

Quantitative assessment of perfusion and permeability in osteochondritis dissecans lesions: feasibility and initial results

A. P. Arnoldi¹, M. Ingrisch², S. Utzschneider³, M. F. Reiser¹, and S. Weckbach¹

¹Department of Clinical Radiology, Ludwig-Maximilians-University Munich, Munich, Bavaria, Germany, ²Josef Lissner Laboratory, Department of Clinical Radiology, Ludwig-Maximilians-University Munich, Munich, Germany, ³Department of Orthopedics, Campus Grosshadern, Ludwig-Maximilians-University Munich, Munich, Germany

Purpose:

Osteochondritis dissecans (OCD) is a common cause of morbidity especially among skeletally immature and young adult orthopedic patients. While the origins of OCD and its exact pathophysiology have not yet been clearly understood, determination of the best management of the condition still remains difficult and continuously discussed [1, 2]. The purpose of the study was to evaluate the feasibility of quantitative assessment of perfusion and permeability in OCD lesions by 3D dynamic contrast enhanced (DCE) MRI.

Materials and Methods:

6 (mean age 18 y) patients with OCD of the medial femoral condyle (n=3) and of the medial talar dome (n=3) underwent DCE-MRI at 3T (Magnetom Verio, Siemens Medical Solutions, Germany) using a view-sharing 3D gradient echo sequence (TE/TR 2.46/4.78ms, flip angle 18°, spatial resolution 0.6x0.6x4.0mm³, matrix size 256*220*16, temporal resolution 3.0s) after bolus injection of 0.2 mmol/kg Gd-DTPA. The arterial input function was measured in the popliteal artery (knee) or in the anterior tibial artery (ankle), respectively. Regions of interest (ROI) in OCD lesions were drawn on maps of maximum signal enhancement; subsequently, hemodynamic parameters in these regions were determined using a 2-compartment exchange model, yielding estimates of plasma flow (PF), plasma volume (PV), permeability surface product (PS) and extravascular, extracellular volume (VEE) [3].

Results:

In all patients, OCD lesions were clearly visible on the maximum enhancement maps and showed strongly elevated perfusion and permeability (Fig. 1). Mean values (SD) of the estimated parameters were: PF: 121 (70) ml/100ml/min, PV: 14.5 (5.3)%, PS: 16.3 (10) ml/100ml/min and VEE: 16.7 (6.7)%.

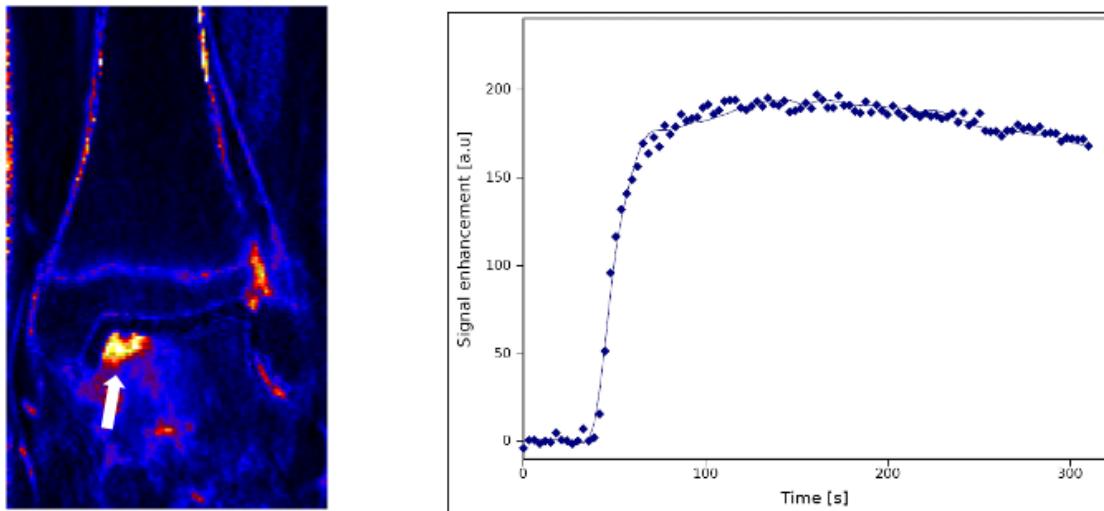


Figure 1. Color coded maximum signal enhancement map of an OCD lesion of the medial talar dome (left). Graph for the signal enhancement curve along with a two-compartment model fit of the region indicated by an arrow. (PF: 212 ml/100ml/min, PV: 24.7 %, PS: 29.2 ml/100ml/min, VEE: 25.9 %) (right).

Conclusion:

Our study shows the feasibility of DCE-MRI to i) detect lesions in patients with OCD and ii) quantify perfusion and permeability using a two compartment model. This quantitative approach provides additional information on the pathophysiology of the condition, might influence disease management and provide a non-invasive means of therapy monitoring.

References:

- [1] P. F. O'Loughlin, et al. 2010 Am J Sports Med 38 2 392-404;
- [2] M. S. Kocher, et al. 2006 Am J Sports Med 34 7 1181-91
- [3] S Sourbron et al, 2009 MRM 62 205-217