Current use of radionuclide imaging techniques in heart failure

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Case 1

- Male 59 yrs, 1.72 m, 79 kg
- Old anterior AMI
- Prior smoking habit, dyslipidemia
- Reason for consultation: dyspnoea
- Clinical question: is there viable myocardium to justify revascularization?
201Tl stress (adenosine 50.4 mg in 4.5 min) - redistribution (9h)
Question 1

What is the myocardial perfusion interpretation?

1. Normal
2. Dilated LV with no perfusion defects
3. Reversible defect in the septum
4. Partially reversible defects in the septum, apical anterior and apex segments
5. Fixed defect in the apex
Correct answer

1. Normal
2. Dilated LV with no perfusion defects
3. Reversible defect in the septum
4. Partially reversible defects in the septum, apical anterior and apex segments
5. Fixed defect in the apex
What is the LV function interpretation?

1. Normal
2. Apical dyskinesia with reduced systolic thickening, moderate septal hipokinesia and mild inferolateral hipokinesia
3. Apical akinesia with reduced systolic thickening
4. Apical hypokinesia with reduced systolic thickening and moderate septal hipokinesia
5. Global hypokinesia
Question 2

Correct answer

1. Normal
2. Apical dyskinesia with reduced systolic thickening, moderate septal hipokinesia and mild inferolateral hypokinesia
3. Apical akinesia with reduced systolic thickening
4. Apical hypokinesia with reduced systolic thickening and moderate septal hipokinesia
5. Global hypokinesia
Gated-SPECT interpretation

Nontransmural scar in the septum & apex with persistence of moderate ischemia in these territories (thus still viable); viability also in the remaining LAD territory as well as LCX and RCA territories
What is the next step in the patient management?

1. Discharge with primary prevention
2. Discharge with secondary prevention
3. Send to the cath lab
4. Send to the operation theatre for CABG
5. Send to the operation theatre for cardiac transplantation
Question 3

Correct answer

1. Discharge with primary prevention
2. Discharge with secondary prevention
3. Send to the cath lab
4. Send to the operation theatre for CABG
5. Send to the operation theatre for cardiac transplantation
<table>
<thead>
<tr>
<th>Vessel</th>
<th>Condition</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td>LAD</td>
<td>100%</td>
<td>(PCI impossible)</td>
</tr>
<tr>
<td>mLCx</td>
<td>80%</td>
<td></td>
</tr>
<tr>
<td>mRCA</td>
<td>90% PLT</td>
<td>100%</td>
</tr>
</tbody>
</table>
Volumen FD : 100.5 ml
Volumen FS : 60.6 ml
Volumen por lat. : 39.9 ml
Indice FDV : 
Indice FSV : 
Indice de vol. p. l. :
Gasto cardíaco :
Indice cardíaco :
Catéter : 2.00 mm
Tamaño pixel : 0.296 mm
Regresión FDV : "0.783-3.759
Regresión FSV : "0.783-3.759

EF : 39.7 %
Question 4

How should the patient be managed?

1. Conservatively with primary prevention
2. Conservatively with secondary prevention
3. Invasively with revascularization
4. Invasively with cardiac transplantation
5. Treatment is not needed
Correct answer

1. Conservatively with primary prevention
2. Conservatively with secondary prevention
3. Invasively with revascularization
4. Invasively with cardiac transplantation
5. Treatment is not needed
• The patient underwent revascularization
  • CABG
    – IMA to LAD
    – LRA to 10M
  • PCI + stent in RCA (after 5 months)

• Asymptomatic. MPI of control at 8 months of CABG (3 months of PCI)
99mTc-tetrofosmin stress-rest

10 METs, 138 bpm (82% MPHR)

no significant ECG changes or clinical events
Question 5

What is the myocardial perfusion gated-SPECT interpretation?

1. No evidence of myocardial ischemia
2. Dilated LV with no perfusion defects
3. Mild ischemia in the inferior wall
4. Nontransmural infarction in the inferior wall
5. Normal
Correct answer

1. No evidence of myocardial ischemia
2. Dilated LV with no perfusion defects
3. Mild ischemia in the inferior wall
4. Nontransmural infarction in the inferior wall
5. Normal
201Tl Stress-redistribution

- Injection: 201Tl
- SPECT: 4 hours
- Late SPECT: ± 24 hours

201Tl Reinjection

- Injection: 201Tl
- SPECT: 4 hours
- Reinjection: 15 minutes
- SPECT: 15 minutes

201Tl Rest-redistribution

- Injection: 201Tl
- SPECT: 4 hours
- Late SPECT: ± 30 minutes

Dual isotope with late 201Tl redistribution

- Injection: 201Tl
- Injection: 99mTc-agent
- SPECT: 15 minutes
- SPECT: 30 minutes
- Late SPECT: 24 hours
Teaching Points

