Multimodality imaging in heart failure

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Clinical Case

Male, 62 yrs
- 1987: Infero-postero-lateral infarct
- 1988: Repeat inferior infarct
- 1994: Antero-septal infarct
- 1996: CABG: LIMA-graft LAD, venous graft MO-LCX and RDP/RCA
- 2000: Non-sustained ventricular tachycardia

Co-morbidities
- Diabetes II
- COPD
- chronic renal failure (creatinine 300 micromol/l)
Clinical Case

Male, 62 yrs

- Reduced exercise capacity
- NYHA III
- Dizziness / Hypotension

- Weight 53 kg, length 1.64 m
- RR 90/65 mmHg
- Holosystolic murmur 3/6 apex
RSR 60/min, PR 200 ms, QRS 240 ms, LBBB
Severe heart failure

CAD: yes or no?

LV function and size?

LV shape and severe MR?

CAD: viability?

ICD needed?
CAD: yes or no?

LCA
Future? Non-invasive angiography?
3T MRI
Future? Non-invasive angiography? 320 MSCT

LAD: normal, intramural course mid
LCx: normal
LV function and size?
LV function and size?
Other techniques?
LV function and size?
Other techniques?
LV function and size?
Other techniques?
Severe MR?

TTE  TEE
Severe MR – other techniques?
3D Flow Quantification in All Valves

3D volume scan /w 3-dir velocity encoded MRI

MV & TV

AV

PV
3D Flow Quantification in All Valves

\[
\begin{align*}
V_{\text{forward}} &= 116 \text{ ml} \\
V_{\text{back}} &= 32 \text{ ml} \\
V_{\text{eff}} &= 84 \text{ ml} \\
\text{Regurg. Fraction} &= 27\%
\end{align*}
\]
Severe MR – other techniques?

3D TTE
Severe MR
Importance of MV anatomy

3D TEE
Severe MR
Importance of MV anatomy
MSCT: Study of Mitral Valve Geometry
LV shape?

Pre-op

Post-op
LV shape? – other techniques
Is there viability?

to predict prognosis post-surgery
N= 20 studies, 2362 pts

No randomised data available (STICH)
Is there viability?
Viability assessment - Future?
Viability assessment - Future?
ICD needed?

- Patients with:
  - previous infarction
  - LVEF <30%

- Benefit from ICD:
  - MADIT II: improved survival
ICD shocks in primary and secondary prevention

N=250 pts, CAD
92% previous MI
Follow-up 3.8 years
Recurrences:

N=720 pts, MADIT II
Follow-up 21 months
Recurrences:

Moss et al. Circ 2004
Van der Burg et al. HR 2004
FUTURE: Is reduced presynaptic sympathetic innervation of the heart related to ventricular arrhythmias?

MIBG visualizes
-cardiac innervation
-cardiac denervation
-behaves as norepinephrine
-tracer is internalized by pre-synaptic nerve endings
Study Population (n = 116)

116 consecutive patients referred for ICD implantation based on guidelines for primary prevention

<table>
<thead>
<tr>
<th>Baseline characteristics of the study population (n = 116)</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>65 ± 9</td>
</tr>
<tr>
<td>Male</td>
<td>80 (69)</td>
</tr>
<tr>
<td>Ischemic cardiomyopathy</td>
<td>86 (74)</td>
</tr>
<tr>
<td>NYHA functional class</td>
<td>3.0 ± 0.5</td>
</tr>
<tr>
<td>LVEF (%)</td>
<td>27 ± 8</td>
</tr>
</tbody>
</table>
MIBG SPECT to predict ICD therapy

Cumulative event rate 79% vs. 5%
4-year follow-up data
Back to the patient:
Summary of Findings on cardiac imaging

- Severe, diffuse 3-vessel CAD
- Poor run-off bypass grafts – no stenoses
- LVEF 32%, LV dilatation, no aneurysm
- Scarred segments: inferior, posterior, anterior
- Viable segments: lateral and septal
- Severe mitral regurgitation
- NYHA III, QRS 240 ms
Treatment strategy

• Not eligible for revascularization (poor coronary anatomy)
  ► Viability would justify revascularisation but it is not feasible
  ► Mitral regurgitation would justify surgery but risk too high

• Patient meets criteria for ICD / CRT because of
  NYHA III
  LVEF <35%
  QRS width >120 ms
CRT works

CARE-HF: Main Trial Results

Primary endpoint
HR 0.63
p < 0.001

All-cause mortality
HR 0.64
p < 0.002

%  

39  55
CRT + medical therapy

20  30
Medical therapy alone

Cleland et al. NEJM 2006
3-Dimensional Echocardiography

**BASELINE**
- LVESV: 139 mL
- LVEDV: 203 mL
- LVEF: 30%

**FOLLOW-UP**
- LVESV: 86 mL
- LVEDV: 153 mL
- LVEF: 44%
Longitudinal Strain Assessment

**Baseline**

GLS = -5.3%

**Follow-up**

GLS = -11.3%