Journal of Cardiovascular Magnetic Resonance

Poster presentation

Open Access

Visualization and characterization of transmural gradients in high resolution first pass perfusion images

Gilion LTF Hautvast*[1], Amedeo Chiribiri[2], Marcel Breeuwer[1], Eike Nagel[2] and Sven Plein[3]

Address: [1]Philips Healthcare, Best, Netherlands, [2]King's College London, London, UK and [3]University of Leeds, Leeds, UK
* Corresponding author

from 13th Annual SCMR Scientific Sessions
Phoenix, AZ, USA. 21-24 January 2010

Published: 21 January 2010

Journal of Cardiovascular Magnetic Resonance 2010, **12**(Suppl 1):P247 doi:10.1186/1532-429X-12-S1-P247

This abstract is available from: http://jcmr-online.com/content/12/S1/P247

Introduction

High spatial resolution imaging enables detailed assessments of the spatial variation of myocardial perfusion. Transmural gradients in myocardial perfusion are of particular interest, as the endocardium is more sensitive to ischaemia from a coronary stenosis than the epicardium. Gradients in myocardial perfusion are also seen in left ventricular hypertrophy and microvascular disease.

Purpose

We present a new method to visualize and characterize the temporal evolution, severity and extent of subendocardial to subepicardial gradients in myocardial contrast uptake on first-pass myocardial perfusion CMR.

Methods

Our new method relies on high spatial resolution imaging and an integrated motion compensation algorithm to enable extraction of signal intensity curves in layers within the myocardium. By subtracting signal intensities of the epicardial and endocardial layers, a so-called "gradientogram" is generated, in which the horizontal axis corresponds to time, the vertical axis corresponds to the angular position and the grey values correspond to the transmural gradient in contrast uptake. From each line in the gradientogram, the mean and peak gradient can be measured. Moreover, perfusion deficits causing a transmural gradient appear as dark blobs that can be segmented to allow for quantitative characterization, which can include measurements related to the gradient ampli-

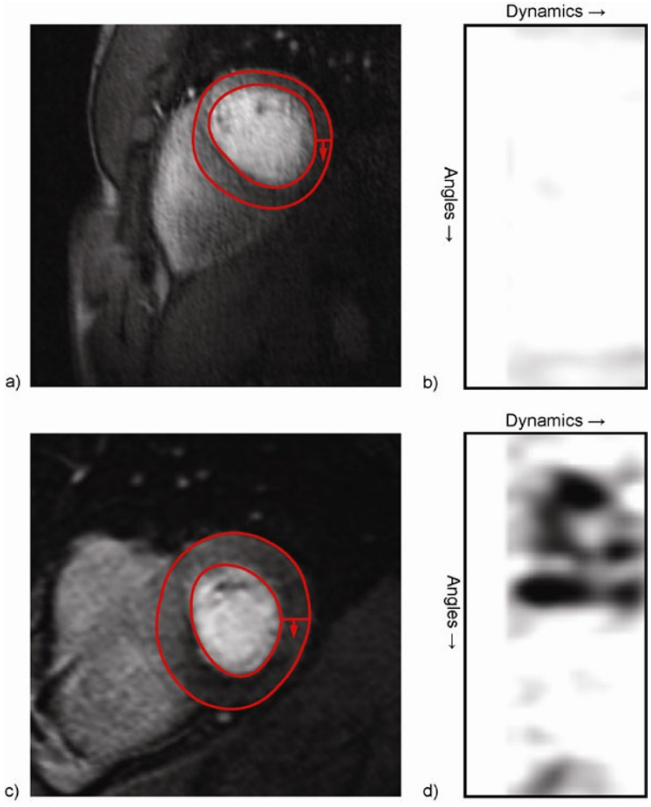

Figure 1
Original data and gradientogram of the basal slice in the negative (a, b) and positive case (c, d).

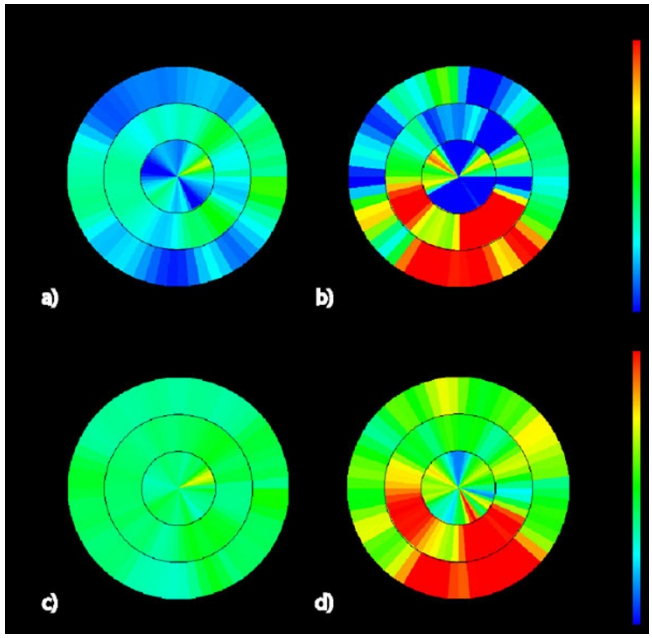

Figure 2
Bulls eye plots for the negative (a, c) and positive case (b, d) of the mean (a, b) and peak (c, d) gradient.

tude (i.e. intensities within the segmentation), the temporal persistence (i.e. the width of the segmentation) and the circumferential extent (i.e. the height of the segmentation) in which transmural gradients occur.

Results

We tested our method on a negative and a positive case. First-pass perfusion images were acquired using high resolution kt-accelerated imaging. Visualization of gradientograms after motion compensation and contour delineation revealed a clear distinction between the negative (figure 1ab, homogenous gradientogram) and positive case (figure 1cd, dark signal corresponding to an inferior perfusion defect). Measurements of the mean and peak gradient were visualized in a bull's eye plot (figure 2). Quantitative characterization of the segmented gradientogram at all slices of the positive case showed that the transmural gradient spanned 42.7-146.4 degrees, persisted for 6.4-15.7 seconds and had an average amplitude of 93.2-161.5.

Conclusion

We have developed a novel method to visualize and characterize transmural gradients in myocardial contrast uptake. More extensive validation experiments will be performed to establish the clinical value of our method.