State-of-the Art Technology in Cardiac MR

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Cardiovascular Tools
- anatomy & morphology
- function & wall motion
- perfusion
- viability
- angiography

Total Imaging Matrix: Tim
- Up to 105 coil elements
- Connected into 32 channels

Parallel in all Directions
- High-speed / high-resolution parallel imaging.
- In all directions, whole body.
- No need for specific PAT coils anymore.

Real-time Cine Imaging
- TSENSE x 3
- 65 msec true temporal resolution
- 80x192 matrix, 255mm x 340mm x 8mm
- TE 1.1 msec, 80º flip angle TrueFISP

High spatial resolution in real time
- 32 channel cardiac coil, PAT 4, T-SENSE
- Res: 1.1 x 0.8 mm²
- TA: 92 ms / image
- PAT 4

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A Symposium on Cardiovascular Imaging
“New Horizon of Cardiac CT & MRI”
Seoul, October 13, 2006

**GRE-EPI with T-SENSE X 2**
Case example: anterior and inferior first-pass defects

**3D Perfusion with iPAT2 and T-SENSE**
Full cardiac coverage with PAT 8 (4 x 2)

- GRE-EPI: Inversion Recovery / Fat Saturation
- Matrix: 128x64, FA: 30°, BW/pixel: 1860 Hz, EPI 4, 1D T-SENSE R=2;
- 8 Partitions, 50% slice resolution; TI 200 ms; TR / TE 5.5/1.2 ms

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**Two in one: Cine – Late Enhancement**
Combined wall motion and late enhancement in one exam

**Cine Late Enhancement**

- TrueFISP Cine
- Late Enhancement

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**3D Coronary Imaging**
without contrast agent

- New navigator techniques
- Adaptive motion correction
- New visualization tools

**Free Breathing Coronary MRA**

- LAD
- Proximal RCA
- Distal RCA
Free Breathing Coronary MRA

Soap Bubble Reformat

TR / TE / flip = 2.3 ms / 1.0 ms / 90°
FOV = 500 mm × 500 mm
Matrix = 320 × 320
Slice thickness = 4 mm interpolated to 2 mm
TA = 6 min, 15 sec
Free breathing

Non-contrast MRA: Dilated aorta

TR / TE / flip = 2.3 ms / 1.0 ms / 90°
FOV = 500 mm × 500 mm
Matrix = 320 × 320
Slice thickness = 4 mm interpolated to 2 mm
TA = 6 min, 15 sec
Free breathing

Transposition of the great vessels

TR / TE / flip angle = 2.3 ms / 1.0 ms / 90°
FOV = 420 mm × 420 mm
Matrix = 256 × 256
Slice thickness = 4 mm interpolated to 2 mm
TA = 9 min, 59 sec

Dynamic MRA with T-SENSE 2

Acceleration: 8
Matrix: 256x256x40
FOV: 400x400x120 mm³
TR/TE: 3.5/1.1 ms
TSENSE: 4x2
Acq time/measure: 2.7 s

Dynamic MRA Using TWIST:

As is well-known, k-space can be divided into two regions, A and B. "A" defines the overall image contrast, and "B" adds object details. In the TWIST sequence, region B is scanned at a lower sampling rate to increase the frame rate.
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Dynamic MRA Using TWIST:

Congenital Vascular Disease
Avanto, UCLA

Time-resolved (iPAT x 2)
1.3 x 1.1 x 4.0mm³
1.8 sec / frame

Dynamic Peripheral MRA at 3.0 T

AVM, time-resolved MRA using TWIST

Cardiac MR at 3T

1.5T
3.0T

Cardiac Function @ 3T

Cine TrueFISP

Comparison of 3T and 1.5T
- resting first-pass perfusion -

1.5T
3.0T

Higher SNR at 3T

Comparison of 3T and 1.5T
- tagging sequence -

1.5T
3.0T

Better CNR at 3T

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Cardiac MRI @ 3T

- Aortic valve leaflet defect
- Aortic regurgitation
Cine FLASH to avoid off-resonance artifacts

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Viability & Function @ 3T

- IR single shot TurboFLASH
- IR segmented TurboFLASH (4 h)

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Cine, Perfusion, and Viability @ 3T

- Cine TrueFISP
- SR TurboFLASH + TSENSE
- Phase sensitive IR TurboFLASH
- function
- perfusion
- viability

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Pulmonary MRA

- high res, 20 sec
- Dynamic MRA (TWIST)
- 1 sec resolution

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Aortic Dissection

- Dynamic MRA (TWIST)
- High-res MRA (Thin MIP)

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