NON INVASIVE ASSESSMENT OF AORTIC FLOW WITH 3D AND 2D PCMRI TECHNIQUES
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Introduction
MRI based, non-invasive techniques for measuring arterial flow are gaining interest especially when assessing aortic hemodynamics. 2D phase contrast MRI (PCMRI) sequences provide valuable information regarding aortic flow and geometry but they are limited on evaluating a specific aortic cross-section at a time. Overcoming this limitation, 3D PCMRI sequences can provide the complete time resolved blood flow field rendering possible a more refined visualisation of flow along the aorta [Markl 2007]. The aim of this study was to evaluate both imaging modalities for the estimation of aortic flow waveforms.

Methods
MRI flow measurements were performed in the aorta of 4 male volunteers (no obvious cardiovascular disease, no hypertension medication, non smoking, age range: 26 to 37). The datasets were acquired on a 3T clinical MR scanner (MAGNETOM Trio, Siemens, Germany). 3D (time resolved) PC MRI data of the entire aorta were acquired with an ECG-gated RF-spoiled gradient echo (GRE) sequence. 2D PC MRI data were also acquired at 5 locations along the aorta [Hickson, 2010]. Aortic flow waveforms were visualised and exported at the same location as the 2D cine datasets using 4D flow software (Siemens, Germany). 2D cine flow waveforms were extracted with a specifically developed MATLAB (The Mathworks, USA) script.

Results
Figure 1a presents a comparison between the average of the waveforms in the ascending aorta (for all the subjects) as derived by the two different imaging techniques. 3D PCMRI resulted in lower peak flow values in the ascending aorta. Figure 1b shows the flow waveforms recorded in 5 locations along the aorta with the 3D PCMRI method.

Discussion
A good agreement exists between the derived flow waveforms in 3D and 2D PC MRI datasets. 3D cine data can provide flow waveforms at multiple locations with only one scan. This is an on going study that aims to analyse flow patterns in a large cohort of the aging population.

References
Hickson et al, JACC Card Im 3:1247-1255, 2010

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