Artifact in Nuclear Cariology

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Disclosure

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- Attenuation Artifact
- Gating
- Incorrect Processing
- Motion
- Extra-Cardiac
Breast Attenuation

• Usually seen in large-breasted females

• Fixed anterior or anterolateral defect

• Defect may appear as partially reversible if breast positioning differs for the rest and stress acquisitions

• Defect size and position may vary depending on breast size and positioning

• Upright imaging systems may change the defect to be more inferior

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Breast Attenuation

Before

Breast taped

Dilsizian, V, Narula, J, Brunwald, E. Atlas of Nuclear Cardiology. Current Medicine, Inc. 2003; Fig 4-12B-C.
Breast Attenuation

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What can you do?

- **Consistency**
  - Bra must be on/off for both scans
  - Arms must be in the same position for both scans
  - Velcro strap
  - If the attenuation is uniform – the result is not as problematic.

- **Use an appropriate protocol**
  - 2 day protocol
  - TI-201 will have more attenuation artifact than Tc-99m in most patients

- **Prone imaging**
  - Distributes soft tissue over larger area

- **Attenuation correction**
Diaphragmatic Attenuation

- Commonly seen in obese males or males with large chests
- May appear as black area underneath the heart on cine view
- Defect seen as fixed inferior wall defect
- Upward creep diaphragmatic reversible defects were more commonly seen with thallium imaging

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Diaphragm Attenuation Supine
Diaphragm Attenuation Prone

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Myocardial Perfusion SPECT Protocols - Acquisition

• Position
  – Supine
  • Routine
  – Prone
  • Less inferior wall attenuation, more uniform breast attenuation
  • May cause artifactual anteroseptal defect secondary to ↑ sternal attenuation
  • Less motion artifact
Myocardial Perfusion SPECT
Protocols-Acquisition

• Position
  – Supine and Prone Combination
    • To identify breast, inferior wall and lateral chest-wall fat attenuation artifacts
    • Gating is not usually performed in prone position

  – Acquisition time
    • Supine = 20 secs/step for 64 proj, for 25-30 mCi
    • Prone = (reduced by 20-40%) = 15 secs/step for 64 proj, for 25-30 mCi
What can you do?

• Use an appropriate protocol
  – 2 day protocol
  – TI-201 will have more attenuation artifact than Tc-99m in most patients

• Prone imaging
  – Heart will fall more forward in the thorax which reduces the area of the heart covered by the diaphragm

• Attenuation correction
Gating Problems

- Change in heart rate
  - Beats are not falling within set limits

- Irregular heart rate
  - A-fib, PAC’s, PVC’s
  - Misrepresentation of ED and ES
    - Inaccurate LVEF

- Lack of counts in frames
Germano G.  *Technical Aspects of Myocardial Perfusion SPECT Imaging.*  

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Incorrect orientation artifact
Misalignment Artifact
• Approximately 20% of defects can be attributed to motion

• Motion correction programs can correct only one pixel motion shift, therefore, a repeat scan may be required

• Patient comfort and cooperation is critical
Motion Artifact

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Linograms and Sinograms

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Self-Study Program III: Nuclear Medicine: Cardiology. Topic 5 — Myocardial Perfusion Scintigraphy — Tech Aspects. SNM, Inc. 2001;96, Fig 68.

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Motion Defect

Upward displacement

Downward displacement

Identifying Motion Artifact

• Can be related to the camera (COR)

• Vertical

• Horizontal
  – Usually has a worse effect on images

• Vertical and Horizontal

• Motion Correction
  – Does not work in cases of severe motion

• RESCAN is always best
What can you do?

- Patient comfort
- Explain procedure to patient
- Multi-detector cameras
- Shorter scan times
Low Count Study vs.. High Count Study

Wackers, Bruni, Zaret Nuclear Cardiology: The Basics. How to Set up and Maintain a Laboratory Humana Press 2004

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A high target-to-background ratio provides:

- Clean and clear images
- Easier SPECT reconstruction
- Increased confidence in reading the inferior wall
Lovely Liver

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Extra-cardiac Activity

- Liver Activity
  - Excessive liver activity can cause scatter artifacts and an increase in inferior wall activity

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3 Effects of a “Hot” Liver

1. Cause an underestimation of hypoperfusion.

2. Cause an overestimation of perfusion with an apparent decreased perfusion in a contra-lateral wall.

3. Result in a processing defect artifact due to over-subtraction in counts.

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Extra-cardiac Activity

- **Bowel Activity**
  - Activity within bowel loops can cause inferior wall defects
  - Liver, gallbladder, or bowel activity may cause normalization problems

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Axillary Lymph Node Uptake


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CARDIAC SPECT IMAGING – N.C. FINDINGS

FIRST ACQUISITION

SECOND ACQUISITION

RIGHT AXILLARY LYMPH NODE FROM INFILTRATED DOSE

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• Tc-99m labeled myocardial perfusion tracers and TI-201 can be taken up by both malignant and non-malignant lesions. Lymphoma or metastases to lymph nodes can also have uptake.

• Infiltrated doses will drain to lymph nodes.
  – Always report infiltrated / partially infiltrated doses to interpreting physician
  – Always make site of administration available to interpreting physician
Gastric Reflux

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What is wrong with this picture?

Stress images acquired on Co-57 peak.

Stress images acquired on Tc-99m peak.

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Skeletal Uptake

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Skeletal Uptake

JNC 2006; 13:427-31

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Lung Tumor
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