Μαγνητική τομογραφία καρδιάς
Ηλίας Νινίος
Ιατρικό Διαβαλκανικό Κέντρο Θεσσαλονίκης
Fig. 3 Most common CMR indications by ‘Appropriate Use Criteria’ categories
MR sequences: a quick view...

- **T1, Haste: Anatomy**
- **Cine**
- **Tagging**
- **Flow**

- **T2: Anatomy + Edema**
- **1st pass perfusion**
- **Delayed enhancement: fibrosis, Edema**
• CMR is increasingly used to diagnose coronary artery disease (Class I, Indications: ESC Guidelines)

✓ Detection of CAD
✓ Hemodynamic relevance of coronary stenosis
✓ Prognostic information
CMR is the standard of reference for volume and mass assessment (SSFP sequences)
Radiology 1999;213:513-20
STENOSIS IS NOT ALWAYS ISCHEMIA

Coronary angiography provides limited information about the functional severity of a stenosis. Luminography (no information on vessel wall/plaque characterization) is especially required in MODERATE CAD (luminal narrowing 40-70%) for additional information (stress test, coronary flow reserve).
MR-INFORM: STRESS PERFUSION IMAGING TO GUIDE THE MANAGEMENT OF PATIENTS WITH STABLE CORONARY ARTERY DISEASE

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Hypothesis

Guiding the initial management of patients with stable angina and intermediate to high risk of coronary artery disease receiving OMT by MR-perfusion imaging is non-inferior to invasive angiography supported by FFR.
Assessed for eligibility (n=16620)

Excluded (n=15705)
Not meeting inclusion criteria (n=13928)
Refused to participate (n=1584)
Other reasons (n=193)

Randomized (n = 918)

Allocated to FFR-INFORM (n=464)
Received invasive angiography (n=448)
Did not have angiography (n=17)
Lost to follow-up (n=14)

Allocated to MR-INFORM (n=454)
Received MR perfusion imaging (n=446)
Did not have MR-Perfusion study (n=8)
Lost to follow-up (n=16)

Recruitment period: 12/2010 – 08/2015
Discussion / Summary

- Guiding the initial management of patients with stable angina and an intermediate to high risk for coronary artery disease with non-invasive MR-perfusion imaging is non-inferior to a strategy with invasive angiography supported by FFR during a follow-up of one year.
- Both strategies are safe and result in a low total event rate.
- The number of revascularization procedures is significantly lower when guided by MR perfusion imaging in comparison to invasive angiography supported by FFR.
<table>
<thead>
<tr>
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<th><strong>FFR (n = 462)</strong></th>
<th><strong>MR (n = 450)</strong></th>
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<tbody>
<tr>
<td><strong>Events (n)</strong></td>
<td>18 (3.9%)</td>
<td>15 (3.33%)</td>
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<tr>
<td><strong>Death</strong></td>
<td>1 (Angio +, CABG planned, death before CABG)</td>
<td>4 (2 non-cardiac, 1 MR+, Angio+, CABG planned, death before CABG 1 death after CABG)</td>
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<tr>
<td><strong>Myocardial Infarction</strong></td>
<td>8</td>
<td>8</td>
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<tr>
<td><strong>Re-revascularization</strong></td>
<td>9</td>
<td>3</td>
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<tr>
<td><strong>Absolute Risk Difference [95% CI]</strong></td>
<td>-0.56 [-2.98; 1.86]</td>
<td></td>
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<tr>
<td><strong>Hazard ratio [95% CI]</strong></td>
<td>-0.852 [-0.43; 1.69]; p = 0.62</td>
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Dr. Kallifatidis Al.-Dr. Ninios I. St. Luke’s Hospital- Thessaloniki
High Dose Dobutamine stress
LVEF=71%  EDVi=54ml/m²  ESVi=16ml/m²
Stress perfusion

CHU St. Etienne, Pr. Croisille - Dr. Kallifatidis
Delayed-Enhancement Imaging

T1-enhanced Inversion Recovery
Segmented Gradient Echo
PSIR

10-15 min post Gd-DTPA
(0.2mMol/kg)
Subendocardial

Subendocardium: terminal vascularization / ventricular pressure

Subendocardial
Lenticular
Coronary distribution

Epicardial}

- Myocarditis
- Anderson-Fabry
- Chagas
MYOCARDIAL INFARCTION

- Late Gadolinium

- IR GRE T1 excellent contrast between normal-infarcted myocardium

- Gold Standard Sequence**
  - Infarct location
  - Infarct Extension
  - Transmurality, > sensitivity than SPECT*
  - MVO


CMR in acute myocardial infarction

- Global and regional LV function (gold standard technique)
- Edema
- LV thrombus
- MVO
- Infarct extension
- Viable myocardium
MYOCARDIUM

- T2 edema: zone at risk
- Enhanced areas: necrosis
- «Dark» areas: no-reflow
NO-REFLOW : BAD PROGNOSIS

• bad prognostic indicator for remodelling, > from Infarct extension*

• increased likelihood for future complications**

* Circulation 2000;101:2734-41

** Wu Circulation 1998; 97:765-772
LATE GD

Infarct Extension

Wu Circulation 1998; 97:765-772
VIABLE MYOCARDIUM

% of transmurality

- < 25% viable** (stunned myocardium)
- > 75% non viable

** Circulation 2001;104:1101-07

Perfusion +
Early gadolinium enhancement

- 1-3min post inj
Late Gd MVO
NON ISCHEMIC LATE GAD PATTERN
LONGITUDINAL STRAIN: -15%

Peak Strain
HR (Avg) = 64 bpm
Time SD = 64.8 ms

AP3 L. Strain = -14.3%
AP4 L. Strain = -18.6%
AP2 L. Strain = -13.1%
Global L. Strain = -15.2%

HR Variation > 10%
Yellow: Accepted
Red: Accept Pending
20.00%
TISSUE TRACKING CMR
LONGITUDINAL STRAIN -16%
PA-AORTA FLOW
CALCULATIONS

✓ RV volume 111ml/m²
✓ RV EF 65%
✓ PA FVol: 115ml
✓ Aorta Fvol: 51
✓ Qp:Qs: 2,3

➢ Qp:Qs > 2  hemodynamic significant shunt
Cardiac MRI:

One stop shop for diagnosis