

Coronary Artery Disease and Low Frequency Heart Sound Signatures

Samuel Emil Schmidt*, John Hansen, Henrik Zimmermann, Dorthe Hammershi, Egon Toft and Johannes Jan Struijk

Laboratory for Cardiotecchnology
Department of Health Science and Technology, Aalborg University

A recent study by the current group showed that coronary artery disease (CAD) alters the frequency distribution of diastolic heart sound at lower frequencies (20-125 Hz) by shifting the energy toward lower frequencies. The aim of the current study was to further study this phenomenon in a new dataset. Heart sound recordings were made from the 4th intercostal space using a newly developed acoustic sensor and a dedicated acquisition system in 42 patients without prior diagnosis of CAD referred for elective coronary angiography. CAD patients were defined as subjects with at least one stenosis with a diameter reduction of at least 50% identified with quantitative coronary angiography. The sample rate of the acquisition system was 48 KHz, but the recordings were later down sampled to 16 KHz. Diastolic periods of heart sounds were identified by an automated segmentation method. The diastolic heart sounds were band pass filtered to emphasize the low frequency part (20-100 Hz) of the signal and an 20th order autoregressive model (AR) was applied. Based on the AR-models the diastolic frequency spectrums were estimated. The AR spectrums of the filtered diastolic heart sound showed that the frequency distribution shifted towards lower frequencies in the case of CAD. In patients with CAD (N=22) the magnitude of the first AR-poles located approximately at 20 Hz was increased and the magnitude of third pole located approximately at 100 Hz was decreased. When the pole magnitudes were used to separate non-CAD and CAD subjects the area under receiver operating characteristic curve was 0.82 for the magnitude of the 1st AR pole and 0.79 for the magnitude of the 3rd AR pole. The finding confirms the prior findings about changes in the low frequency part of the spectrum. The cause of these changes might be due to variations in ventricular filing patterns.