Preliminary investigation of an ultrasound method for estimating pressure changes in deep-positioned vessels. - DTU Orbit (03/01/2019)

This paper presents a method for measuring pressure changes in deep-tissue vessels using vector velocity ultrasound data. The large penetration depth is ensured by acquiring data using a low frequency phased array transducer. Vascular pressure changes are then calculated from 2-D angle-independent vector velocity fields using a model based on the Navier-Stokes equations. Experimental scans are performed on a fabricated flow phantom having a constriction of 36% at a depth of 100 mm. Scans are carried out using a phased array transducer connected to the experimental scanner, SARUS. 2-D fields of angle-independent vector velocities are acquired using directional synthetic aperture vector flow imaging. The obtained results are evaluated by comparison to a 3-D numerical simulation model with equivalent geometry as the designed phantom. The study showed pressure drops across the constricted phantom varying from -40 Pa to 15 Pa with a standard deviation of 32%, and a bias of 25% found relative to the peak simulated pressure drop. This preliminary study shows that pressure can be estimated non-invasively to a depth that enables cardiac scans, and thereby, the possibility of detecting the pressure drops across the mitral valve.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, University of Waterloo, University of Hong Kong
Number of pages: 6
Publication date: 2016

Host publication information
Title of host publication: Proceedings of SPIE
Volume: 9790
Publisher: SPIE - International Society for Optical Engineering
Editors: Duric, N., Heyde, B.
Article number: 97900J
Keywords: Medical ultrasound, Pressure estimation, Vector flow imaging, Synthetic aperture
Electronic versions:
olesen_et_al_SPIE_2016.pdf
DOIs:
10.1117/12.2214974
Research output: Research - peer-review › Article in proceedings – Annual report year: 2016