Ultra High-Pitch Coronary CT Angiography

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Siemens
Bayer
Bracco
General Electric Healthcare
Medrad
2nd Generation DSCT: Single Heart Beat CT

- Single source CT: upper pitch limit 1.5 for gapless z-sampling

![Graph showing 32 row detector, slicewidth: 0.6mm, pitch: 1.5 Rf=595mm, Rd=490.6mm, p=0 mm with z-direction indicated]
2nd Generation DSCT: Single Heart Beat CT

- Single source CT: upper pitch limit 1.5 for gapless z-sampling
- Faster table feed: z-Sampling gaps, degradation of Image quality

32 row detector, slicewi:th 0.6mm, pitch: 3 Rf=595mm, Rd=490.6mm, p=0 mm
2nd Generation DSCT: Single Heart Beat CT

- Single source CT: upper pitch limit 1.5 for gapless z-sampling
- Dual source CT: up to pitch 3.4, depending on SFOV
2\textsuperscript{nd} Generation DSCT: Single Heart Beat CT

Single Heart Beat CT with 2\textsuperscript{nd} Generation DSCT
2nd Generation DSCT: Single Heart Beat CT

- 0.27 s for 120 mm
- 75 ms temporal resolution
- No redundant data
- 2/3 dose of prospective ECG triggering
- 100 kV
- 0.9 mSv
2nd Generation DSCT: Single Heart Beat CT

31-ya man with family hx++, chest pain and abnormal SPECT

Entire heart in one diastole = 270msec
31-yo man with family hx+++ , chest pain and abnormal SPECT

<table>
<thead>
<tr>
<th>Scan</th>
<th>kV</th>
<th>mAs/ ref.</th>
<th>CTDvol mGy</th>
<th>DLP mGycm</th>
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<tbody>
<tr>
<td>Patient Position F-SP Topogram</td>
<td>1</td>
<td>120</td>
<td>36 mA</td>
<td>1.59</td>
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<tr>
<td>FL_CaSc Contrast</td>
<td>2D</td>
<td>120</td>
<td>97 / 80</td>
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<td>3</td>
<td>100</td>
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<td>100</td>
<td>361 / 400</td>
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<table>
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<tr>
<th>Medium</th>
<th>Type</th>
<th>Iodine Conc. mg/ml</th>
<th>Volume ml</th>
<th>Flow ml/s</th>
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2\textsuperscript{nd} Generation DSCT: Single Heart Beat CT
Entire Chest in Acute Chest Pain Patients

- 56 yo ♀
- Acute chest pain
- 100 kV
- 1.4 mSv thorax
- 0.67 s for 290 mm
- 0.75 ms temporal resolution

<table>
<thead>
<tr>
<th>Patient Position F-SP</th>
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<th>kV</th>
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<th>TI s</th>
<th>cSL mm</th>
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<td>100</td>
<td>308 / 320</td>
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<td>94</td>
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<th>Flow ml/s</th>
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**ECG-Synchronized Thorax < 1 sec**

26-Jul-2011 13:31

**Ward:** A1CP  
**Physician:** em / 18g in rt ac  
**Operator:**

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<th>Total mAs</th>
<th>Total DLP (mGycm)</th>
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<th>CTDIvol (mGy)</th>
<th>DLP (mGycm)</th>
<th>TI (s)</th>
<th>cSL (mm)</th>
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<td>F-SP</td>
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<tr>
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<td>80</td>
<td>312</td>
<td>40</td>
<td>0.28</td>
<td>0.6</td>
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</table>

**Medium**  
**Type**  
**Iodine Conc. (mg/ml)**  
**Contrast**  
**Ultravist**  
370
Recent Literature: Coronary CTA

- 50 patients <100 kg bodyweight and ≤ 60bpm
- Sensitivity of 100%, specificity of 82% for CAD ≥ 50% compared to cath
- Positive predictive value 72%, negative predictive value 100%
- @ 0.76 ± 0.08 mSv

Achenbach et al. (J Am Coll Cardiol Img 2011;4:328–37)
Recent Literature: Acute Chest Pain Protocols

- Image quality (study in 51 patients, entire chest)
- All patients: 3.2% of coronary segments non-evaluable
- $\leq 65\text{bpm (}n = 30\text{)}$ only 1.5% segments classified as non-evaluable

Bamberg et al. EurJRadiol 2011
Adenosine Stress Perfusion with High-Pitch

Compared with CMR
Sensitivity 96%; specificity 88% @ 2.5 mSv

Delayed Enhancement with High-Pitch

- Study in 24 patients, compared with 1.5T MRI
- Per-patient sensitivity of 90%, specificity of 93% @ 0.89±0.07 mSv

High-Pitch CTA of the Entire Aorta

Group 1 = Sensation 16; Group 2 = Single-Source 128; Group 3 = High-Pitch 3.0

Beeres et al. Eur Radiol (2011)
High-Pitch CTA of the Entire Aorta

Beeres et al. Eur Radiol (2011)
High-Pitch CTA of the Entire Aorta

Conventional CTA

High-Pitch CTA

Vliegenthart et al. NASCI 2011
High-Pitch cCTA: MUSC Experiences

- Requires regular heart rate < 65 bpm
  Should be performed during diastole
- Does not work reliably during systole
- Works in 95% of patients the first time
- Remains < 1mSv with 80 or 100kV
- Technique can be adjusted to higher BMI
- Can easily be extended to the entire chest or torso
- Scan protocol of 1st choice in young, low-risk patients