

Automated quantification of early bone alterations and pathological bone turnover in experimental arthritis by *in vivo* PET/CT imaging.

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Abstract

The assessment of bone damage is required to evaluate disease severity and treatment efficacy both in arthritis patients and in experimental arthritis models. Today there is still a lack of *in vivo* methods that enable the quantification of arthritic processes at an early stage of the disease. We performed longitudinal *in vivo* imaging with [¹⁸F]-fluoride PET/CT before and after experimental arthritis onset for diseased and control DBA/1 mice and assessed arthritis progression by clinical scoring, tracer uptake studies and bone volume as well as surface roughness measurements.

Arthritic animals showed significantly increased tracer uptake in the paws compared to non-diseased controls. Automated CT image analysis revealed increased bone surface roughness already in the earliest stage of the disease. Moreover, we observed clear differences between endosteal and periosteal sites of cortical bone regarding surface roughness. This study shows that *in vivo* PET/CT imaging is a favorable method to study arthritic processes, enabling the quantification of different aspects of the disease like pathological bone turnover and bone alteration. Especially the evaluation of bone surface roughness is sensitive to early pathological changes and can be applied to study the dynamics of bone erosion at different sites of the bones in an automated fashion.

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