IMR in Stable Patients

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Indications for IMR in Stable Patients

- To evaluate the etiology of chest pain/abnormal stress test in a patient with angiographically appearing normal coronaries
- To assess for the likelihood of peri-PCI myocardial infarction
- Research purposes
Case Example (April 13, 2015):

- 72 year old retired naval officer
- HTN and dyslipidemia
- PCI of proximal LAD in 2006
- Some relief of angina
- Recent worsening angina
- Multiple stress tests (mild apical ischemia) and coronary angiograms
IMR of LAD = 28

Pa mean
66
Pd mean
0.83
FFR
1.6
CFR
-0.03
dT
2.9
cursor

2015-04-13 11:18:30
Myocardial Bridge

MSA = 4.3 mm²

IVUS of LAD
FFR OM = 0.85
Case Summary:

- No significant endothelial dysfunction/spasm
- Moderate restenosis of the LAD stent with mild diffuse epicardial atherosclerosis, which is not functionally significant
- Short mild bridging which is not significant
- Evidence for microvascular dysfunction
- Moderate OM disease which is not functionally significant

Treatment plan: Augment medical therapy (statin, ACE I, carvedilol, calcium blocker, nitrate)
Chest Pain and “Normal Coronaries”

- 139 patients referred for coronary angiography because of symptoms and/or abnormal stress test and found to have “normal” appearing coronaries

- FFR, IMR, CFR, IVUS and acetylcholine challenge were performed down the LAD

## Chest Pain and “Normal Coronaries”

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>n=139</th>
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<tbody>
<tr>
<td>Age (years)</td>
<td>54 ±11</td>
</tr>
<tr>
<td>Female</td>
<td>77%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>53%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>23%</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>63%</td>
</tr>
<tr>
<td>Tobacco Use</td>
<td>8%</td>
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</tbody>
</table>

Chest Pain and “Normal Coronaries”

- The mean IMR was 19.6 ±9.1

- Microvascular dysfunction was present in 21% (defined as IMR ≥ 25)

- Patients with microvascular dysfunction were older and more often hypertensive and diabetic

Chest Pain and “Normal Coronaries”

77% of patients had at least one occult coronary circulatory abnormality

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IMR after PCI in Stable Patients

- 50 patients randomized to conventional stenting with predilatation versus direct stenting

- IMR measured after PCI and correlated with troponin release

- In the 10 patients with elevated Tn post PCI, IMR was $24.7 \pm 13.3$ vs. $16.9 \pm 10.2$, $p=0.04$.

IMR *Before PCI in Stable Patients*

*IMR measured before PCI in 50 stable patients undergoing LAD PCI*

**IMR Before PCI in Stable Patients**

*IMR measured before LAD PCI in 50 stable patients*

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**Multivariable Regression Analysis**

<table>
<thead>
<tr>
<th>Variable</th>
<th>( P )</th>
<th>Odds ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMR</td>
<td>0.002</td>
<td>1.25</td>
<td>1.08 – 1.43</td>
</tr>
<tr>
<td>Beta-blocker</td>
<td>0.064</td>
<td>13.97</td>
<td>0.97 – 200.56</td>
</tr>
<tr>
<td>Post-dilation</td>
<td>0.072</td>
<td>0.09</td>
<td>0.01 – 1.24</td>
</tr>
<tr>
<td>Total inflation time</td>
<td>0.115</td>
<td>1.01</td>
<td>0.99 – 1.03</td>
</tr>
<tr>
<td>Stent length</td>
<td>0.35</td>
<td>1.08</td>
<td>0.92 – 1.27</td>
</tr>
</tbody>
</table>

IMR Before PCI in Stable Patients

*IMR measured before PCI in 54 stable patients*

\[15.6 \pm 1.8\] vs. \[21.2 \pm 2.1\] for IMR Pre no PPMI vs. IMR Pre PPMI

*P* = 0.02

Indications for IMR in Stable Patients

- To evaluate the etiology of chest pain/abnormal stress test in a patient with angiographically appearing normal coronaries
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- Research purposes
IMR measured after PCI in 80 patients randomized to either 1 month pretreatment with pravastatin or placebo

IMR post ACE Inhibitor Therapy

40 patients randomized to IC enalaprilat or placebo prior to PCI

IMR post ACE Inhibitor Therapy

40 patients randomized to IC enalaprilat or placebo prior to PCI

IMR post Stem Cell Therapy

IMR measured in 15 patients with ischemic cardiomyopathy before and 6 months after intracoronary stem cell delivery

Conclusions:

- Measurement of FFR and IMR can help to diagnose the etiology of chest pain/abnormal stress test in patient with angiographically normal appearing coronaries.
- IMR measured at the time of PCI can predict peri-procedural myocardial infarction.
- IMR is a useful research tool for evaluating the efficacy of various therapies.