Results: All lesions were clearly visible in each canine heart. The mean lesion size of in-vitro cardiac tissue was 13.0±2.3, 22.0±4.2, 30.2±4.8, 33.0±5.3, and 34.3±3.2 mm^2 respectively. The mean lesion size of in-vivo dog hearts was 8.5±4.2, 16.2±5.3, 23.0±9.4, 30±3.2, and 33±5.3 mm^2, respectively. There was no statistical difference in lesion size between each study, however, the in-vivo lesions tended to be smaller.
Conclusion: HIFU can be used to create targeted, well-demarcated thermal lesions in the ventricular myocardium during cardiac contraction. HIFU may allow for a noninvasive approach to ablation of cardiac tissues in many disease processes.

1168-163 High Frequency Ultrasound Thrombolysis: In Vitro Effects of Ultrasound Mode, Duration, Temperature, and Frequency

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Background: physical factors influencing ultrasound thrombolysis efficacy are incompletely understood.
Methods: a diagnostic echo transducer was operated by a pulse generator and an amplifier to insonate freshly obtained human blood clots after storage for 4 h at 8° C (mean mass 495± 235 mg). Clots were positioned in a water bath in the focal zone at 7.5 cm from the transducer distance and precision-weighed before and after insonation. Thrombolytic efficacy was expressed as percent baseline thrombus mass ablation. Control clots were positioned in the same experimental setup, but not insonated. Insonation time was 10-60 min. Ultrasound frequency varied 2-4.5 MHz. Ultrasound intensity in the focal zone measured by a hydrophone varied 6.5-90 W/cm2 (spatial peak temporal average). Continuous wave mode was compared to pulsed wave mode with duty cycles of 1:100, 1:50, and 1:10. 20° C versus 37° C temperature and tap water bath versus saline bath were also compared. For each combination of factors, at least five clots exposed to insonation were compared to five control (not insonated) clots.
Results: in a total of 147 experiments, ultrasound ablated thrombi with an average efficacy of 46% versus 27% in 147 controls (p<0.0001). Efficacy varied directly with output power (p<0.01) and insonation time (r=0.81, p<0.01), increased with increasing duty cycle and was highest with continuous wave ultrasound (p<0.01). A temperature of 37° C and saline were more effective than 20° C and tap water, respectively (each p<0.05). Corrected for focal zone intensity, thrombolytic efficacy was inversely dependent on ultrasound frequency (r=-0.72, p<0.001).
Conclusions: ultrasound in the 2.0-4.5 MHz frequency range ablates fresh thrombus at a distance without the use of adjuvant thrombolytic or contrast agents. The thrombolytic efficacy depends directly on mode of operation, duration and inversely on the frequency of insonation.

1168-164 Relation of Diastolic Strain Measurements by Doppler Echocardiography to Myocardial Structure and Function in Healing Canine Infarcts: Implications for the Assessment of Myocardial Viability

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Background Assessment of regional diastolic function by strain Doppler imaging is a new promising technique. However, the hemodynamic and structural determinants of these measurements have not been adequately examined.
Methods Sixteen dogs underwent LAD (n=8) or circumflex (n=8) occlusion. All animals were imaged at baseline, acutely and 1-8 weeks post infarction (MI). In 10 dogs, invasive hemodynamic monitoring with a conductance catheter placed in the left ventricle (LV) was performed at the above time points. Dobutamine was infused post MI to examine LV contractile reserve. Histopathological analysis was performed on all animals (n=16) to determine the extent of interstitial fibrosis as well as the cellular and fibrillar interstitial changes post MI. ResultsAcutely and at 1-8 weeks post MI, diastolic strain rate measurements (in radial and longitudinal planes) decreased significantly (44% and 65%, respectively, p<0.01) in the distribution of the diseased artery and were significantly (correlation shown for radial and longitudinal strain rate) related to: tau (r=-0.74 ; -0.9, p<0.01), end systolic wall stress (r=-0.72 ; -0.9, p<0.01), stroke volume (r=0.78 ; 0.9, p<0.01), filling pressures (r=0.59 ; 0.62, p<0.01) and the ratio of cellular infiltration to collagen accumulation (r=0.81 ; 0.88, p<0.01). Among several indices of systolic and diastolic function, diastolic strain rate during dobutamine infusion readily identified segments with >20% transmural infarction and related best to the extent of interstitial fibrosis (r=-0.86, p<0.01).
Conclusions
Diastolic strain rate measurements are dependent on LV preload, afterload, tau, stroke volume and myocardial structure. In an animal model of healing canine infarcts, diastolic strain rate by Doppler appears to be a promising novel index of myocardial viability.

