Left Ventricular Structure and Function Assessed by Cardiac MRI in Hemodialysis Patients

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Background

• Echocardiography assessment of left ventricular mass and geometry varies with fluctuations in volume status and limits its usefulness in patients undergoing hemodialysis

• Cardiac MRI may provide more accurate, detailed and reproducible images of the heart

Methods

• We performed 3D Cardiac MRI on 30 stable hemodialysis patients with a GE scanner. Four patients underwent a second MRI to assess reproducibility

• LV mass, length, diameter, ejection fraction, wall thickness, volume and geometry measurements were determined using FIESTA sequences with contiguous short axis slices using Simpson's rule, a combination of 2, 4 and 5 chamber views

• We compared our results to a previously reported normal population pubished in the *Journal of Cardiovascular Magnetic Resonance, No.1 Jan 2005*

Definitions

• LV Mass Index = LV Mass / Body Surface Area

• End Diastolic Volume Index = End Diastolic Volume / Body Surface Area

• LV Diameter = Septum --- Posterior wall distance (short axis view in diastole)

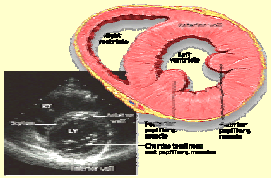
• LV Length = Apex --- MV Annulus distance (4 chamber view in diastole)

Relative Wall Thickness = $\frac{\text{(Septal Wall Thickness + Lateral Wall Thickness)}}{\text{LV Diameter}}$

LV Sphericity Index = LV Length / LV Diameter

Demographics

	Males n=20	Females n=10	Combined n=30
Age (years)	57 ± 16	67 ± 13	60 ± 16
Hemoglobin (g/dl)	11.9 ± 0.9	12.4 ± 0.8	12.1 ± 0.9
Systolic Blood Pressure (mm Hg)	147 ± 31	147 ± 26	147 ± 29
Diastolic Blood Pressure (mm Hg)	83 ± 17	77 ± 19	81 ± 18
Body Surface Area (m^2)	1.9 ± 0.2	1.9 ± 0.3	1.9 ± 0.2
Body Mass Index (kg/m^2)	25 ± 4	29 ± 7	26 ± 6
Coronary Disease (n)	6	7	13
Diabetes (n)	4	7	11
Hypertension (n)	19	10	29
Converting Enzyme Inhibitors (n)	12	2	14
EKG Left Ventricular Hypertrophy (%)	50	33	42



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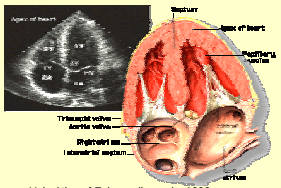

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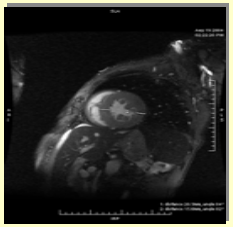
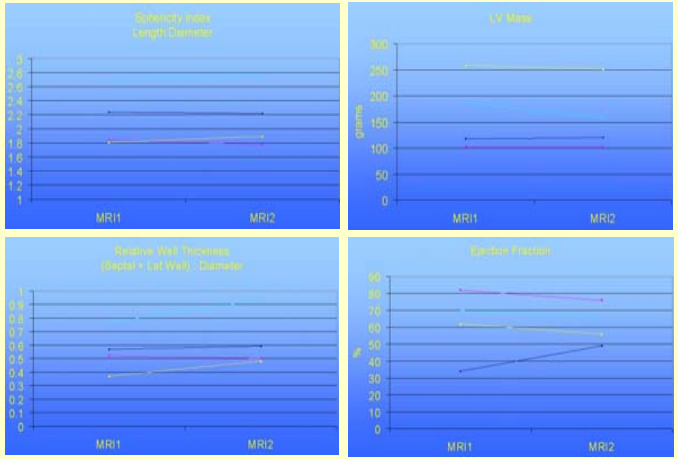


Results

	Males (n=20)	Females (n=10)	Combined (n=30)	Normal† (n=150)
Ejection Fraction (%)	57 ± 15	60 ± 19	58 ± 16	60 ± 5
LV Mass (g)	184 ± 65	137 ± 30	169 ± 59*	107 ±17
LV Mass Index (g/m^2)	99 ± 36	74 ± 17	91 ± 33*	62 ± 10
End Diastolic Volume Index (ml/m^2)	98 ± 39	89 ± 33	95 ± 37*	71 ± 13
Relative Wall Thickness	0.54 ± 0.21	0.59 ± 0.20	0.56 ± 0.20*	0.35 ± 0.09
3D Geometry: LV Mass / End Diastolic Volume (g/ml)	1.05 ± 0.25	0.87 ± 0.18	0.99 ± 0.24	0.92 ± 0.20
3D Geometry: LV Sphericity Index	2.09 ± 0.32	2.06 ± 0.35	2.08 ± 0.32	2.00 ± 0.21

LV = Left Ventricular † JCMR Jan 2005 * p< 0.05 combined vs. normal

Reproducibility



Conclusions

• LV mass and relative wall thickness are increased in hemodialysis patients

• 3D LV geometry as demonstrated by LV sphericity index and LV mass:volume ratio are similar to normal controls

• Cardiac MRI results appear to be reproducible

Discussion

Cardiac MRI provides 3D geometry information that is not available with echocardiography and appears to have greater reproducibility.

Cardiac MRI does not appear to be adversely affected by the significant patient volume fluctuations inherent in hemodialysis patients as is commonly seen with echocardiography.

Hypertension is a likely cause of the increased LV mass and relative wall thickness we measured in our patients. Surprisingly, the 3D geometry appears to be well preserved despite the increased LV mass. Further study will need to be performed to determine the clinical significance of the 3D geometry information that Cardiac MRI provides.