THE VALUE OF DCE-MRI IN THE DIFFERENTIAL DIAGNOSIS OF PSORIATIC ARTHRITIS AND EROSIVE OSTEOARTHRITIS OF THE HAND

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Introduction

Psoriatic arthritis (PsA) is a synovial inflammatory arthropathy defined as the occurrence of seronegative arthritis and psoriasis. Psoriatic arthropathy may antedate skin changes in 20% of patients. The peripheral joint involvement in PsA is often asymmetrical and oligoarticular, and can even mimic rheumatoid arthritis [1]. Clinically, it may be difficult to distinguish polyarticular PsA from erosive osteoarthritis (EOA), because both entities share many clinical features, such as the pattern of joint involvement and the involvement of collateral ligaments and tendons [2]. Furthermore, there are few specific diagnostic markers, so that laboratory parameters may not contribute in the differential diagnosis either.

In order to prevent serious joint damage, early differentiation of PsA and EOA is important, because new treatment approaches are particularly adapted for each arthritis entity [3]. Recent studies demonstrated that analysis of synovial membrane inflammation by dynamic contrast-enhanced (DCE)-MRI is useful, both in characterization of inflammation activity as well as in the differentiation of arthritis types [4-6]. Therefore, the aim of the present study was to investigate DCE-MRI in the differential diagnosis of PsA and EOA of the hand.

Material and Methods

Patients: Twenty-six patients (17 PsA, 9 EOA; **Table 1**) with symptomatic joint involvement of the hands were studied. Synovial enhancement curves of the clinically most affected joint were recorded in the metacarpophalangeal (MCP), proximal (PIP) or distal interphalangeal joints (DIP). ***MRI Protocol:*** Measurements were performed on a 3 T whole-body MRI scanner (Magnetom Trio, Siemens Healthcare, Germany) using a one-channel receive/transmit wrist-coil. In addition to anatomical images, a 3D encoded spoiled gradient-echo sequence was applied to assess contrast-medium uptake curves in the synovium (FLASH: fast low-angle shot, TR/TE 3.91 ms/1.45 ms, resolution 0.8 x 0.8 x 0.8 mm^3, bandwidth 350 Hz/px, 32 slices per slab, flip angle 20°, spectral fat saturation, acquisition time 10 sec). After bolus injection of 0.1 mmol Gd-DTPA per kg body weight with an injection rate of 2 ml/sec, a series of 16 repetitive scans were recorded within 3 min. Late enhancement was assessed fifteen minutes after contrast-medium injection. ***Image Analysis:*** Synovial enhancement curves were assessed by manually placing ROIs in affected synovial tissue in the axial dynamic images. Time to peak (TTP) was assessed, and the relative enhancement (RE) in relation to S_0 was calculated by $RE_t = ((S_t - S_0)/S_0) \times 100\%$ at t = 35 s, t = 52 s, t = 3 min, t = 15 min. S_0 and S_t indicate the signal intensity before and at t seconds after contrast injection. Statistical analysis was performed using statistical software SPSS version 14.0 for Windows (SPSS Inc., Chicago, USA). Means were compared by the Wilcoxon test. Significance level was set to 5 %.

Results

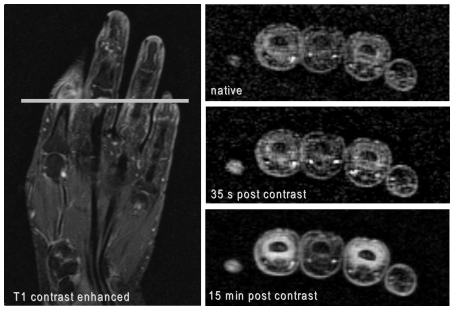
Diagnostic image quality was reached in all patients. A typical image series is shown in **Figure 1,** whereas enhancement data from all patients are summarized in **Table 1**. Significant difference between PsA and EOA was found regarding the relative late enhancement after 15 minutes ($p < 0.05$) with higher values in EOA. In contrast, no difference in relative enhancement was found in TTP and early enhancement at 35 seconds, 52 seconds, and 3 minutes after contrast injection (**Table 1**). PsA patients had lower TTP than EOA patients, although this difference did not reach statistical significance.

Table 1 Patients' characteristics and enhancement values

	psoriatic arthritis	erosive osteoarthritis	p-value
number of patients	17	9	
male/female	8/9	5/4	
mean age	48 ± 7 (37-61)	59 ± 5 (51 - 66)	
disease duration (years)	7.2 ± 7.5 (0.2 – 22.0)	1.8 ± 1.7 (0.3 - 4.5)	
patients with MCP joint prevalence	8	3	
patients with PIP, DIP joint prevalence	9	9	
TTP in sec	283 ± 176 (129 -681)	213 ± 47 (133 - 260)	0.2963
RE 35s in %	109 ± 64 (3- 247)	139 ± 12 (15 - 421)	0.6143
RE 52s in %	164 ± 100 (16 - 412)	182 ± 102 (78-421)	0.5704
RE 3 min in %	252 ± 99 (116 – 512)	308 ± 114 (256 – 601)	0.0896
RE 15 min in %	269 ± 55 (191 - 404)	362 ± 97 (249 -526)	0.0275*

Values are given as mean ± standard deviation (range)
MCP = metacarpophalangeal, PIP = proximal interphalangeal, DIP = distal interphalangeal, TTP = time to peak, RE = relative enhancement, * significant

Figure 1 Image series obtained in a PsA patient



Coronal post contrast (left row) image of the right hand indicates slice positioning for axial dynamic measurements marked by the line at the level of the PIP joints.
The three axial images on the right show the native scan (top) and exemplarily at 35s (middle) and the late enhancement after 15 min post contrast (bottom) of the synovial tissue of the second and fourth proximal interphalangeal joint.

Discussion

Dynamic MRI has gained increasing importance in the investigation of patients with arthritis [5, 7-8, 9]. In the present study, different enhancement values were identified in the synovium of PsA and EOA regarding the relative late enhancement recorded 15 minutes after contrast injection. As it is known that contrast media uptake in the inflamed synovial membrane is a result of the number, size, and permeability of vessels and volume of the synovial membrane [11]. The results may reflect microstructural differences of the inflamed synovium in the two entities, particularly different forms of vessel architecture [10].

The recorded DCE-MRI patterns can provide objective diagnostic information which may have important clinical implications: DCE-MRI may aid in the differentiation between EOA and PsA. DCE-MRI could help in detection of additional joint disease (such as PsA in patients already suffering from hand EOA). Moreover, the role of DCE-MRI as an objective measurement tool for evaluating treatment efficacy of new disease-modifying agents for both EOA and PsA needs to be further investigated. The study is limited by the fact that PsA patients had significantly higher disease duration than EOA patients. Whether or not the observed difference in peak and late enhancement is valid for later stages needs to be investigated in subsequent prospective follow-up studies.

Conclusion

The present study indicates that DCE-MRI can help in differentiating PsA from OA in clinically ambiguous cases by analyzing the late enhancement. The results strongly encourage further testing of this technique in patients with suspected or unclassified arthritis.

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