

Sunrise Course: *Advanced MSK MRI Techniques with Clinical Applications*  
Day: Tuesday - Thursday, 23-25 April 2013

### **Dynamic contrast-enhanced MRI**

William B. Morrison, MD  
Thomas Jefferson University Hospital  
Philadelphia, PA

#### **Technique:**

- Baseline noncontrast fast T1 SE, GRE or other fast T1 acquisition (<20sec)
  - fat suppression optional (slows acquisition)
- Bolus of Gd contrast (standard dose) injected into peripheral vein
- Immediately repeat T1 SE or GRE MR imaging performed
- Follow out 4-5 runs, immediately following each other
  - number of runs depends on vascularity and location (ie, toes in diabetic patients must be followed out longer)
- Perform analysis
  - Objective: ROI measurement of signal intensity in regions of concern
  - Subjective: Subtraction of post-contrast images from pre-contrast mask

#### **Concept:**

- Post-contrast imaging with delay may not show true vascularity
- Early washout can cause false negative results in highly vascular conditions
  - Contrast distribution through extracellular compartment can result in false positive results
  - Only imaging post-bolus can define true vascularity

#### **Uses:**

##### *Tumor imaging*

- vascularity can be defined pre-treatment and on follow-up

##### *Infection*

- vascularity can indicate a more aggressive nature
- ? Differentiating infection from neuropathic disease

##### *Hyperemia versus osteonecrosis*

- Bone marrow edema can indicate hyperemia or ischemia
- May appear identical on T1 and T2w imaging
- i.e., femoral head (subchondral stress fracture vs. AVN) or scaphoid after fracture
- Rapid contrast uptake excludes osteonecrosis
- Gives surgeon information regarding whether bone is viable for fixation / repair

##### *Arthritis*

- Analysis of synovial proliferation
- Activity of arthropathy (i.e., rheumatoid arthritis)
- Treatment efficacy

##### *Perfusion mapping*

#### **References**

1. Guo J, Reddick WE, Glass JO, Ji Q, Billups CA, Wu J, Hoffer FA, Kaste SC, Jenkins JJ, Ortega Flores XC, Quintana J, Villarroel M, DawNC. Dynamic contrast-enhanced magnetic resonance imaging as a prognostic factor in predicting event-free and overall survival in pediatric patients with osteosarcoma. *Cancer*. 2012 Aug 1;118(15):3776-85.
2. Müller GM, Månsson S, Müller MF, Ekberg O, Björkman A. Assessment of perfusion in normal carpal bones with dynamic gadolinium-enhanced MRI at 3 tesla. *J Magn Reson Imaging*. 2012 Nov 27.
3. Chan WP, Liu YJ, Huang GS, Lin MF, Huang S, Chang YC, Jiang CC. Relationship of idiopathic osteonecrosis of the femoral head to perfusion changes in the proximal femur by dynamic contrast-enhanced MRI. *AJR Am J Roentgenol*. 2011 Mar;196(3):637-43.
4. Boesen M, Kubassova O, Bouert R, Axelsen MB, Ostergaard M, Cimmino MA, Danneskiold-Samsøe B, Hørslev-Petersen K, Bliddal H. Correlation between computer-aided dynamic gadolinium-enhanced MRI assessment of inflammation and semi-quantitative synovitis and bone marrow oedema scores of the wrist in patients with rheumatoid arthritis—a cohort study. *Rheumatology (Oxford)*. 2012 Jan;51(1):134-43.

