MR of Myocardial Infarction
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MR Evaluation of IHD

- Regional Function
  - rest, stress
- Regional Perfusion
  - rest, stress
- Viability

Regional Function – CINE MRI

Cardiac Function
SSFP
TR / TE = 3.5 / 1.7
25 phases / 7 s
12 / 40 phases
256 x 228 / 150 FOV

Detection of Hemodynamically Significant CAD with Pharmacologic Stress Cine MRI

<table>
<thead>
<tr>
<th>Study</th>
<th>Sens</th>
<th>Spec</th>
<th>n</th>
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</thead>
<tbody>
<tr>
<td>Pennell et al. '92</td>
<td>94</td>
<td>—</td>
<td>25</td>
</tr>
<tr>
<td>V Rugge, et al. '94</td>
<td>0.81</td>
<td>1.00</td>
<td>37</td>
</tr>
<tr>
<td>Baer, et al. '94</td>
<td>0.84</td>
<td>1.00</td>
<td>27</td>
</tr>
<tr>
<td>Nagel, et al. '99</td>
<td>0.86</td>
<td>0.86</td>
<td>168</td>
</tr>
<tr>
<td>Hundley, et al. '99</td>
<td>0.83</td>
<td>0.83</td>
<td>153</td>
</tr>
</tbody>
</table>

First Pass Perfusion Imaging

TI-enhanced Saturation Recovery Single Shot Gradient Echo
TR = 2.7 ms, TE = 1.3 ms, a = 20°
T5 = 150 ms
SENSE = 2
4 slices per heartbeat
104 ms/image
Gd-DTPA 0.1 mMol/kg IV, bolus
**Patient with Angina and Dyspnea on Exercise**

MR perfusion imaging during hyperemia demonstrates hypoperfusion in the subendocardial layer.

**ROC Curves of MRI and SPECT for detecting CAD on coronary angiography**

![ROC Curve Graph]

- **MRI** (Az = 0.89*, 0.91*)
- **SPECT** (Az = 0.71, 0.75)

* p<0.001

**Stress perfusion MRI in a patient with triple-vessel disease**

Before CABG surgery  
After CABG surgery

**Delayed-enhancement Imaging**

- **T1-enhanced Inversion Recovery**
- **Segmented Gradient Echo**
- TR = 4.2 ms, TE = 2.1 ms, α = 15°
- TI = 225 ms
- 15 min post Gd-DTPA (0.2 mMol/kg)

**Myocardial Viability Extent**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Extent</th>
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<tbody>
<tr>
<td>I</td>
<td>(&lt;25%)</td>
</tr>
<tr>
<td>II</td>
<td>(25-50%)</td>
</tr>
<tr>
<td>III</td>
<td>(50-75%)</td>
</tr>
<tr>
<td>IV</td>
<td>(&gt;75%)</td>
</tr>
</tbody>
</table>

**Transmural**

- 50-75%
- 25-50%
**Functional Recovery Following CABG**

Segments with infarction of <50% of the wall are more likely to recover function following CABG.

R. Kim et al. NEJM 2000; 343:1445-1453

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**Hibernation**

- 50 pts. imaged before revascularization
- 804/2093 segments dysfunctional at baseline
- 694/2093 had areas of hyperenhancement

R. Kim et al. NEJM 343:1445-1453, 2000

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**Thickness of nonenhanced myocardium vs. transmural extent of hyperenhancement**

- Chronic MI (>6M)
  - Nonenhanced myocardium (Az = 0.928)
  - Transmural extent (Az = 0.928)
  - p < 0.001, N = 216

- Acute MI (<1W)
  - Nonenhanced myocardium (Az = 0.872)
  - Transmural extent (Az = 0.872)
  - p < 0.05, N = 216

F. Ichikawa et al.

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**Function / Late Enhancement**

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**Myocardial Viability / Late Enhancement**

From Minton, RB et al., ISMRM 2000

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**Myocardial Viability / Late Enhancement**

Courtesy S. Flamm, Texas Heart Institute
**Myocardial Viability**

**Hybernating Myocardium**

61 year-old man – Acute MI

Balanced TFE cine MRI

64 year-old male

- Recently reperfused Acute MI
- Not improving function

70 year-old male

- Previous MI
61 year-old man

- Anterior chest pain 2 weeks before MRI study.
- ECG indicated anterior MI.

61 year-old man

Balanced TFE cine MRI

Summary

- “One stop shop”
- Infarct vs hibernation
- Predict functional recovery
Thank you