- $^{201}$TI late redistribution indicates ischemic but still viable myocardium and elevated risk
- Gated SPECT improves diagnostic accuracy (if there is wall motion or wall thickening there is viability, the inverse is not true)
Case 2

- Female 75 yrs, 1.60 m, 61 kg
- DCM: idiopathic + ischemic
- DM-II, hypertension, CRF
- Reason for consultation: AMI (LVEF 12% in the subacute phase)
- Angio: calcified pLAD lesion (95%); extreme revascularization risk
- Clinical question: is there viable myocardium in the anterior territory?
Dobutamine stress CMR:
Increase of wall motion/thickening only in basal segments
Nontransmural Scar and Prediction of Recovery

Question 6

Which one of the following is correct?

1. There is viable myocardium in the apex
2. There is viable myocardium in the septum
3. There is viable myocardium in the lateral wall
4. There is viable myocardium in the LAD territory
5. There is viable myocardium in the lateral wall and basal segments of the anterior and inferior walls
Question 6

Correct answer

1. There is viable myocardium in the apex
2. There is viable myocardium in the septum
3. There is viable myocardium in the lateral wall
4. There is viable myocardium in the LAD territory
5. There is viable myocardium in the lateral wall and basal segments of the anterior and inferior walls
How should the patient be managed?

1. Treatment is not needed
2. PCI in the calcified pLAD lesion
3. CABG on the LAD
4. Medical treatment
5. ICD placement
Question 7

Correct answer

1. Treatment is not needed
2. PCI in the calcified pLAD lesion
3. CABG on the LAD
4. Medical treatment
5. ICD placement
PET Imaging Protocols

- CT Topo
- CTAC
- Perfusion PET
- 82Rb
- 13NH3
- H215O
- 18FDG

*Oral Glucose Load / Clamp > 45 min of 18FDG injection
Teaching Points

PET

• Most common technique: resting perfusion ($^{13}$NH$_3$ or $^{82}$Rb)/metabolism $^{18}$F-FDG
• $^{18}$F-FDG PET may be performed in isolation without a blood flow study, with >50% relative uptake taken to indicate viability
  – Preferably use a metabolic clamping procedure to standardize regional glucose utilization

CMR

• Late Gd enhancement (LGE) is used to define scar transmurality (thickness) and extent
  – Transmurality >50% LGE is taken as indicative of inability for functional improvement after revascularization (the inverse is not always true)
• Dobutamine stress
  – Improves the specificity and PPV of LGE if transmurality ≤50% LGE

Combined PET / CMR

• Intermediate or low values of transmurality: CMR defines the transmurality of scar while PET characterizes the state of the nonscarred supepicardium and helps refine the likelihood of functional recovery
Case 3

- Male, 64 yrs
- Hypertension
- DM-II
- Dyslipidaemia
- DCM (mitral and aortic valve replacement + old inferior MI)
- AF
- PAH
- CRF under hemodyalisis
- HF NYHA III, LVEF 15%
- Treatment: bosentan, enalapril, furosemide, spironolactone, digoxin, amiodarone, acenocoumarol, simvastatine, gliclazide, paroxetine
- Cadidate to ICD (implanted after MIBG imaging)
- Exitus 3 yrs after MIBG imaging (pump failure)
Rest tetrofosmin
MIBG

15 min

4 h
Rest tetrofosmin

15 min MIBG

4 h MIBG
How are cardiac MIBG defects in relation to myocardial perfusion defects in ischemic heart disease?

1. the same
2. larger
3. smaller
4. cardiac MIBG uptake is not affected by ischemia
5. cardiac MIBG uptake is only reduced if infarction occurs
Question 8

Correct answer

1. the same
2. larger
3. smaller
4. cardiac MIBG uptake is not affected by ischemia
5. cardiac MIBG uptake is only reduced if infarction occurs
How should MIBG SPECT be interpreted?

1. Scaled to the washout rate
2. Scaled to the myocardial axes slices
3. Scaled to the lung uptake seen on the planar image
4. Scaled to the liver uptake seen on the planar image
5. Scaled to the heart uptake seen on the planar image
Question 9

Correct answer

1. Scaled to the washout rate
2. Scaled to the myocardial axes slices
3. Scaled to the lung uptake seen on the planar image
4. Scaled to the liver uptake seen on the planar image
5. Scaled to the heart uptake seen on the planar image
Denervated viable myocardium has been related with which of the following?

1. arrhythmias
2. good prognosis
3. acute myocardial infarction
4. positive exercise test
5. left bundle branch block
Question 10

Correct answer

1. arrhythmias
2. good prognosis
3. acute myocardial infarction
4. positive exercise test
5. left bundle branch block
Thank you for your attention

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