MR IMAGING OF VASCULAR MALFORMATIONS: PRE AND POST TREATMENT
Scott Resnick, MD FSIR
Professor, Radiology and Surgery
Northwestern University

CHALLENGES
- Heterogeneous spectrum of lesions
  - Location
  - Composition
  - Inaccurate nomenclature

ISSVA CLASSIFICATION
- Preponderant vascular channels
  - Venous vs lymphatic vs capillary vs arterial
- Flow dynamics
  - Low vs High

VALUE
- Anatomic extent
  - Relationship to adjacent structures
- Hemodynamics
  - Procedure success evaluation

MR VM BASICS
- Basic
  - Multiplanar
  - T1
  - Fat suppressed T2
  - STIR (Heavily T2 weighted)
- Preference
  - CEE MRA (cor 1 weighted gradient echo GRE)
  - Dynamic time-resolved MRA
  - TOF sequences less useful

T1
**T2 (FAT SUPPRESSED) OR STIR**
- Bright water
- Blood
- Thrombus
- Fluid
- Edema
- Good for lesion extent overestimation

**CE MRA**
- Lesion perfusion
- AV shunting
- Pre/post CE subtraction
- 3D reformation
- Faster acquisition
- High temporal resolution
- Artery vs vein
- Feeding vs draining

**CE MR GRE PRE POST**

**TR CE MRA**

**DYNAMIC TIME RESOLVED MRA**
- 3D MRA + time = 4D imaging
- Virtual angiography

**LESION CHARACTERISTICS**
- **Low Flow**
  - Mass
  - Septated
  - Infiltrative
  - Phleboliths
- **High Flow**
  - No well defined mass
  - Enlarged feeding arteries
  - Enlarged draining veins
  - Infiltrative

Image courtesy Michael Markl, PhD, Northwestern University
LOW FLOW
- Usually minimal mass effect
- Mass
- Septated
- Infiltrative
- Phleboliths

HIGH FLOW
- No well defined mass
- Enlarged feeding arteries
- Enlarged draining veins
- Infiltrative

MRI CHARACTERISTICS

Low Flow
- Low signal T1
- High signal T2
- No flow voids
- No significant enhancement
  - Rim or septal
  - Very late

High Flow
- Flow voids
- Early enhancement
- AV shunting

PRETREATMENT UTILITY
Anatomic characteristics
Structures involved
Risk mitigation
Treatment planning

POST TREATMENT MR

Low Flow – signal changes
- < 3 months
  - Inflammatory reaction
  - Increased signal
  - Peripheral enhancement
- > 3 months
  - Scar
  - Diminished signal
  - Lesion size diminution

High Flow – anatomic changes
- Reduced or absent shunting
- Venous thrombosis
- Magnetic susceptibility artifact
- Ferromagnetic coils

T1
- Blood dark
- Thrombus bright
- Scar dark

T2
- Blood bright
- Thrombus bright
- Scar dark

LOW FLOW POST T1

LOW FLOW

HIGH FLOW

PRETREATMENT UTILITY

POST TREATMENT MR
LOW FLOW POST T2

POST TREATMENT MR

FUTURE DIRECTIONS
- 4D flow techniques
- Virtual angiography
- Applicable for VMs

Image courtesy James Carr, MD, Northwestern University

SRESNICK@NORTHWESTERN.EDU
CELL 773-485-8523