

Multicontrast Delayed Enhancement (MCOE) Newly Characterizes A Common Linear Delayed Enhancement Abnormality in the Anteroseptum of the Heart

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Introduction: Myocardial infarction as documented by gadolinium delayed enhancement has been shown to have prognostic significance[1]. Atypical patterns of delayed enhancement within cardiomyopathic processes such as hypertrophic cardiomyopathy are also thought to be associated with arrhythmias [2], and any form of myocardial delayed enhancement may portend a poor prognosis. Two common locations of high signal intensity on delayed enhancement are within the septum and the right ventricular insertion into the inferoseptal-inferior wall junction. While atypical delayed enhancement of the right ventricular insertion point is not uncommon, high signal intensity findings within the anteroseptum are not as well-characterized. On a basal short-axis view or on a three-chamber view, a sliver of bright signal intensity is often seen between a moderator band or papillary muscle and the septum. Whether this represents a thin layer of blood or solid tissue has not been resolved. Multicontrast delayed enhancement (MCOE) [3] is a technique that has been useful in discriminating subendocardial myocardial infarction from blood pool by simultaneously providing a T2-weighted image in addition to the standard delayed enhancement image, thus allowing distinction between true enhanced myocardium and blood pool. In this pilot study, our goal was to use MCOE to distinguish whether delayed enhancement in the interventricular septum was truly within myocardium or represented blood.

Materials and Methods: Twenty patients with a region of atypical delayed enhancement within either the left ventricular septum or the right ventricular insertion into the myocardium were enrolled over a two month period and imaged with steady state free precession-MCOE (SSFP-MCOE). Typical imaging parameters included a matrix of 256 x 126 mm, slice thickness 6 mm, TI 300 msec, TE 1.6, BW 930 Hz/pixel, readout flip angle 50° for the T1-weighted IR image, and 65° for the T2-weighted image, and rate 2 parallel imaging. The imaging was performed on either a 1.5 T Siemens Espree or Avanto scanner approximately 10-15 minutes after the administration of 0.15 mmol/kg of Gadolinium-DTPA. Images were analyzed for bright signal intensity within the region of interest on both the T1-weighted image and the T2-weighted image. Normal myocardium and blood pool regions of interest were also obtained for comparison.

Results: Out of the 20 patients, 19 patients had diagnostic quality MCOE images. One exam was unable to be analyzed due to artifact. From the 19 patients, there were 20 MCOE datasets (one patient had two separate regions in question). There were 15 high signal intensity abnormalities within the septum and six abnormalities at the right ventricular insertion point. The abnormalities were categorized into groups of linear (n = 11), patchy (n = 7), and focal (n = 3) patterns. Of these abnormalities, all 14 septal regions in question had intermediate T2W and T1W signal intensity characteristics that were more similar to myocardium than blood pool. All six right ventricular insertion point abnormalities appeared to be true atypical delayed enhancement with high signal intensity on the T1 image but low signal intensity on the T2 image.

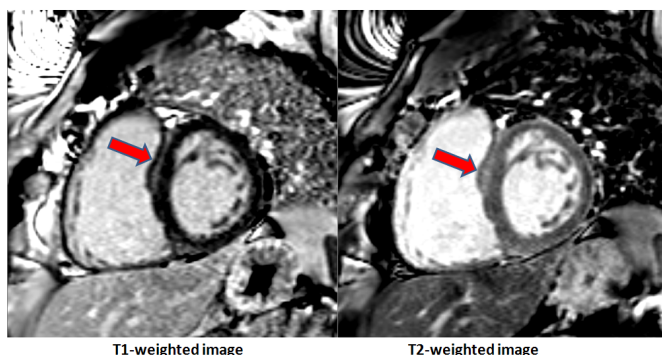


Fig.1a Left panel: A bright linear signal intensity within the septum on the T1-weighted image is often thought to be due to blood pool; however, the signal intensity on the T2-weighted image is more like that of myocardium than blood pool.

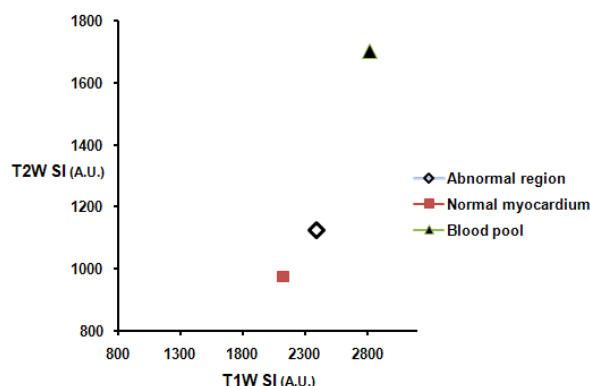


Fig.1b Right panel: The same patient's signal intensity values from the T1 and T2 images are plotted against each other, illustrating the inherent differences between blood pool and normal myocardium. The high signal intensity region in the septum demonstrates intermediate T2 characteristics, closer to that of myocardium than blood pool.

Discussion: Our study demonstrates that a commonly visualized region of atypical delayed enhancement within the anteroseptum is not blood pool but rather a tissue structure. We postulate that the linear abnormality is a band of fibrous tissue either associated with the membranous septum or the aortic root. Incorrectly interpreting high signal intensity as myocardial delayed enhancement can also dilute the diagnostic value of the test and may affect patient management. MCOE is a technique that can distinguish between myocardial delayed enhancement and blood pool adjacent to the myocardium. Since many of the possible atypical regions of delayed enhancement are small or thin, it is an important technical benefit of MCOE that the T2 and T1 weighted images are acquired within the same breathhold, eliminating registration issues. However, since the T2 image has some residual T1-weighting, a post-contrast image must be interpreted cautiously with regard to subtle signal intensity changes.

References: [1] Kwong R., et al, *Circulation* 2006;113:2733-43. [2] Adabag A., et al, *JACC* 2008;51:1369-74. [3] Kellman P., et al, *J Magn Reson Imaging* 2005;22:605-13.