CMR in Ischemic Heart Disease

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Reffelmann T, Kloner R A Heart 2002;87:164

CMR in Acute Myocardial Infarction

Higgins CB, DeFoire A (eds) Cardiovascular MRI & MRA
Philadelphia: Lippincott, Williams, & Wilkins 2003, p 224
Schematic depicting the multiple mechanisms that contribute to the no-reflow phenomenon at the ultrastructural level

Reffelmann T, Kloner RA Heart 2002;87:164

Basic Cardiac MRI Protocol for AMI Imaging

Multisequence Imaging of Microvascular Obstruction (MVO) imaging:

Time course of MO post-infarction

The presence and persistence of MO can predict how well the LV remodels in the subsequent year!


T2* imaging to improve the differentiation between MO with and without hemorrhage

O’Regan DP et al. Heart 2010;96:1885–1891
Persistent Iron Within the Infarct Core After ST-Segment Elevation Myocardial Infarction predicts LV remodeling, death and heart failure hospitalization

All cause death or HF, HR 3.9
MACE, HR 3.3

Current Smoking and infarct morphology

Smoker: 6 m: infarct size: 31.2% LVEDVi 84.8 ml/m²
Non Smoker: 6 m: infarct size: 15.2% LVEDVi 78.4 ml/m²
Cardiovascular magnetic resonance images of myocardium at risk (MaR) and infarct

Salvage = MaR-LGE

Time line of post MI LGE regression

Sources at Radiology: Dec 18, 2009; Vol 254, No 1
MI Complications

LV Pseudoaneurysm
RV Infarct
Papillary Muscle Infarct

MI Complications: LV thrombus

Use long inversion time TI 450-550 ms for thrombus imaging

Dark Blood LGE in subendocardial LGE

Hansen et al. Journal of Cardiovascular Magnetic Resonance
Assessment 2018 38 77
Mapping techniques in acute myocardial infarction

Prognostic parameters assessed by CMR in acute myocardial infarction.

Diagnostic algorithm in patients with myocardial infarction with no obstructive coronary atherosclerosis (MINOCA).
Relation between coronary artery stenosis severity and perfusion reserve.

Stress CMR modalities.

Perfusion stress protocol.
Perfusion stress test and "splenic switch off" phenomenon to assess adequacy of vasodilatation

"splenic switch off" phenomenon exists with only with adenosine and not with regadenoson!!

Victory at last! CMT perfusion versus invasive FFR: MR-INFORM Trial


Dobutamine stress protocol


Interpretation of dobutamine response (ischemia protocol and viability protocol)

From: The EACVI Textbook of Cardiovascular Magnetic Resonance

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Ex CMR vs Angiography
Sensitivity: 79%,
Specificity: 99%,
PPV of 92%, and
NPV: 96%.
Agreement between treadmill stress CMR and 
angiography was strong (κ=0.82),
and moderate between SPECT and 
angiography (κ=0.48) and 
CMR versus SPECT (κ=0.48).

Chronic infarct imaging and viability

PATIENT DATA
161 segments with subendocardial infarction, 85 (47%) were 
not detected by SPECT. On a per patient basis, six (13%) 
individuals with subendocardial infarcts visible by CMR had 
no evidence of infarction by SPECT.

Probability of recovery of dysfunction according to preoperative transmurality of 
LGE.

WAGNER, AT AL LANCET, VOLUME 361, ISSUE 9355, P374-379, FEBRUARY 01, 2003
Quantification of myocardial late gadolinium enhancement using different techniques for late enhancement delineation

There was no statistically significant difference between LGE volume by the FWHM, manual, and 6-SD or 5-SD techniques. The FWHM technique was the most reproducible.

Conditions evaluated: AMI, CMI, HCM.

From: The EACVI Textbook of Cardiovascular Magnetic Resonance

Infarct size and mortality based on quartiles of infarct size

Author(s): Holger Thiele, Nuno Bettencourt, Michael Salerno, and Erica Dall'Armellina

Acute myocardial infarction (AMI), chronic myocardial infarction (CMI), and hypertrophic cardiomyopathy (HCM) were evaluated using cardiovascular magnetic resonance (CMR). The FWHM technique was found to be the most reproducible for quantifying myocardial late gadolinium enhancement (LGE). There was no statistically significant difference between LGE volume by the FWHM, manual, and 6-SD or 5-SD techniques. The FWHM technique was the most reproducible.

Classifications of infarct size were as follows:
- Infarct Size Quartile 1: 0%–25%
- Infarct Size Quartile 2: 25%–50%
- Infarct Size Quartile 3: 50%–75%
- Infarct Size Quartile 4: ≥75%

Mortality rates based on infarct size quartiles showed an increasing trend as the infarct size increased.
Scar Burden and risk of VT in ischemic CMP

Beyond the scar: The Gray Zone (of Death)

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Characterization of the Peri-Infarct (Gray) Zone by Contrast-Enhanced Cardiac Magnetic Resonance Imaging Is a Powerful Predictor of Post-Myocardial Infarction Mortality and ICD Therapies.

Dead Meat Don’t Beat: Six-month response rate to cardiac resynchronization therapy (CRT) in ischemic CMP based on pacing region of the left ventricle (LV) or right ventricle (RV).

Cardiac resynchronization therapy guided by late gadolinium-enhancement cardiovascular magnetic resonance.
Still in doubt what is the best imaging technique in ischemic heart disease?

OR

From DAIC, April 12, 2019: First Image of a Black Hole Shows Signs of Myocardial Ischemia

Black hole at the center of Messier 87, a massive galaxy in the nearby Virgo galaxy cluster. Distance from detector: 55 million light years.

Heart at the center of a patient, Bob 87, not that massive, Distance from detector: 55 cm.

From DAC, April 12, 2019: First Image of a Black Hole Shows Signs of Myocardial Ischemia

Only test with comparable diagnostic accuracy to CMR....