Poster presentation

Assessment of the myocardial twisting motion by through-plane velocity-mapping in long axis geometry

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Introduction
Several studies have revealed the relevance of assessing the rotational motion of the heart, especially for selection of DCM patient for CRT therapy, in which a reduced LV twisting was found to be predictive for the response [1,2].

Purpose
The purpose was to evaluate the possibility of combining conventional CINE imaging techniques in long axes geometry with through-plane velocity-encoding for fast simultaneous assessment of the twisting motion.

Methods
The protocol was performed in 3 healthy volunteers. All imaging was performed on a 3 T whole-body-scanner (Achieva, Philips Medical Systems, Netherlands) with a segmented gradient echo phase contrast black blood imaging sequence. 6 long axis views were acquired at 30° angular spacing. The imaging parameters were: TR/TE = 6.8 ms/4.6 ms, resolution $2 \times 2 \times 8$ mm^3, flip angle 15°, VENC = 15 cm/s in through plane direction, 30 heart phases. Black-blood contrast was achieved by the application of two alternating saturation-prepulses with 5 mm distance to the imaged slice. Image acquisition time for each slice was 1:04 minutes. Quantitative through-plane motion analysis was performed by an in-house developed analysis software. After manual segmentation of the left ventricle the rotation angle ϕ was calculated for apical, equatorial and basal segments and compared for retrieval of the twisting motion component.

Results
Figure 1 shows the anatomical (a) and c)) and velocity encoded (b) and d)) images exemplarily for one of the 6 long axis views of one volunteer. The opposing rotational direction of the apex and the basis is clearly revealed in both images. Figure 1e) displays the resulting rotation curves for the myocardial lateral wall. The twist angle (curve blue) shows the typical systolic twisting and diastolic untwisting. The twist angle was the minimal in the septal wall as also described in [3].

Discussion
It has been shown [4] that CINE imaging of 6 long axes (LAX) can be applied for retrieving the regional wall motion score. In this contribution it was shown that the LAX technique can be combined with through-plane motion-encoding, which enables additional assessment of the twisting motion of the myocardium. The combination of both techniques appears promising for the simultaneous identification of the contraction impairments and its impact on the twisting motion, which might enable improved identification of patients prone to respond to CRT.

References
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3. Young , et al.: Circulation 1994, **90(3):**1584.
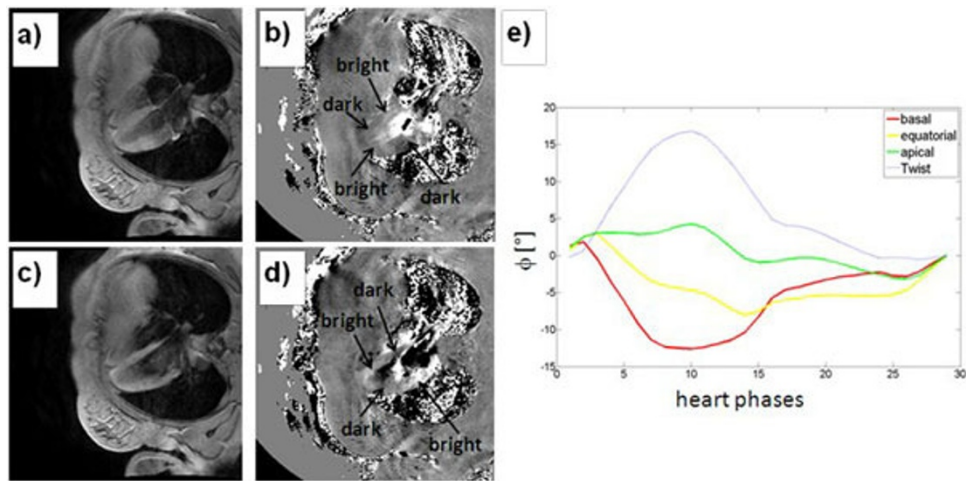4. Bernhardt , et al.: in press.

Figure 1
a) anatomical and b) velocity image at endsystole (heart phase 11); c) anatomical and d) velocity image at diastole (heart phase 6). In both velocity images the velocity twist is visible. In b) the velocity direction of the apical heart is counterclockwise in respect to the short axes geometry and the basal velocity is vice versa. In d) the velocity direction is changed. 1e) displays the angle of the myocardial free wall, by which it is rotated. Red: basal rotation; green: apical rotation; yellow: equatorial rotation and blue: twist angle = phi_{apical} - phi_{basal}.