Case Based Cardiac $^{123}$ Imaging: Tomographic Image Interpretation

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Disclosure Information

*Receives royalties from the sale of the following software programs: Emory Cardiac Toolbox, PERFEX, Heartfusion, Synctool, AdreviewTools and ExSPECT II.

*Consultant to Syntermed, Lantheus and DraxImage

*Receives research funding from GE, Progenics, Syntermed and has an equity position with Syntermed inc.
Topics

• SPECT H/M ratios determination
• Planar vs. SPECT H/M ratios
• Innervation vs. dysinnervation
• Normal innervation SPECT distribution
• Extent of dysinnervation
• Match/mismatch tools
• Patient Examples

SPECT vs. Planar H/M ROIs/Ratios

Rationale for SPECT Measurements

Planar ROIs
Medastinum = Tubular
Heart = ellipse/tube

Tomo ROIs
Medastinum = sphere
Heart = ellipsoid
Heart to Mediastinum ROIs*
* Ji Chen et al, JNC 2012; 19:92-9

Heart to Mediastinum Measurement*
* Exact same ROIs for FBP, OSEM & DSP – all reconstructions within ECTb

A. Patient with normal mIBG uptake
B. Patient with abnormal mIBG uptake
### Planar vs. SPECT FBP/OSEM/DSP

**Heart/Std Ratio**


<table>
<thead>
<tr>
<th>I-123 Energy Window</th>
<th>True Ratio</th>
<th>Planar FBP</th>
<th>OSEM</th>
<th>DSP AC</th>
<th>OSEM DSP AC</th>
<th>DSP AC</th>
</tr>
</thead>
<tbody>
<tr>
<td>15%</td>
<td>23.4</td>
<td>3.64</td>
<td>8.19</td>
<td>13.02</td>
<td>22.2</td>
<td>14.2</td>
</tr>
<tr>
<td>20%</td>
<td>23.4</td>
<td>3.59</td>
<td>8.9</td>
<td>13.5</td>
<td>18.8</td>
<td>13.9</td>
</tr>
</tbody>
</table>

### H/M Admire SPECT Results

*(Ji Chen et al, JNC 2012, 19:92-9 (n = 926 HF / 90 controls)*

<table>
<thead>
<tr>
<th></th>
<th>Planar</th>
<th>FBP</th>
<th>OSEM</th>
<th>DSP</th>
<th>OSEM</th>
<th>DSP</th>
</tr>
</thead>
<tbody>
<tr>
<td>HF</td>
<td>1.44±0.20*</td>
<td>2.42±1.04*</td>
<td>2.19±0.87*</td>
<td>3.61±2.00*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>1.77±0.23*</td>
<td>3.87±1.48*</td>
<td>3.67±1.20*</td>
<td>6.49±2.93*</td>
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<td></td>
</tr>
<tr>
<td>Cutoff</td>
<td>1.58</td>
<td>2.72</td>
<td>2.61</td>
<td>4.01</td>
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<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>0.78</td>
<td>0.72</td>
<td>0.76</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specificity</td>
<td>0.79</td>
<td>0.78</td>
<td>0.86</td>
<td>0.83</td>
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<td></td>
</tr>
<tr>
<td>AUC</td>
<td>0.85</td>
<td>0.82</td>
<td>0.87</td>
<td>0.83</td>
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<td></td>
</tr>
</tbody>
</table>

*p < .0001 between HF and controls

ROC curves of SPECT H/M in differentiating HF from controls
Innervated vs. Dysinnervated

Match vs. Mismatch

AdireView - MALE
Mean normal Distribution
OSEM H/M > 2.61

H/M as a Function of Innervated Myocardium
Dysinnervation Extent: Visual vs. QT

LV defect extent

Quantitative extent

Average visual extent

y = 0.5024x
R² = 0.71681
R = 0.85

Emory Cardiac Toolbox™

Version 3.3

AdroView, MisMatchOSEM

General Hospital / Nuclear Medicine
AdreView™ (mIBG)
Match/Mismatch Tool

Innervated vs. Dysinnervated
Match vs. Mismatch
Innervated vs. Dysinnervated
Match vs. Mismatch
Innervated vs. Dysinnervated

Match vs. Mismatch

OSEM H/M = 3.61

Innervated vs. Dysinnervated

Match vs. Mismatch

Female NL distribution

OSEM H/M = 1.58
Summary

• SPECT H/M ≠ Planar H/M
• Use OSEM SPECT H/M with Normal > 2.61
• Proper mIBG SPECT image normalization is key for visual interpretation
• SPECT OSEM mIBG normal innervation distribution shows reduction of counts in the inferior wall, more from 4 to 6 O’Clock.
• Dysinnervated extent visually is about twice the extent determined quantitatively
• Match/mismatch tools compare perfusion uptake to innervation uptake

The International Cardiovascular Imaging Meeting

May 3-5, 2015

Madrid, Spain
www.icnc12.org

Key Dates

October 10, 2014 - Abstract submission deadline
December 5, 2014 - Abstract selection results
February 23, 2015 - Early registration fee deadline
April 6, 2015 - Late registration fee deadline
April 27, 2015 - Last minute online registration
Thank you

<table>
<thead>
<tr>
<th>Visual</th>
<th>Dysinnervated</th>
<th>Innervated</th>
<th>Mismatch</th>
<th>Match</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysinnervated</td>
<td>24</td>
<td>1</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Innervated</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>6</td>
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</table>

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<th>Mismatch</th>
<th>Match</th>
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<tbody>
<tr>
<td>Quantitative (Vascular</td>
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<td></td>
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<tr>
<td>Territory Results</td>
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<td>3</td>
<td>29</td>
<td>4</td>
</tr>
<tr>
<td>Innervated</td>
<td>13</td>
<td>34</td>
<td>18</td>
<td>39</td>
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</tbody>
</table>
### Quantitative (LV Global Results)

<table>
<thead>
<tr>
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<th>Mismatch</th>
<th>Match</th>
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<td>1</td>
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<td>18</td>
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<tr>
<td>Innervated</td>
<td>0</td>
<td>5</td>
<td>Match</td>
<td>4</td>
</tr>
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### Quantitative (Vascular Territory Results)

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<th>Mismatch</th>
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