

Cardiac Failure Detection Using a Wearable Patch Sensor in a Point-Of-Care Setting

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The importance of ventricular stroke volume (SV) for the detection of cardiac failure has been well established in the clinical field. The focus of this study was to develop a simple to use sensor that could be applied like an adhesive bandage that could potentially measure SV, and subsequently aid in the detection of cardiac failure. A patch sensor was designed from a trace of a copper configured into a square planar spiral. The patch sensor self-resonates when impinged upon by a specific range of radio frequency (RF) waves. Human participants (n = 5) were recruited to measure SV using the patch sensor and the data was compared against a clinical standard (impedance cardiography). Shifts in the resonance were registered as blood volume changes throughout the cardiac cycle. A statistical correlation analysis was performed to determine the patch sensor's performance in measuring SV, heart rate (HR), and cardiac output (CO). Changes in the effective permittivity in the aortic arch (AO) due to changes in blood volume were directly correlated to the measurements of SV. SV, HR, and CO were measured with the patch sensor with a 94.0 % accuracy as compared to the clinical standard impedance cardiography. This work presents a foundation for the development of a patch sensor that may be used as a non-invasive diagnostic to detect cardiac failure for people that live in low resource environments or have limited access to medical care.