POSTER SESSION

1169 The Detection of Myocardial Fibrosis, Necrosis, and Inflammation by Magnetic Resonance Imaging

Tuesday, March 09, 2004, 3:00 p.m.-5:00 p.m.
Morial Convention Center, Hall G
Presentation Hour: 4:00 p.m.-5:00 p.m.

1169-151 Prediction of Reversible Left Ventricular Dysfunction: Comparison of Contrast-Enhanced Magnetic Resonance Imaging and Thallium-201 SPECT

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Background: Contrast-enhanced (ce) magnetic resonance imaging (MRI) has been shown to assess myocardial viability. We compared ce MRI and Thallium-201(Tl-201) single photon emission computed tomography (SPECT) to predict reversibility of left ventricular (LV) dysfunction.
Methods: 57 patients (pts) with LV dysfunction (EF 39±13%) were examined. Functional cine studies and ce images were acquired. Rest-redistribution SPECT was performed. 32 pts had suffered acute myocardial infarction (MI) and were examined with follow-up cine MRI studies 9 months after MI. The other 25 pts showed chronic LV dysfunction and were repeatedly examined 9 months after revascularization. A 17-segment model was analysed for MRI and SPECT. Segmental hyperenhancement (HE) for MRI and tracer uptake for SPECT were quantified. For MRI, segments were considered to be viable if showing less than 25% segmental HE, for SPECT, if more than 60% Tl-201 uptake. Functional recovery in the follow-up MRI was correlated with prediction of viability by both imaging modalities. LV ejection fraction (EF) for both MRI scans was determined.
Results: In pts with acute MI, 151 of 255 (59%) dysfunctional segments showed improved wall motion with follow-up MRI. In these pts, ce MRI showed a sensitivity (sens) of 93%, a specificity (spec) of 91%, and an accuracy (acc) of 92% to detect viable myocardium, whereas SPECT a sens of 87% (p=0.3), a spec of 58% (p=0.0008), and an acc of 66% (p=0.003). In pts with chronic LV dysfunction, 79 of 161 (49%) revascularized dysfunctional segments improved. In these pts, ce MRI exhibited 94% sens, 95% spec, and 94% acc for detection of viable myocardium as compared to 86% sens (p=0.7), 56% spec (p=0.002), and 68% acc (p=0.006) for SPECT. Increase of LVEF >5% was shown in 13 (41%) pts with acute MI, and in 10 (40%) pts with chronic LV dysfunction. Multivariate regression analysis identified the dysfunctional-but-viable ratio by ceMRI as the only predictor of increase in LVEF >5%(p<0.05), whereas the equivalent by SPECT was not predictive.
Conclusion: Ce MRI, compares favorably to Tl-201 SPECT for prediction of regional and global improvement of dysfunctional myocardium in the setting of acute and chronic myocardial ischemia.

1169-152 Clinical Evaluation of Patients With Suspected Coronary Artery Disease Using a Multimodality Stress Magnetic Resonance Imaging Protocol

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Background Stress perfusion MRI (pMRI) requires high temporal resolution which limits image quality and potentially introduces artifacts. We hypothesized that a clinically feasible stress MRI protocol including cine and contrast enhancement MRI (ceMRI) results in improved diagnostic accuracy.
Methods We prospectively enrolled 69 consecutive pts (age 58.5±11.2 yrs, 29 F) without history of cardiac disease referred for coronary angiography (CA). Cine MRI, ceMRI, adenosine and rest pMRI was performed in 62 pts within 24 hrs prior to CA. For pMRI, a SR GRE-EPI sequence was used (109 msec / slice; 4-5 slices per heart beat; 0.0625 mmol/kg Gd). All MRI studies were randomized into a pool including 30 control pts and analyzed qualitatively, blinded to pt identitiy, as follows: pMRI alone, cine alone, ceMRI alone, and incorporating all 3 sets of MRI data. Coronary artery disease (CAD) was defined as stenosis ≤ 70% on CA.
Results The sensitivity, specificity and diagnostic accuracy of pMRI, cine, and ceMRI alone are shown in the table. The multimodality analysis had the highest accuracy which was significantly improved (P=0.02) compared to pMRI alone. Specificity was improved by the recognition that matched stress and rest pMRI defects in the absence of corresponding hyperenhancement on ceMRI were artifacts and not true perfusion defects.
Conclusion A clinically feasible, multimodality stress MRI protocol has a significantly higher diagnostic accuracy compared to stress perfusion MRI alone for the detection of CAD.

	Sensitivity	Specificity	Accuracy
pMRI alone	80 %	68 %	73 %
Cine alone	52 %	62 %	58 %
ceMRI alone	40 %	97 %	74 %
Multimodality	84 %	89 %	87 %