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Meeting abstract

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2059 Determination of left ventricular asynchrony by cardiac MRI

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Introduction

Cardiac resynchronisation therapy (CRT) is a well established treatment of patients with ischemic or non-ischemic cardiomyopathy classified NYHA III or IV with sinus rhythm, complete left bundle branch block (LBBB, QRS > 120 ms), and a left ventricular ejection fraction (LVEF) < 35%. It is still challenging to identify those patients, who will benefit from CRT. As one criterion for the detection and characterization of asynchrony, the echocardiographically measured septal to lateral intraventricular delay has been described. However, in some patients evaluation by echocardiography is limited due to poor acoustic window.

Purpose

Measurement of intraventricular delay by cardiac MRI (CMR).

Methods

With a 1.5 T MR-Scanner (Magnetom Sonata, Siemens Medical Solutions, Erlangen, Germany) 14 patients with a complete LBBB have been examined in a preliminary study. Balanced Steady State Free Precession cine-sequences (SSFP, TR 3 ms, TE 1.5 ms, FA 60°, spatial resolution 1.4 × 1.4 mm^2) with prospective ECG triggering and retrospective gating in contiguous short axis slices have been applied. By using this sequence, it is possible to calculate 64 images for one cardiac cycle, retrospectively. The virtual temporal resolution, thus, equals one cardiac cycle length in ms divided by 64. At heart rates of 60 to 90 bpm the effective temporal resolution is 10 to 16 ms (true temporal resolution: 31.4 ms). In a basal short axis view, the delay time (TT) between ECG trigger and the maximum wall thickening in the septal and lateral wall was measured by identifying the frame with maximum thickening. The difference was calculated as a measure of intraventricular asynchrony.

Calculation of left ventricular ejection fraction was performed by manual planimetry of the left ventricle short axes by the method of summation of discs. As the standard of reference, echocardiography with calculation of septal to lateral delay in anatomic M-Mode was performed (Vivid 5, GE Vingmed Ultrasound, Horten, Norway). LVEF was determined by Simpson rule.

Correlations among intraventricular delay and LVEF estimated by CMR and DSCT were determined by linear regression analysis. The agreement between both methods was assessed using the Bland Altman method. In addition, contrast enhanced images were acquired (IR-FLASH, TR 8 ms, TE 4 ms, FA 25°) in corresponding slices after infusion of 0.2 mmol/kg BW Gadodiamide (Omniscan®, GE Healthcare Buchler, Munich) for viability diagnostics (detection of delayed enhancement).

Results

Using the above described MR sequence, intraventricular delay of all patients could be calculated by evaluating the difference of the particular maximum wall thickness time points. There is a good correlation to the echocardiographically measured values (r = 0.89). Mean of differences is 20 ms with a standard deviation of 39 ms. Comparing the measured ejection fraction the correlation coefficient is r = 0.91, the mean of differences is -2.9% with standard deviation of 2.1%. In five patients, a myocardial scar was detected (ICM), in eight patients contrast enhanced images show a typical pattern of dilated cardiomyopathy and in one patient no delayed enhancement was found (DCM).

Conclusion

Calculation of intraventricular delay by CMR seems to be possible and, thus, offers the opportunity to calculate asynchrony in patients who have limitations to echocardiography. Another advantage is that information on the degree of functional loss and on viability of the myocardium can be collected at the same examination. In order to prove if the described CMR technique is sufficient to identify CRT responder, further long term follow up studies are needed.