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COMBINED ASSESSMENT OF CARTILAGE AND SUBCHONDRAL BONE IN OSTEOARTHRITIC AND NON-OSTEOARTHRITIC KNEE COMPARTMENTS: A ULTRA-HIGH FIELD MRI STUDY

Keywords: Imaging

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Background: Knee osteoarthritis (OA) is one of the most common degenerative diseases causing disability in elderly people. Although X-ray radiography is widely used as a diagnostic tool, several limitations have been identified [1]. MRI is a non-invasive imaging method widely used in order to assess articular and periarticular structures of the knee joint [2]. However, the image resolution provided by conventional MRI is not high enough to assess subchondral bone so that ultra-high field MRI (7 Tesla) has been proposed as an alternative of interest to compute bone microarchitectural parameters [3].

Objectives: We used ultra-high field MRI (UHF 7 Tesla MRI) to assess cartilage and subchondral bone microarchitecture in patients with mild and severe OA. For each patient, compartments classified as osteoarthritic were compared with non-osteoarthritic compartments.

Methods: Twenty-four patients were divided into 3 groups according to the Kellgren Lawrence staging and 12 volunteers were recruited as controls. UHF MRI was used to calculate cartilage thickness (Tc), volume (Vc), and T2*. MRI sequences used were T1 3D gradient recalled echo sequence (T1 3D GRE) and sagittal T2* mapping. Bone microarchitecture was assessed on the basis of trabecular thickness (TbTh), trabecular number (TbN), trabecular space (TbSp), and bone volume fraction (BVF).

Results: For the medial tibial plateau, while Tc was unchanged between the two OA groups, Vc was decreased in patients with severe OA ($\Delta = -49\%$, $p < 0.05$). For the patella, Vc was decreased in patients with mild OA ($\Delta = -36\%$, $p < 0.05$), while Tc was unchanged. Similar results were found for the lateral femoral condyle. The study of T2* cartilage relaxation (T2* mapping) revealed no statistically significant changes in all knee joint compartments. Computed TbSp in the lateral tibial plateau and patella was significantly higher in the mild OA group ($\Delta_{\text{lateral tibial plateau}} = +25\%$; $\Delta_{\text{patella}} = +31.5$, $p < 0.05$), whereas most subchondral bone parameters were unchanged. Medial femoral condyle cartilage volume was significantly correlated with patellar cartilage thickness $r = 0.46$ ($p = 0.01$). Medial tibial plateau cartilage thickness and patellar cartilage thickness were linearly related $r = 0.587$ ($p < 0.05$). Medial tibial plateau cartilage volume was significantly correlated with patella TbTh, $r = 0.41$ ($p = 0.02$).

Conclusion: Cartilage volume seems to be more sensitive than thickness for the assessment of cartilage changes in OA. TbSp would be a sensitive marker of subchondral bone degradation. Cartilage degradation in a given OA compartment would be accompanied by changes in subchondral bone and cartilage in the opposite healthy compartments. UHF MRI can provide interesting information for the analysis of cartilage and subchondral bone and could be considered as a tool of interest for the subtle evaluation of changes associated to therapeutic strategies. #8232;#8232;

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