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Diastolic function with 3D three-directional velocity encoded MRI in patients with ischemic cardiomyopathy

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Introduction

Three-dimensional (3D) three-directional velocity-encoded (VE) MRI more accurately describes transmitral flow and regurgitation in patients with ischemic cardiomyopathy, as compared to 2D one-directional VE MRI. However, the value of diastolic function assessment from 3D VE MRI in patients with ischemic cardiomyopathy has not yet been studied.

Purpose

To compare 3D three-directional VE MRI with two-dimensional (2D) one-directional VE MRI for assessment of diastolic function in patients with ischemic cardiomyopathy.

Methods

Local medical ethics committee approval was obtained and 44 patients (31 men; mean age 60 years) gave written informed consent. Diastolic function parameters, early diastolic mitral septal velocity (E'), effective forward flow volume and regurgitation fraction were determined from transmitral flow graphs, with both VE MRI methods. Furthermore, early mitral velocity (E), E' , E/A ratio and E/E' of both VE MRI methods were compared to echocardiography.

Results

3D three-directional VE MRI is statistically significantly different from 2D one-directional VE MRI for all parameters describing diastolic function, except for E/A -ratio. Fur-

thermore, three-directional VE MRI is statistically significantly different from 2D one-directional VE MRI for assessing net forward flow (mean signed difference: $-19.3 \text{ ml} \pm 13.9(\text{sd})$; p -value < 0.01 ; Pearson correlation (r) 0.8) and regurgitation fraction (mean signed difference: $5\% \pm 7\%(\text{sd})$; p -value < 0.01 ; Pearson correlation (r) 0.5) at the mitral valve. Furthermore for both MRI-methods E , E' , E/E' differed significantly from echocardiography, except for E/A -ratio. However, agreement between 3D VE MRI and echocardiography was better as compared to 2D VE MRI and echocardiography. Results for E , E' , E/E' E/A -ratio for both VE MRI methods and echocardiography are described in table 1.

Conclusion

3D three-directional VE MRI is more accurate in transmitral flow assessment than 2D one-directional VE MRI, and therefore we assume that diastolic function parameters are more accurately assessed with 3D three-directional VE MRI. Also, 3D three-directional VE MRI shows better agreement with echocardiography.

Table 1: Comparison between 3D, 2D VE MRI methods and echocardiography.

	Paired t-test Mean difference	95% CI	p-value	Correlation R	p-value
Early mitral velocity (m/sec ²)					
3d MRI to 2d MRI	-7.3	-10.0 ± -4.6	< 0.01*	0.6	< 0.01*
3d MRI to echo	-43.0	-49.9 ± -36.1	< 0.01*	0.5	< 0.01*
2d MRI to echo	-35.7	-42.9 ± -28.4	< 0.01*	0.4	0.01
E' (m/sec ²)					
3d MRI to 2d MRI	-8.5	-10.9 ± -6.1	< 0.01*	0.05	0.75
3d MRI to echo	0.7	-0.2 ± 1.6	< 0.12*	0.11	0.48
2d MRI to echo	9.3	6.9 ± 11.6	< 0.01*	0.14	0.37
E/E'					
3d MRI to 2d MRI	5.2	3.7 ± 6.7	< 0.01*	0.06	0.71
3d MRI to echo	-15.7	-27.4 ± -3.9	0.01*	-0.01	0.93
2d MRI to echo	-20.9	-32.5 ± -9.2	< 0.01*	0.05	0.77
E/A ratio					
3d MRI to 2d MRI	-0.24	-0.6 ± 0.1	0.21	0.8	< 0.01*
3d MRI to echo	0.17	-0.1 ± 0.5	0.25	0.8	< 0.01*
2d MRI to echo	0.41	-0.1 ± 0.8	0.06	0.7	< 0.01*

E': early mitral septal velocity in (m/sec²); E/E': ratio of Early mitral velocity divided by early mitral septal velocity; E/A-ratio: ratio of Early mitral velocity divided by atrial mitral velocity. * MRI and echocardiography parameters were compared using the paired t-test, mean differences, 95% confidence intervals (95% CIs) and p-values were given. * p < 0.05.

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