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Hall F, West Concourse
Nuclear Magnetic Resonance Imaging

DETERMINATION OF ATRIAL SEPTAL DEFECT SIZE BY NUCLEAR MAGNETIC RESONANCE IMAGING.

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With the introduction of techniques for percutaneous catheter closure of atrial septal defects (ASD), accurate sizing of ASDs is essential for appropriate patient selection. We studied 13 patients (mean age 45, range 12-67) with ASDs (12 secundum, 1 sinus venosus) by NMR imaging (MRI) at 0.6 Tesla. High resolution Spin Echo (SE) images were obtained in 2 orthogonal views (short axis, four chamber) perpendicular to the plane of the inter-atrial septum (IAS). Gradient echo cine images with velocity compensation in the read-out direction (with and without first moment gradient nulling in the slice select direction) were obtained in the plane of the ASD. The ASD area (cm^2) was determined by planimetry of the region of signal enhancement due to shunt flow across the ASD (usually best seen in early diastolic cine MRI frames), or by planimetry of the region of phase change due to through-plane flow along the slice selection gradient in phase reconstructed cine MRI images. MRI measurements were compared to templates cut during surgery to match the defect (n=8), or to ASD diameter determined by balloon sizing at catheterization (n=5).

ASD areas by cine MRI (y) were well correlated with areas derived from templates or balloon diameters (x) (y=0.88 x, r=0.91). Calculation of the ASD area from the 2 orthogonal SE views, assuming an elliptical opening with major and minor axes equal to the length of signal drop-out of the IAS in the SE images, overestimated the ASD size by 192% when compared to x.

We conclude that accurate ASD size can be determined by dynamic imaging of the trans-septal flow stream. SE imaging, using the assumed geometrical limitations, overestimates the ASD size. Thinning and possibly increased mobility of the central portion of the IAS may be responsible for the larger signal void.

MAGNETIC RESONANCE IMAGING OF HUMAN TRANSPLANTED HEARTS WITH GADOLINIUM-DOTA MYOCARDIAL ENHANCEMENT: POTENTIAL USE FOR THE DETECTION OF REJECTION.

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To study the value of Gd-DOTA myocardial enhancement (ME) in 1.5 T MRI for the detection of heart rejection (HR), 40 examinations (Ex) were performed in 32 orthotopic heart transplant recipients (OTR). Twenty T2 measurements (M) were performed using TE 30, 60 ms and TR=RR. Left ventricular ME was assessed on T1 weighted image (TE 30 or 20 ms) before and 4, 9 minutes after IV Gd-DOTA (0.1 mmol/kg).ME (%) was defined by signal (S) measured in region of interest (ROI) as (maximal post iv S-pre iv S) / pre S x 100, with a maximal ME value equal to peak ME and average ME value equal to mean. Histological graded HR determined groups of OTR: A= No HR; B=mild focal HR; C=mild diffuse or moderate HR (who need specific treatment).

T2 M was feasible in only 10 Ex, but did not correlate with histological findings. ME results were as follows:

	A	B	C	A vs B	B vs C
n Ex	13	12	7		
peak ME%	85	123	138	p<0.01	p NS
mean ME%	54	68	81	p<0.05	p NS
sd dev peak/mean		44 / 27	21 / 16	47 / 30	

In 6 OTR (14 Ex) observed at different time points after surgery, 2 cases in 4 OTR in higher HR grade at the second Ex showed increased ME.In last 2 OTR one decreased ME after HR treatment; one were stable case with similar ME. **Conclusion:** MRI using Gd-DOTA ME permits separation of normal OTR and HR, without allowing grading of the severity of rejection. It may prove valuable for the detection of HR and the selection of cardiac biopsy candidates.

A NEW SEMI-AUTOMATED METHOD FOR DEFINING LV VOLUMES FROM SHORT-AXIS CINE NMR IMAGES

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LV volumes are currently defined from multi-phase, multi-slice gradient echo images by manually outlining the endocardium in each slice. A new method, which finds edges based on classifying pixels using statistical information in local neighborhoods (CLASS), has been developed. Internal calculations were verified by comparing completely automatic CLASS volume with that of a cast made from an excised dog heart. LV cast volume by CLASS was 42.9ml vs. 44.7ml by water displacement. Verification was then performed using 8 volunteers comparing EDV, ESV, and EF obtained by CLASS with those from regions of interest (ROIs) drawn manually by an independent observer (MANUAL). ROIs were generated from stacked slice cine images (total 696). Percent of boundary voxels determined to be found automatically by an experienced observer was 94±4%. MANUAL EDV ranged from 77 to 207ml; ESV 26 to 81ml; EF 47% to 67%. Correlations between CLASS and MANUAL were: EDV r=0.98, SEE=8.4ml; ESV r=0.98, SEE=4.6ml; EF r=0.92, SEE=3.1%. Using CLASS, LV volumes can now be determined routinely with a high degree of objectivity and marked reduction in analysis time.

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Hypertrophic Cardiomyopathy

HEMODYNAMIC AND DIAGNOSTIC IMPLICATIONS OF MYOCARDIAL CATECHOLAMINES IN MYOCARDITIS AND CARDIOMYOPATHY: AN ENDOMYOCARDIAL BIOPSY STUDY

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The aim of this study was to assess diagnostic utility of myocardial catecholamine concentration in pts with biopsy proven myocarditis (M), dilated (DCM) and hypertrophic (HCM) cardiomyopathy. Myocardial norepinephrine (MNEC) and epinephrine (MEC) concentrations were measured using catechol-O-methyl-transpherase radioenzymatic method. The comparison of myocardial catecholamines in LV endomyocardial biopsies (EMB) of 34 pts with HCM (64% males, aged 29-54 years) and 32 pts with DCM (75% males, aged 21-56 years) showed significantly higher (t=20.9, p<0.01) MNEC (781 ± 125 HCM vs 262 ± 68 ng x g^{-1} fresh tissue DCM) and MEC (91 ± 13 HCM vs 35 ± 6 ng x g^{-1} DCM) in HCM. In the same group of DCM pts, we correlated MNEC and MEC with LV hemodynamic parameters. A significant correlation between MNEC and LV ejection fraction (r=0.49, p=0.007), LV max dp/dt (r=0.54, p=0.003) and LVEDP (r=-0.35, p=0.046) was found. MEC correlated closely with LV ejection fraction (r=0.61, p=0.001), LVEDP (r=-0.43, p=0.018) and PCWP (r=-0.52, p=0.005). The comparison of myocardial catecholamines in EMB of 20 pts with M (80% males, aged 18-42 years) and 32 pts with DCM showed markedly higher MNEC (262.2 ± 68.9 DCM vs 415.45 ± 71 ng x g^{-1} fresh tissue M, t=-10.6, p<0.001) in pts with M. These data indicate myocardial catecholamines may be useful for both diagnostic and functional evaluation in pts with heart muscle disease.