

SSC07-04

The TEFR Field Study: Results of Continuous Biochemical and Morphological Cartilage Analysis of Hindfoot, Ankle, and Knee Joints in Course of a 4,500 km Ultramarathon Race throughout Whole Europe Using T2*-mapping on a Mobile MRI Truck Trailer

Monday 11:00-11:10 AM | SSC07-04 | NA

[RSNA Country Presents Travel Award] Award: RSNA Country Presents Travel Award

PURPOSE

We took advantage of the possibility for a continuous, mobile MR surveillance of cartilage integrity during a transcontinental ultramarathon over 4,486 km. Biochemical changes, thickness and focal lesions of the cartilage of knee, ankle, and hindfoot joints as well as muscle mass and respective relationships were presented.

METHOD AND MATERIALS

MRI data were acquired with a mobile 1.5T scanner travelling with 44 participants of the TransEurope FootRace (TEFR) for 64 days. Repeated follow-up scans were obtained using a T2* GRE-, a TIRM-, and a fat-saturated PD-sequence. T2* values were obtained from inline reconstructed T2* maps by using a pixelwise, monoexponential nonnegative least squares fit analysis. Statistical analyses regarding cartilage T2* and thickness changes and influencing factors were done on the finishers of the race.

RESULTS

With exception of the patellar joint, nearly all cartilage segments showed a significant initial mean T2* signal increase within the first 1500km run: ankle 25.6%, subtalar joint 20.9%, midtarsal joint 26.3%, femorotibial Joint (FTJ) 25.1 to 44.0%. Interestingly, an unexpected secondary T2* decrease was observed in ankle (-30.6%) and hindfoot joints (-28.5% and -16.0%), but not in the FTJ. A significant loss of cartilage thickness was detected in the FTJ, but not in the other joints. A side dependent, positive relationship between muscle volumes of the thigh and cartilage T2* at baseline could be found in the FTJ. Osteochondral lesions were detected, however all were already present at baseline and showed no changes throughout TEFR. Reasons for stopping the race were not associated with joint problems.

CONCLUSION

After initial significant intrachondral matrix changes, a subsequent T2* value recovery indicates the ability of the cartilage matrix to regenerate under ongoing running burden in ankle and hindfoot joints. In contrast, for the FTJ no T2* signal recovery could be observed accompanied by loss of cartilage thickness. No new lesions were observed during TEFR. Asymmetry of cartilage T2* behavior is in line with the hypothesis of the "breaking" limb and demonstrates leg-preference even in well-trained ultra-runners.

CLINICAL RELEVANCE/APPLICATION

The capability of most parts of human cartilage to recover in the presence of extreme physical stress has not been shown previously indicating a high regenerative potential of human joint cartilage.

FIGURE (OPTIONAL)

http://abstract.rsna.org/uploads/2015/15003074/15003074_mkgv.jpg