Detecting preload changes using seismocardiography

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Introduction: Seismocardiography (SCG) is a non-invasive tool that utilizes the chest wall vibrations from the beating heart to measure cardiac measures using a highly sensitive accelerometer. SCG offers continuous measurement of cardiac function that could be utilized for monitoring, diagnostic assessments, and prognostic health checks. **Aim:** The aim of this study was to investigate if the SCG could detect an increase in preload by fast saline infusion. **Methods:** Twenty-six subjects were included in this study, sixteen with cardiac diseases such as hypertrophic cardiomyopathy, dilated cardiomyopathy, aortic valve disease or ischemic heart disease (age 45.8±17.7 years and 93% male) and ten subjects without known cardiac conditions (age 42.1±14.4 years and 70% male). Ensemble average SCG heartbeat signals were constructed and utilizing a fiducial point detection algorithm, the amplitudes and time intervals of the SCG fiducial points were identified. Wilcoxon signed rank test was used to test for significant difference pre and post infusion. **Results:** Post infusion SCG was not obtained in two subjects, therefore only twenty-four subjects were included post infusion and twenty-six pre infusion. Post infusion the diastolic SCG amplitudes D_d increased 24% (p=.016), E_d increased 47% (p = <.000) and the systolic L_s increased 20% (p = <.015). Diastolic time intervals B_d to F_d decreased with 9% (p = .010), and B_d to Ed decreased 4% (p = .040). The same was observed for early systolic time intervals E_s to G_s that decreased 3% and E_s to L_s that decreased 8% (p = <.000) However, the mid systolic interval G_s to B_d increased 5% and L_s to B_d increased 12% **Conclusion:** The results found in this study demonstrates a significant difference between the SCG measures pre fluid and post fluid infusion, thus indicating that the SCG could potentially be utilized to detect preload changes.
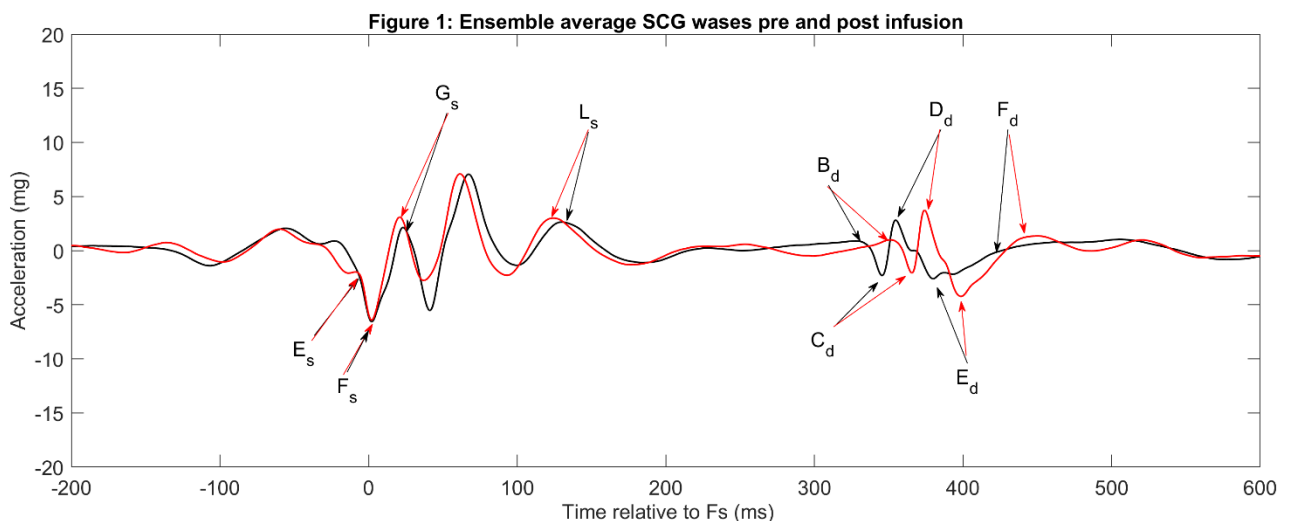
Figure 1 visualizes the SCG waves pre and post fluid infusion for one subject with the fiducial points E_s (mitral valve closing), G_s (aortic valve opening), B_d (aortic valve closing) and F_d (mitral valve opening).