Modelling of the Human Blood Circulation and Detection of Pathophysiological Symptoms of Atherosclerosis in Dependence of the Arterial Blood Flow Volume and Blood Pressure

Yang Bai*, Benjamin Strathen, Eberhard Engelien, Okan Ecin, Reinhard Viga, Thomas Hilbel, Rainer Kokozinski and Anton Grabmaier

Introduction By virtue of excessive nutrition and changes in the lifestyle, like the working and living conditions, more pathophysiological symptoms occur with people in the western industrialized countries. Slowly progressive diseases which emerge without symptoms for years, for example arteriosclerosis, are the reason for an increasing rate of mortality. The blood circulation is simplified and simulated idealised by a generated arterial model to study virtual pathophysiological symptoms. Methods The human circulatory system is simulated by the aorta and major arteries in a geometry model of glass tubes and rubber hoses. The arterioles and capillaries are not modelled because of their fine and complex structure. According to the respective geometrically idealized cross sections of the simulated artery, the volume flow of the human body is divided into various areas. Due to the specific problems of blood in technical structures water is used instead of blood and is adjusted to a constant volume flow. By discrete variation of individual cross sections of flow in the vessel segments pathophysiological symptoms are generated. The changes of volume flow and pressure of the artery in the left leg are measured and analysed using generated symptoms in the artery model. Results In the left leg of the arterial model different volume flow rates are analysed by varying the cross section in different areas of the vascular model. The pressure remains constant because of the constant volume flow. Conclusion The pathophysiological symptoms can be generated simply by varying the volume cross section in the geometric vascular models. With this method the effect of pathophysiological symptoms, like stenosis, can be simulated and analysed easily and without any risks for the human body.