QIBA Musculoskeletal (MSK) Biomarker Committee (BC) Call

Tuesday, February 19, 2019 at 10:30 AM CT

Call Summary

In attendance			**RSNA**
Xiaojuan Li, PhD (Co-Chair)	Alejandro Espinoza, PhD	Yuxi Pang, PhD	Joe Koudelik
Thomas Link, MD, PhD (Co-Chair)	Gabby Joseph, PhD	Erika Schneider, PhD	Susan Stanfa
Michael Boss, PhD	Feliks Kogan, PhD	Ramya Srinivasan, MD	
Angie Botto-van Bemden, PhD	Leon Lenchik, MD	Carl Winalski, MD	
Robert Boutin, MD	Kecheng Liu, PhD, MBA	Cory Wyatt, PhD	
Majid Chalian, MD	Nancy Obuchowski, PhD		

Moderator: Dr. Link

Presentation: **Defining Normative MRI cartilage T_2 values in the knee: data from the Osteoarthritis Initiative (Dr. Gabby Joseph, PhD and Thomas Link, MD, PhD)**

[Some information taken from presentation slides]

- Two previous research studies were highlighted: T_2 Reference Database → T2 Z-score quantification
- Joseph GB, McCulloch CE, Nevitt MC, Heilmeier U, Nardo L, Lynch JA, et al. **A reference database of cartilage 3 T MRI T_2 values in knees without diagnostic evidence of cartilage degeneration: data from the osteoarthritis initiative**. *Osteoarthritis Cartilage*. 2015; 23(6):897-905. doi: 10.1016/j.joca.2015.02.006.
    - Purpose:
        - To establish a gender- and BMI-specific reference database of cartilage T_2 values
        - To assess the associations between cartilage T2 values and gender, age, and BMI in knees without radiographic osteoarthritis or MRI-based (WORMS 0/1) evidence of cartilage degeneration
    - Why normative values?
        - Provide a reference database of T_2 values for future studies with similar acquisition and scanning methodologies
        - Enable comparisons to studies that focus on cohorts with expected abnormal T_2 values
    - Inclusion and exclusion criteria were provided and imaging methods and statistics were outlined
    - Results were provided:
        - Percentiles by gender and BMI
        - Adjusted T_2 values in males and females
        - T_2 and BMI in normal, overweight and obese subjects
        - The association between BMI and cartilage T_2 – figure showed adjusted means with 95% confidence intervals
        - The association between age and cartilage T_2 – figure showed adjusted means with 95% confidence intervals
    - Discussion:
        - Substantial variation found among subject and between cartilage compartments
        - While an association between cartilage T_2 and both age and gender was established, the association with BMI was the most pronounced (e.g., the higher BMI resulted in higher image noise)
        - The age and BMI relationship was not studied
        - Patients that were obese were more susceptible to developing cartilage defects and damage

        - Age had very little impact on T_2 measurements; it was only significant in the patella and was borderline in the medial femur
        - There was not much difference in results between males and females
        - Interactions between muscle and cartilage were not addressed in this study
        - T_2 results were available only for the right knee
        - Ultimately, this study has data that are useful for only a specific technique – T_2; data are not available for T1ρ

- Joseph GB, McCulloch CE, Nevitt MC, Gersing AS, Schwaiger BJ, Kretzschmar M, et al. **Medial femur T_2 Z-scores predict the probability of knee structural worsening over 4-8 years: Data from the osteoarthritis initiative**. *Journal of Magnetic Resonance Imaging*. 2017; 46(4):1128-1136. doi: 10.1002/jmri.25662.
    - Subject selection was detailed and methods were explained
    - Results regarding the association between baseline cartilage T_2 Z-score and the probability of progression of OA were provided; the higher the Z-score, the higher probability of cartilage degeneration in the patient's future
    - Discussion: knowing a T_2 Z-score may be beneficial for clinicians to identify patients at risk for OA progression; these patients would benefit most from modifiable lifestyle changes that slow OA progression
    - Factors that affect T_2 quantification:
        - Reference database/Z-score calculation feasible with the OAI data since the following factors were standardized:
            - MRI scanner
            - Field strength
            - RF coil
            - MRI pulse sequence
            - T_2 fitting method
    - Comment re: interest in data for joint space narrowing
    - Baseline to discuss data interpretation and how to deal with it; a good reference database exists for T_2, but not for newer sequences and T1ρ
    - Suggestion to define Z-scores instead of absolute values
    - For standardization, a Z-score that is site-dependent rather than scanner dependent was suggested, since the absolute values between scanners show high variation
    - Caution voiced regarding having an imaging protocol/Profile be scanner dependent
    - Suggestion to use OA phantom
        - Caution to avoid overcorrecting data is needed
        - Both OAI and MAPSS sequences were used in the Arthritis Foundation (AF) phantom study
            - Systematic differences were identified; correlation and differences were seen between the two
            - The phantom used in the AF study was not an OAI phantom, but another calibration phantom
        - There was concern re: the life span of phantoms
        - Material components were solutions (not gel-based) and should be easy to reproduce
        - While solutions are typically quite stable; better reproducibility when using agar
    - **It was advised that the MSK Profile and protocol be site and scanner independent**
    - Z-scores are not as dependent on absolute values; data needed for comparison between sites

- Z-scores will be better than absolute values in regard to reducing variability and dependence from different scanners
- This discussion will inform the work on Section 3.9: Data Interpretation of the MSK Profile and will be continued during an upcoming MSK BC call

Next Call: Tuesday, March 26, 2019 at 10 AM CT

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