ABILITY OF MAGNETIC RESONANCE IMAGING TO DISTINGUISH STUNNED FROM INFARCTED MYOCARDIUM FOLLOWING TRANSIENT EXPERIMENTAL ISCHEMIA

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Determining the success of coronary reperfusion may be difficult early in the course of ischemia because of an inability to distinguish stunned but viable tissue from infarcted myocardium. To test the ability of MRI to distinguish reversibly ischemic (TC+-) from infarcted (TC-) myocardium, 16 dogs underwent coronary occlusion for 30, 60 or 120 min prior to reperfusion. Wall thickening (WW) and wall motion were measured using 2D echo at baseline, during coronary occlusion, and 3 times during reperfusion: before MRI, after MRI and 12-14 h later. Risk area was estimated with contrast echo. Spin-echo multislice short-axis images (TE 26 and TE 60) at 1.5 T were obtained 2-45.5 h after reperfusion. All TC- and TC+ dogs had reduced Ww (p<0.001 vs. baseline for both groups) and persistently abnormal regional wall motion during MRI. Seven of 8 TC+ dogs exhibited an area of + signal intensity (SI) on TE 60 images (mean diameter 12.5+8.9 cm of control area, p<0.003) while all 8 TC- dogs had no significant + SI, despite reduced Ww. MRI overestimated the % of LV infarcted, but was correlated with infarct size (p<0.69), not risk area (p=0.09). Thus, MRI can be applied early after reperfusion to assess viability of dysfunctional myocardium. Increased SI is specific for irreversibly injured tissue. The extent of the region of + SI correlates with, but overestimates eventual infarct size.

ACCURATE PREOPERATIVE DIAGNOSIS OF PERICARDIAL CONSTRICTION USING CINE COMPUTED TOMOGRAPHY

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The preoperative diagnosis of constrictive pericarditis (CP) requires both anatomic and physiologic data. To study the potential of cine computed tomography (CCT) in this area, we retrospectively identified 15 consecutive patients with echocardiographic findings suggestive of constrictive pericarditis. Measurements were made on cine images from short-axis tomograms and on continuous waveforms of characteristic pressure wave forms) who had CCT. Pathologic data were available in 12. Of these, 5 had thickened pericardium with improvement following pericardiectomy (GI). The remaining 7(GI) had cardiac hypertrophy with normal pericardium at either operation or autopsy (5) or fibrosis on myocardial biopsy (2). GI were normal volunteers in. CCT were obtained for the entire heart (8 cm slices, 17 frames/sec, noncontract frame). Pericardial thickness (PT) was measured at 198 locations over both RV and LV in each subject. PT was 10.52 (ISEE) in GO and 11.1 for G2 and GI (p<0.05 CF vs. no CF). The total amount of pericardial filling was assessed by calculating the filling fraction (FF) in early diastole. FF = 100 x (volume at 168 msec after end-systole - end-diastolic volume)/stroke volume. Heart rate did not significantly differ between groups. BVFF was 91.22 for GI (CF), 61.2 for G2 (no CF), and 38.2 for GI (no CF). BVFF was 83.21 for G1, 61.2 for G2, and 42.2 for GI (p<0.05 GI vs. G2). There was no overlap in either PT or FF between those with and those without surgical evidence of pericardial constriction. Conclusion: CCT provides both anatomic and physiologic data which allow accurate preoperative diagnosis of pericardial constriction.

MEASUREMENT OF BLOOD FLOW VELOCITIES IN SMALL ARTERIAL VESSELS: IN VIVO VALIDATION OF NUCLEAR MAGNETIC RESONANCE IMAGING TECHNIQUES

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Adequate noninvasive assessment of blood flow in small, deeply located vessels is not currently feasible. The distribution of velocities within the lumen of the vessel reveals the nature of the flow (e.g., a parabolic or a blunted velocity profile). Nuclear magnetic resonance imaging (NMR) techniques have recently been developed to measure blood flow velocities. However, such measurements in small vessels require in vivo validation. Therefore, velocities in small arterial vessels were measured using NMR techniques and compared to velocities obtained from directly applied Doppler ultrasonic crystals. An ultrasonic crystal was attached to the abdominal aorta in 9 rabbits. Velocity-resolved data were obtained in a 2.4 Tesla NMR unit using velocity-compensated, gradient-refocused echo, perpendicular-velocity resolved pulse sequences. These data were reduced to velocity spectra or histograms. Velocity measurements were made at several phases of the cardiac cycle using both techniques.

The aortic diameter averaged 2.61 mm (range 1.75-3.75 mm). The NMR velocity spectra agreed qualitatively with the Doppler velocity profiles and agreed with theoretical predictions. The velocities measured by Doppler ultrasound (range -3.44-77.3 cm/s) and NMR (range -6.24-80.8 cm/s) were similar (r=0.94). These data indicate that NMR techniques provide an accurate noninvasive assessment of blood flow velocities in small, deeply located vessels.

EFFECT OF AUTONOMIC BLOCKADE ON DOPPLER INDICES OF DIASTOLIC FILLING

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Previous studies have demonstrated marked changes in early transmural filling velocity (E), late filling velocity (A), and isovolumic relaxation time (IRT) in response to changes in loading conditions. To assess the influence of autonomic reflexes, 2-D and Doppler echocardiography was performed in 8 normal subjects before and during autonomic blockade (propranolol 0.2 mg/kg IV and atropine 0.04 mg/kg IV) in the supine (SUP), passive upright 80° tilt (TILT), and passive leg raised (ELEV) positions and during supine isometric exercise (ISO). Heart rate (HR), systolic blood pressure (SBP), and left ventricular end-diastolic dimension (EDD) were obtained. Supine values are given below. *P<0.05 versus pre value

<table>
<thead>
<tr>
<th>Autonomic</th>
<th>HR</th>
<th>SBP</th>
<th>EDD</th>
<th>E/A</th>
<th>ERT</th>
<th>IRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRE</td>
<td>74</td>
<td>119</td>
<td>5.2</td>
<td>0.85</td>
<td>1.0</td>
<td>5.2</td>
</tr>
<tr>
<td>SUP</td>
<td>53</td>
<td>119</td>
<td>5.2</td>
<td>0.85</td>
<td>1.0</td>
<td>5.2</td>
</tr>
<tr>
<td>With TILT</td>
<td>57</td>
<td>131</td>
<td>5.2</td>
<td>0.85</td>
<td>1.2*</td>
<td>76*</td>
</tr>
</tbody>
</table>

With TILT: Autonomic blockade did not alter the increase in EDD, E and E/A or the increase in IRT despite blocking the increase in HR. With ELEV: autonomic blockade was associated with increase in EDD and HR not seen before blockade. With ISO: autonomic blockade blocked the increase in HR, SBP, and IRT but did not alter the decrease in E and E/A. Hemodynamic blockade significantly modifies both hemodynamic response and Doppler indices of diastolic filling and may allow better understanding of the relationship between loading conditions and Doppler diastolic indices.

Wednesday, March 21, 1990
10:30AM-12:00NOON, Room 14
Echo/Doppler Assessment with Diastolic Function