

# Estimation of Hemodynamic Parameters from Seismocardiogram

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Biosignals such as seismocardiogram (SCG), ballistocardiogram and apex-cardiogram represent the mechanical vibrations of the body as the result of heart beating and have their main components in the infrasound range. SCG, in particular, is recorded from the sternum and represents the acceleration that heart creates on the surface of the body in an axis perpendicular to it.

In this paper it is shown that SCG can be used to estimate two important hemodynamic parameters of stroke volume and left ventricular ejection duration. In this study, recordings of suprasternal pulsed Doppler and Impedance cardiogram (ICG) were used as the reference methods for comparison to the values estimated by SCG.

Simultaneous SCG and ICG and Doppler were recorded from eight male subjects between 20-30 years old. Linear regression analysis was used to estimate the stroke volume from features extracted from SCG and Bland and Altman method was used to compare the results to values estimated by the Doppler method. The average of the correlation coefficients between the two methods and over all the subjects was 0.74 and the upper and lower confidence intervals were estimated to be 6.1 and -6.6 mL. The mean of differences between the two methods were less than 0.1 mL. The linear regression estimator gave us similar results as the support vector machine (SVM). For the same subjects the left ventricular ejection time estimated by SCG was compared to the same parameter estimated from simultaneous ICG signal.

The goal of this study was to prove the possibility of using the vibrations recorded from the sternum to estimate two important hemodynamic parameters, stroke volume and left ventricular ejection time, and to identify the possibilities that such an inexpensive methodology can provide for monitoring of the cardiac dynamics non-invasively and as an compliment to the methods that already exist.