

POSTER PRESENTATION

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Quantitative comparison of 2D and 3D late gadolinium enhancement MR imaging for cardiomyopathies

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Background

LGE is widely used as a means to quantify scar or fibrotic tissue in patients suffering from cardiomyopathies. In clinical routine 2D data acquisition is most commonly practiced, albeit having the drawback of multiple breath-holds and long acquisition times. 3D acquisition can significantly reduce acquisition time. This leads to shortened scan time and a more efficient use of available MRI resources. So our purpose was to determine whether the quantification of myocardial fibrosis in patients with Fabry disease and hypertrophic cardiomyopathy (HCM) using a late gadolinium enhancement (LGE) single-breath-hold three-dimensional (3D) inversion recovery magnetic resonance (MR) imaging sequence is comparable with a clinically established two-dimensional (2D) multi-breath-hold sequence.

Methods

40 consecutive patients (18 men; mean age 50 ± 17) with either Fabry disease ($n = 18$) or HCM ($n = 22$) were enrolled in this prospective study. Studies were conducted on a 1.5-T clinical MR imaging system. Spatial resolution was the same for 3D and 2D images (field-of-view, 350×350 mm²; in-plane-resolution, 1.2×1.2 mm²; section-thickness, 8 mm). Datasets were analyzed for subjective image and quantitative evaluation of myocardial mass (grams), fibrotic mass (grams) and total fibrotic tissues percentage. Statistical analysis included Wilcoxon-signed-rank test, student's t-test for paired samples and Bland-Altman analysis.

Results

There was no significant difference in subjective image quality between acquisitions ($P > 0.1$) for either disease. In patients with Fabry disease there was no significant differences in myocardial mass between 3D ($100.7 \text{ g} \pm 30.8 \text{ g}$) and 2D acquisition ($99.9 \text{ g} \pm 31.9 \text{ g}$; $P = 0.55$), as well as for fibrous tissue mass ($3.9 \text{ g} \pm 6.4 \text{ g}$ vs $4.0 \pm 6.4 \text{ g}$; $P = 0.89$) and total fibrous percentage ($3.4\% \pm 5.5\%$ vs 3.4 ± 5.5 ; $P = 0.89$). Bland-Altman analysis showed good agreement between 3D and 2D datasets for myocardial mass (mean difference: 0.8 g; limits of agreement: -10.2 g - 11.8 g), fibrous tissue mass (mean difference: -0.02 g; limits of agreement: -1.45 g-1.41 g), total fibrous percentage (mean difference: 0.02%; limits of agreement: -1.31%-1.35%). In patients with HCM there was no significant differences in myocardial mass between 3D ($115.5 \text{ g} \pm 33.3 \text{ g}$) and 2D acquisition ($116.7 \text{ g} \pm 33.6 \text{ g}$; $P = 0.48$), as well as for fibrous tissue mass ($5.6 \text{ g} \pm 8.6 \text{ g}$ vs $5.7 \text{ g} \pm 8.7 \text{ g}$; $P = 0.6$) and total fibrous percentage ($4.3\% \pm 6.4\%$ vs $4.3\% \pm 6.5\%$; $P = 0.89$). Bland-Altman analysis showed good agreement between 3D and 2D datasets for myocardial mass (mean difference: -1.2 g; limits of agreement: -16.1 g - 13.7 g), fibrous tissue mass (mean difference -0.08 g; limits of agreement: -1.33 g - 1.17 g), total fibrous percentage (mean difference: -0.01 g; limits of agreement: -1.01 g-0.99 g). Acquisition time was significantly shorter for 3D sequences ($24.9 \text{ seconds} \pm 5.2 \text{ seconds}$) as compared to 2D sequence ($349.1 \text{ seconds} \pm 62.3 \text{ seconds}$, $P < 0.001$).

Conclusions

3D LGE imaging enables comparable quantification of fibrous myocardial tissue compared to a 2D sequence at a faster acquisition rate.

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