MRA at 3.0T

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Acknowledgements
- Stefan Ruehm, MD
- Kambiz Nael, MD
- Roya Saleh, MD
- Anthony Ton, MD
- Mayil Krishnam, MD
- Sergio Godines, RT
- Glen Nyborg, RT
- Howard Dinh, MD
- Carissa Fonseca, Ph

General Trends at 3.0T vs 1.5T

- Increased SAR
  - Limits flip angles and minimum TR for high-performance sequences
    - SSFP cine
    - Spin echo train imaging
    - CEMRA

B1 Inhomogeneity
- Shading in some regions
- Inhomogeneous contrast in some regions
- May make calibration of RF transmitter voltages difficult – varying flip angles within body regions

Carotid and Thoracic MRA at 3.0T
**Bifurcations**

**Origins**

**Intracranial**

**Vertebro-basilar**

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**Carotid Disease**

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**CEMRA Procedure: typical**

- Center on head and do pre-Gd brain sequences
- Center on neck via remote table movement (typical offset 140 mm)
- Multiplanar scout images
- Timing-localizer (< 60 secs)
- Run pre- and post-contrast, breath-held 3D MRA
- Move table and do post-Gd brain sequences

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**Contrast Injection Scheme**

- Electronic infusion pump
- Timing run with 2 ml Gd
- MRA: 20 ml Gd at ~ 1.2 ml/sec flow rate
- 30 ml saline flush @ 1.2ml/sec

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**Also works at 1.5T!**


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**TEST BOLUS**

- Ultra-fast 3DFLASH, one 3D data set/sec

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**Timing-run /Localizer**
Time-resolved 3D for Timing Run & Slab Positioning

- 2cc Gd - 20cc saline, temporal resolution 1 sec

Inject test bolus

CEMRA Protocol: Time-resolved 3D

Fast 3D GRE sequence:
TR/TE 2.1/0.9 ms, FA 15°, BW 1200 Hz/pixel
Matrix 384 x 256
Partition thickness 4 mm
GRAPPA x 3
5 ml Gd at 3 ml/s followed by 30 ml of saline flush
Temporal resolution ~ 1.5 secs

CEMRA Protocol: High Resolution 3D

3D Contrast Enhanced MRA of the Head & Neck at 1.0T: Using Highly Acceleration Parallel Acquisition. Radiology, in press.

Time-Resolved 3D MRA

- 5ml Gd. 1.5 secs per 3D phase

CEMRA Protocol: High Resolution 3D

Fast 3D GRE sequence:
TR/TE 3/1.2 ms, FA 20°, BW 790 Hz/pixel
Matrix 460 x 576 (0.84 x 0.67 mm²)
Partition thickness 0.75 mm
GRAPPA x 4
22 ml Gd at 1.2 ml/s followed by 30 ml of saline flush
A coronal 3D slab included the aortic arch, carotids and vertebro-basilar circulation in a 20 second breath-hold

62 yr old female with 'UBO's

6ml Gd, 12 measurements each 1.7 s apart

Atherosclerosis

Headache

Postprocessing: MIP – thin

Postprocessing: Dynamic VR

Postprocessing: VR

20 sec breath hold, 0.8 x 0.7 x 0.7 mm³

20 sec breath hold, 0.8 x 0.7 x 0.7 mm³

Atherosclerosis
Atherosclerosis

STROKE: 3.0T Male 62 yrs

20 sec breath hold, 0.8 x 0.7 x 0.7 mm³

Kawasaki’s Disease: 31 yr old female

6ml Gd, 12 measurements each 1.7 s apart

21 s breath hold

Dynamic Pulmonary Perfusion and Flow Quantification:
3.0 T vs 1.5 T

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Dynamic SNR Evaluation

ROIs were placed over the pulmonary arteries and over both lung fields separately
Perfusion Semi-quantitative Analysis
Gamma variate fit on a pixel by pixel basis calculates: MUS, MTT, TTP, MSI

Conclusion
Anatomical vascular structures were seen with higher SNR at 3.0 T (consistent with theoretical predictions)

Parenchymal enhancement (often related to microvascular perfusion) is better seen at 1.5 T than 3.0 T

No significant difference was found between F.Q. or quantitative perfusion analysis at 1.5 & 3.0 T
High Resolution MRA at 3.0 Tesla

Renal Transplant: 3.0T Tim Trio

GI symptoms: M 55yrs

Bilateral Renal Aneurysms

Breath-hold, ~20 sec
Parallel imaging iPAT x 3
Injection of 25 ml Gd-DTPA

TIM Trio: Branch Renal Artery Stenosis

TIM Trio: Renal Arteries
**Conclusion**

- MRA at 3.0T is versatile and mature
- Only modest doses of contrast are required
- Attention to detail is important
- Post-processing can greatly enhance visualization

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**Thank you**