Gated Thoracic Aortic CTA:
Prospective versus Retrospective

DENNIS FOLEY
MEDICAL COLLEGE WISCONSIN
BAE K T : Peak Contrast Enhancement in CT and MR Angiography: When does it occur and why? Pharmocokinetic Study in a Porcine Model
Radiology 2003; 227: 809-816
Thoracic CT Aortography
Retrospective Gating

Contrast

Saline

10 secs

6 ml/sec 14 secs
FIRST CIRCULATION

6 ml/sec 8 secs

64 x 0.625 MM, 0.20, 0.35 secs 2.5 CM/SEC

2.5 CM/ SEC
Conventional Retrospective Gating

- **ISSUES**
  - SLOW ACQUISITION TIME
    - LOW PITCH TECHNIQUE
  - RELATIVE CONTRAST LOAD
  - HIGH RADIATION DOSE
Retrospectively Gated Thoracic CTA

- **ADVANTAGES**
  - **ASCENDING AORTOGRAM**
    - (WITHOUT MOTION ARTIFACT)
      - DISSECTION
      - PROXIMAL MARGIN OF ANEURYSM
  - **CORONARY ARTERIOGRAPHY**
  - **VALVE MOTION**
  - **LEFT VENTRICULAR FUNCTION**
Thoracic CT Aortography
Non Gated

Contrast

Saline

6 ml/sec 10 secs

FIRST CIRCULATION

SALINE

64 X 0.625 MM, 1.0, 0.5 SECS 8 CM/SEC
Thoracic CT Aortography
Prospective Gating

- **Contrast**
  - Saline
  - 6 ML/SEC 16 SECS
  - 6 ML/SEC 8 SECS
  - 64 X 0.625 MM, 1.0, 0.35 SECS, 2 CM/SECS
Prospective Triggering

- **GATED STEP AND SHOOT**
  - SLIGHTLY LONGER
  - INCREASED CONTRAST LOAD
  - **SIGNIFICANTLY LOWER RADIATION DOSE**
EKG Gating
MDCT Cardio Thoracic Angiography

**EVOLUTION**

- RETROSPECTIVE

PROSPECTIVE
Beta Blocker Therapy

- **APPROPRIATE**
  - RETROSPECTIVE GATING
  - PROSPECTIVE TRIGGERING
EKG Gated MDCT Thoracic Angiography

APPLICATIONS

- CORONARY ARTERY BYPASS GRAFT EVALUATION
- SUSPECTED ACUTE AORTIC SYNDROME
- ASCENDING AORTIC ANEURYSM
- POST OPERATIVE EVALUATIONS
## Patient Demographics

<table>
<thead>
<tr>
<th></th>
<th>Prospective</th>
<th>Retrospective</th>
<th>P</th>
<th>St Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>60.3 +/- 7.8</td>
<td>55.3 +/-14.4</td>
<td>0.12</td>
<td>NS</td>
</tr>
<tr>
<td>WT</td>
<td>194.24 +/-50.4</td>
<td>197.7 +/-60.4</td>
<td>0.80</td>
<td>NS</td>
</tr>
</tbody>
</table>
# Imaging Parameters

<table>
<thead>
<tr>
<th>CT Mode</th>
<th>KVP</th>
<th>Ma</th>
<th>Pitch</th>
<th>Rot Tme</th>
<th>Coll</th>
<th>Beam Width</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retrospective</strong></td>
<td>120</td>
<td>Ekg DM</td>
<td>0.18-0.24</td>
<td>0.35</td>
<td>0.63</td>
<td>40mm</td>
</tr>
<tr>
<td><strong>Prospective</strong></td>
<td>120</td>
<td>~ BW</td>
<td></td>
<td>0.35</td>
<td>0.63</td>
<td>40mm</td>
</tr>
</tbody>
</table>
## Radiation Dose

<table>
<thead>
<tr>
<th></th>
<th>Prospective</th>
<th>Retrospective</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTDI Volume (mgy)</td>
<td>28.8 +/- 2.2</td>
<td>74.7 +/- 13.4</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>DLP (mg/cm)</td>
<td>833.7 +/- 115.7</td>
<td>2,547.3 +/- 553.27</td>
<td>&lt;0.001</td>
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</tbody>
</table>
# Aortic Attenuation

<table>
<thead>
<tr>
<th></th>
<th>Prospective</th>
<th>Retrospect</th>
<th>P</th>
<th>Stat Diff</th>
</tr>
</thead>
<tbody>
<tr>
<td>As Aorta</td>
<td>447.6</td>
<td>350.2</td>
<td>&lt;0.05</td>
<td>s</td>
</tr>
<tr>
<td>Arch</td>
<td>413.2</td>
<td>325.7</td>
<td>&lt;0.05</td>
<td>s</td>
</tr>
<tr>
<td>Desc Ao</td>
<td>418.2</td>
<td>327.6</td>
<td>&lt;0.05</td>
<td>s</td>
</tr>
<tr>
<td>Abdo Ao</td>
<td>355.0</td>
<td>306.2</td>
<td>0.1</td>
<td>ns</td>
</tr>
<tr>
<td>SD</td>
<td>57.3</td>
<td>31.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Non Gated MDCT Thoracic Aortography

- ARCH AND DESCENDING AORTIC ANEURYSM
- FOLLOW UP TYPE B DISSECTION OR STENT GRAFT
- TRAUMA
Flow Velocity

**TRANSIT TIME CALCULATION**

- 2 MINI BOLUS INJECTIONS
- TIME TO PEAK
  - PROXIMAL DESC AORTA
  - EXTERNAL ILIAC ARTERY
- DISTANCE (CM) / TIME (S)
Thoraco Abdominal Aorta 64 Channel MDCT
Flow Velocity < 13 cm/s

10  20  30

4-6 ML/ SEC  11  24 SECS
FIRST CIRCULATION
64 X 0.625,
1.375:1  0.584
0.5 SECS  1.0
Results

- ATTENUATION PROFILE

- 353 +/- 81
- 336 +/- 81
- 333 +/- 85
- 331 +/- 81
- 336 +/- 90
CT Thoracic Aortography

**ASCENDING AORTA**
- RETROSPECTIVE GATING
  - CORONARY ARTERIOGRAPHY
  - ANATOMY, FUNCTION AORTIC VALVE, LV
- PROSPECTIVE TRIGGERING
  - CORONARY ARTERIOGRAPHY
  - ANATOMY AORTIC VALVE, LV

**ARCH, DESCENDING**
- NON GATED

**THORACIC AORTA (ASC, DESC AORTA)**
- GATED (PROSPECTIVE)