

Plenary Lecture-MD

PL01

Advanced MRI of Osteoarthritis

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In this lecture I will cover the imaging of osteoarthritis using MRI.

The lecture will start with an overview of the clinical relevance and societal impact of osteoarthritis and how the prevalence, and hence the consequences, of this disease will significantly increase in the coming decades.

This will be followed by an explanation of the whole-joint concept of osteoarthritis and how this relates to MRI being the most suitable imaging modality to visualize tissue changes in joints affected by osteoarthritis.

Then, I will discuss how conventional, morphological MRI techniques can visualize osteoarthritis-related abnormalities in various tissues such as the articular cartilage, subchondral bone and soft tissues, and how these can be evaluated using semi-quantitative scoring methods. I will also highlight the shortcomings of these conventional MRI techniques.

This will be followed by a presentation of several advanced, quantitative, MRI techniques to characterize joint tissues in the context of OA. These techniques include quantitative techniques to assess articular cartilage and meniscus composition (e.g. T2- and T1rho mapping, Gag-CEST, and sodium MRI) and DCE-MRI to assess inflammation in soft tissues and bone.

I will then introduce PET/MRI as a novel hybrid technology that has shown promise to advance our understanding of the pathophysiology and subtypes of osteoarthritis, and I will explain how my group envisions linking PET/MRI to biomechanical evaluation (motion capture, biomechanical modeling, EMG) to assess the role of abnormal loading in osteoarthritis.

Finally, I will highlight the importance of advanced image analysis pipelines and demonstrate our efforts in the field of image segmentation, AI, and radiomics.

Keywords: *Osteoarthritis, Quantitative MRI, Cartilage, Relaxometry, Perfusion MRI, PET/MRI, Image analysis, Biomechanics*