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Non-invasive estimation of cardiac wall stress by using tissue doppler-echocardiography ultrasound images: People with coronary artery stenosis

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Abstract

In this study, a method for non-invasive estimation of stress on the heart wall in the diastole phase is presented using ultrasound echocardiography and tissue Doppler imaging. The aim of this study was to evaluate the stress on the heart wall as a pre-diagnosis to identify people with coronary artery stenosis. 29 patients with stenosis of more than 70%, 30 patients with stenosis of 50 to 70% and 35 healthy human participated in this study as a control group. the average stress of anterior and intraventicular septum was estimated non-invasively by considering wall thickness, left ventricular dimensions, and end-diastolic pressure by using 2D echocardiography, tissue Doppler and Doppler ultrasound imaging techniques. The statistical analysis results were shown significant difference between the estimated stress at the end of the diastole phase, between groups of patients with severe, moderate stenosis and healthy individuals in all wall segments. Patients with severe obstruction in the anterior descending coronary artery have more diastolic stress than patients with moderate stenosis and healthy humans. The average increase of end-diastolic stress in the longitudinal and radial directions based on percentage by incidence of moderate stenosis in the anterior wall is 12.6 and 13.4, and with severe stenosis is 57 and 103, respectively. In the septal wall, the average increase of end-diastolic stress in the longitudinal and radial directions based on percentage is 9.1 and 17.6 in moderate stenosis, and with severe stenosis is 64 and 63.3, respectively. Therefore, it has been shown that wall stress at the end of the diastolic phase can be considered as an important non-invasive indicator in assessing myocardial function by examining and processing ultrasound echocardiography images for patients with coronary artery stenosis.

Keywords: Ultrasound image processing, Coronary artery disease, Echocardiography, Left ventricular wall stress.

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