Regional Ventricular Function in Non-Ischemic Cardiomyopathy

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Outline

• Significance
• MR Methods
• Ischemic vs Non-ischemic CM
• Differential Diagnosis of NICM
Significance

- Early detection of LV abnormalities
  - Before ↓EF
  - Early management → Preserve Function
- Differential diagnosis
  - Ischemic vs non-ischemic
  - Specific non-ischemic diseases
Early LV systolic dysfunction

- Data mainly Ischemic cardiomyopathy
- Regional myocardial dysfunction precedes ↓ LVEF
- Regional dysfunction independent predictor for heart failure and cardiac events

Yan RT et al. JACC 2011. Regional Left Ventricular Myocardial Dysfunction as a Predictor of Incident Cardiovascular Events: MESA
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**MR Methods – Regional LV Function**

- **Cine MRI**
  - Wall Thickening

- **Tagging**
  - Circumferential, radial and longitudinal strain

- **Phase-contrast**
  - Circumferential, radial and longitudinal strain
Regional Function – CINE MRI

Cardiac Function

SSFP
TR / TE = 3.5 / 1.7
25 phases / 7 s
12 s / 40 phases
256 x 228 / 350 FOV
Myocardial Tagging Quantification

Ordovas KG et al. Impaired Regional Left Ventricular Strain After Repair of Tetralogy of Fallot. JMRI (in press).
Phase Contrast Image
Vector Map
Outline

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Ischemic vs Non-Ischemic

- Regional dysfunction characteristic of ischemic cardiomyopathy
  

- DCM has global dysfunction with regional heterogeneity
  
  Buser PT et al. JACC 1989; 13(6):1294-1300

- Some non-ischemic cardiomyopathies have a specific regional pattern of systolic dysfunction
DCM – Heterogeneous contractility

Buser PT et al. JACC 1989; 13(6):1294-1300
Idiopathic Dilated Cardiomyopathy
Idiopathic Dilated Cardiomyopathy

Ordovas KG, Reddy GP, Higgins CB.
Ischemic Cardiomyopathy
Ischemic Cardiomyopathy

Balanced FFE cine MRI

Courtesy of Dr. Matsumoto, Saijyo Central Hospital
Ischemic Cardiomyopathy

3D delayed enhanced MRI using SENSE

Courtesy of Dr. Matsumoto, Saijyo Central Hospital
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Differential Diagnosis
Non-Ischemic Cardiomyopathies

- ARVC
- Hypertrophic CM
- Infiltrative CM
  - Sarcoid
  - Anderson-Fabry disease
- Stress-Induced CM (Takotsubo)
- Isolated Ventricular Noncompaction
Functional abnormality ARVC

- Mainly RV but can involve LV (advanced disease)
- Can be global or regional
- More specific when combined with morphological abnormality
Regional Abnormality and ARVC

Functional and Structural Alterations

- **Initial Task Force Criteria**
  - **Major**
    - Severe RV dilatation + ↓EF
    - Localized RV aneurysm
    - Severe segmental RV dilatation
  - **Minor**
    - Mild RV dilatation + ↓EF
    - Regional RV hypokinesia
    - Mild segmental RV dilatation

- **Revised Task Force Criteria**
  - **Major**
    - Regional RV dyskinesia, akinesia or dyssynchrony AND
      - RVDEVi ≥ 110(M) ≥ 100(F) or
      - RVEF ≤ 40%
  - **Minor**
    - Regional RV dyskinesia, akinesia or dyssynchrony AND
      - RVDEVi ≥ 100 < 110(M) ≥ 90 < 100(F)
      - RVEF > 40% ≤ 45%
65 y/o with Exertional Syncope

RVEF<40%
53 y/o male with abnormal ECG

Regional Wall Thinning
ARVC – Wall thinning
ARVC – Global Hipokinesis
ARVC – Aneurysm
ARVC – Regional Dyskinesia
ARVC – Fatty Infiltration
Accordion Sign
HARP analysis of short-axis tagged MR images at the mid slice level.

HCM – Regional Dysfunction

- Typically Hypercontractility
- Hypokinesis in Advanced Disease (burned-out phase)
- Midventricular Type – Apical Dyskinesia

Symmetric HCM

Double Inversion Black Blood
Symmetric HCM
Midventricular HCM

Midventricular HCM
Anderson-Fabry Disease

- **X-link lysosomal storage disease**
- **Main differential diagnosis with hypertrophic CM**
- **Regional dysfunction and delayed-enhancement**
  

- **Subclinical regional LV dysfunction**
  - **Early enzymatic therapy**

Anderson-Fabry Disease

Delayed-enhancement

Adapted from: Weidemann F et al. Eur Heart J 2005;26:1221-1227
Cardiac Sarcoidosis

- Regional LV dysfunction without coronary distribution
  

- CMR study:
  - Regional dysfunction more common when delayed-enhancement present

  Patel AR et al. EurJ Heart Fail August 2011 (Epub ahead of print)
34 y/o with RBB
Cardiac Sarcoidosis
Regional Dysfunction
Isolated Ventricular Noncompaction

- Regional areas of noncompacted myocardium
- Regional and global left ventricular dysfunction
- Areas of dysfunction beyond the noncompacted area
  - Microcirculatory dysfunction
  
Isolated Ventricular Noncompaction
Takotsubo Cardiomyopathy

- Transient stress-induced cardiomyopathy
- Also known as apical ballooning
- Can also involve midventricle and base
Takotsubo – Apical Diskinesia

End-diastole  End-systole

Non-Apical Ballooning

Gerbaud E. Arch Cardiovasc Disease 2010; 103(4):270-72
Summary

- MRI allows early detection of LV regional dysfunction
- Clinical Relevance not fully assessed
- Helps differentiate ischemic from non-ischemic CM
- May indicate specific etiology of NICM
Thank you

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