in humans,' In: Nichols WW, O.'Rourke MF, editors. McDonald’s Blood Flow in Arteries, 3rd ed., London: Edward Arnold, pp. 398-420.

10. Pim P. O., Wouter V. P., Sukit C. M., Alex J. B., 2016, 'Age-related changes in aortic 3D blood flow velocities and wall shear stress: Implications for the identification of altered hemodynamic in patients with aortic valve disease,' Journal of Magnetic Resonance imaging, Vol.43, Issue 5, pp. 1239-1249.

11. Redheuil A., Yu W.C, Mousseaux E, Harouni A.A,Kachenoura N, Wu O.C, Bluemke D, Lima A.C,J, 2011, 'Age-Related Changes in Aortic Arch Geometry,' Journal of the American College of Cardiology, Vol. 58, No.12, pp. 1262–70.

12. Reneman R.S., Van M. T., Hick P., Hoeks A.P.G., 1985, 'Flow velocity patterns in and distensibility of the carotid artery bulb in subjects of various ages,' Circulation, Vol. 71, pp. 500–509.

13. Reneman R.S, Van M. T., Hick P., Muytjens A.M.M., Hoeks A.P.G., 1986, 'Age-related changes in carotid artery wall properties in men,' Ultrasound Med Biol, Vol. 12. pp. 465–471.

14. Samijo S.K. , Willigers J.M. , Barkhuysen R. , Kitslaar P.J.E.H.M, Reneman R.S. , Brands P.J. , Hoeks A.P.G., 1998, 'Wall shear stress in the human common carotid artery as function of age and gender,' Cardio--vascular Research, Vol 39, pp. 515-522.

**Index Terms**

Computer Science

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Keywords

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