Time Resolved MRA

- What is Time Resolved MRA?
- Techniques
- Pros and cons when compared to CE-MRA
- Clinical Utility
- Cases
- Limitations
- Future
What is Time resolved MRA?

- It is a real time dynamic contrast MR angiography with high temporal resolution to specifically assess contrast flow dynamics in arteries and veins
- Utilizing only a small contrast dose
Technique

- Rapid sequential imaging of the selected FOV during a tight contrast bolus
- 6 ml of diluted contrast volume (mixed with saline 50:50) at 3 cc/sec followed by saline chaser, 15 ml at 3 cc/sec
- T1 W ultrafast GRE sequence: TR and TE are in -1-2 milliseconds
- Data is acquired before the contrast arrival to the FOV-to obtain subtraction from contrast data
Technique

- Temporal resolution 1-1.2 s
- Number of measurements x temp res = scan time
- Scan time 30-40 sec

Image
Techniques

- TWIST
- TREAT
- TRICKS
- Non Contrast
TR MRA vs CE MRA

- **TR MRA**
  - High temporal resolution
  - Very low contrast dose
  - Low in spatial resolution
  - Functional information obtained
  - Limited in evaluation for fine details
  - May not need breathhold

- **CE-MRA**
  - High spatial resolution
  - Very low temporal resolution (20 sec)
  - Vascular details are best evaluated
  - Stenosis is better assessed
  - More contrast
  - Breathhold
Time Resolved MRA: Clinical Utility

- Cardiac
- Aorta
- Pulmonary vessels
- Central Veins
- Supra-aortic arteries
- Upper extremity
- Lower extremity
- Abdomen

Cardiac applications

- Intra-cardiac shunts
- Patency of Conduits
- Baffle leak

Aorta

- **Aortic dissection:**
  Better differentiation of false and true lumen
- **Aortic aneurysm**
- **Aortic stenosis:** dynamic collateral flow may be seen

Pulmonary Vessels

- Pulmonary artery embolism
- Pulmonary AVMs
- Anomalous pulmonary venous drainage
- Pulmonary vein ostium measurement
Pulmonary

- PAH
- Pulmonary Parenchymal perfusion

Supraaortic arteries

- **Subclavian Steal**
  - Ability to demonstrate delayed contrast filling in the affected subclavian artery and reverse flow in the ipsilateral vertebral artery

Lohan DG, .. Krishnam MS, Finn JP. Ultra-low-dose, time-resolved contrast enhanced MR angiography of the carotid arteries at 3.0 Tesla. Invest Radiol, 2009 Apr
Central Thoracic Veins

- Venous Occlusion
- Collateral flow pattern
- Patency of Stents

Upper extremity

- Vascular Malformation
  - High vs Low
- Patency of AV graft/fistula
- Pre-op planning UE vessels prior to tumor resection
Lower Extremity

- Peripheral vascular disease
  - Single station Calf
  - MRA

- AVM
Other vascular applications:

- Vascular Malformations
  - High flow vs low flow lesions
Other vascular applications:

- Renal Artery
- Aneurysm
Other vascular applications:

- IVC stenosis/occlusion
Other vascular applications:

- Endoleak
Other vascular applications:

- Uterine and ovarian arteries
  - Planning for UFE
Limitations

- Low spatial resolution
- Vascular details
- Reliable evaluation for luminal stenosis is limited
- Widespread availability of the sequence
- Lack of expertise
Future

- Better Z plane spatial resolution
- Ability to do 3D rotation without compromising vascular details
- Better anatomic evaluation of small vessels
- Faster data reconstruction and less scan time
- Potentially can replace CEMRA
- Non contrast TR MRA
Conclusions

- Time resolved MRA depicts real time contrast flow dynamics in vessels.
- It helps to evaluate dynamic contrast filling of both veins and arteries without any overlay.
- It needs only a small amount of contrast dose.
- It is limited in spatial resolution.
- It has a role in various cardiovascular pathologies.
- Currently it is a complimentary technique to CE MRA but for certain conditions it can replace CE MRA.
- This technique will be widely available and utilized in future.
Acknowledgements

- Paul Finn, UCLA
- G Laub, Siemens
- S Ruehm, UCLA
- Sergio Godinez, Glen Nyborg Cardiac MRI Techs UCLA
- MRI Techs UCI
Thank You