

Use of Dynamic Contrast-enhanced MRI (DCEMRI) for Evaluation of Bone Viability

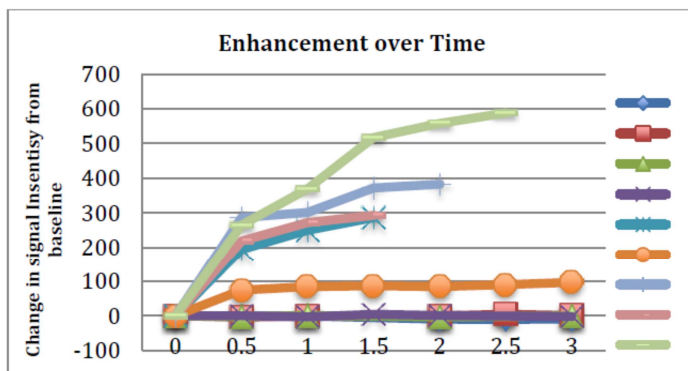
Sandra Rutigliano¹, adam zoga¹, suzanne long¹, and william morrison¹
¹radiology, thomas jefferson university hospital, Philadelphia, PA, United States

Purpose: To determine the utility of dynamic contrast-enhanced MRI (DCEMRI) for differentiation of ischemia/avascular necrosis (AVN) and hyperemia associated with bone marrow disease.

Methods: 14 patients with clinical concern for osteonecrosis and equivocal radiographic findings, as well as bone marrow edema (BME), underwent DCEMRI to evaluate for underlying ischemia. Exams included 10 wrists, 2 hips, 1 tibia and 1 talus (M:F=8:5, average age 35.3, range 17-58). MR imaging was performed in multiple planes, including T1-weighted, T2-weighted fat-suppressed, STIR, as well as pre- and multiple post-contrast fat-suppressed T1 weighted fast multiplanar spoiled gradient echo (FMPSPGR) images followed out to 4 minutes after injection. Region of interest (ROI) measurements were performed of the edematous portion of the marrow as well as adjacent unaffected bone marrow. Contrast uptake over time was plotted and percentage enhancement was recorded. Comparison was made with extent of edema measured on T1 and T2 fat suppressed images relative to adjacent non-edematous marrow. Correlation was made with clinical and/or imaging follow-up as well as surgical results when available.

Results:

Six of fourteen examinations demonstrated no enhancement on DCEMRI. Of these cases, one case was confirmed to have AVN at surgery and the remaining five were shown to have AVN at clinical follow-up. One case demonstrated weak enhancement, suggesting ischemia without frank necrosis. This case, a talus, showed AVN at surgery 2 months after the exam. Another case with weak enhancement, a femoral head, showed AVN at surgery 4 years after the exam. Remaining cases were managed accordingly for the alternative causes of BME, i.e. fracture, lunate abutment.



Subjects A-D demonstrate no enhancement, with essentially no change in signal intensity following contrast administration. Subject F demonstrates a normal bone marrow enhancement pattern, in keeping with minimal amount of bone marrow edema. Remaining subjects demonstrate brisk enhancement.

	Mean drop in T1 signal	Mean increase in T2 signal
BME with AVN	71.76%	58.23%
BME without AVN	60.44%	267.3%

T1 signal in the area of interest was decreased in all cases. The T1 signal intensity dropped by 64% on average, range 51.2-91.4%, st dev 12.7%. There was considerable variation in the degree of increased T2 signal, which ranged from 25.7% to 1229.3% (mean 180.19%, st dev 333.91%).

Conclusion:

AVN and alternate causes of BME have similar clinical presentations and often are referred to MR for evaluation. However, appearance on non-contrast MR can be nonspecific. Dynamic contrast-enhanced MR can be a useful tool to differentiate AVN from alternate causes of BME.