THE ASSESSMENT OF OSTEOARTHRITIC KNEE SEVERITY USING MRI – COMPARISON IRREGULARITY INDEX WITH WORMS

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Purpose: Osteoarthritis of the knee joint (OA) is one of the commonest musculoskeletal diseases among elderly population and affects their quality of life. X-ray examination is standard method for diagnosis or grading of OA. However, we sometimes experience discrepancies between X-ray grades and severity of symptoms. Recently, several findings of magnetic resonance imaging (MRI) are implicated to have relationship with clinical symptoms and new methods to assess OA knee based on MRI have been proposed.

In our previous study, we have shown that irregularity of contour of femoral condyle on MRI that was calculated with newly developed computer, which was named irregularity index (IR), correlated with knee functional score and visual analogue scale (VAS) for pain evaluation. Another method, Whole Organ Magnetic Resonance Imaging Score (WORMS) has been reported as a reliable method to evaluate OA and several reports referred to its effectiveness. The purpose of this study was to compare the IR and the WORMS.

Methods: Twenty-nine OA knees were involved in this study. They consisted of 12 males and 17 females and the average age was 69.6 years old. All the knees were evaluated with x-ray examination as well as MRI. The Kellgren-Lawrence grading (K/L) was employed for x-ray grading. The irregularity index and the WORMS were scored. Japanese Orthopaedic Association score (JOA), Japanese Knee Osteoarthritis Measure (JKOM) and visual analogue scale (VAS) for pain evaluation. Another method, Whole Organ Magnetic Resonance Imaging Score (WORMS) was scored. Japanese Orthopaedic Association score (JOA), Japanese Knee Osteoarthritis Measure (JKOM) were used for clinical assessment. Then, the WORMS and the irregularity index were compared with the JOA score, JKOM and K/L. It was used for statistical analysis and the level of significance was set at <0.05.

Results: Three knees were grade I, 6 grade II, 9 grade III, and 11 grade IV. Overall correlation between knee scores and the WORMS were excellent. The IR value tended to be constant for the knees with K/L grade I, II, and III whereas WORMS tended to be constant for the knees with K/L IV. This implies WORMS is suitable for evaluating early stage OA, and the IR is better for severer OA.

Conclusions: As assessing methods of OA using MRI, both the IR and the WORMS were useful for objective evaluation. The WORMS was more useful for early stage OA, and the IR was more useful for late stage OA. The IR has advantages over the WORMS because it is automatically calculated by computer software whereas the WORMS depend upon observer.

TWO YEAR LONGITUDINAL CHANGES IN REGIONAL CARTILAGE MORPHOLOGY IN A MULTICENTER, MULTIVENDOR MRI STUDY AT 3.0T – THE A9001140 STUDY

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Purpose: We have previously reported relatively small changes in cartilage thickness at total femorotibial cartilage plate level in an enriched OA population (i.e., obese women with KLG 2 and 3) over 1 year in a multicenter, multivendor MRI study at 3.0T. Subregional analysis revealed that the sensitivity to change in the external and central subregions of the medial tibia (MT), and in the central area of the weight-bearing (central) medial femur (cMF) was greater than at total plate level. The objective is to compare annual rates of cartilage loss over 1 and 2 years, and to investigate whether the regions with the highest sensitivity to change observed over 2 years are the same as those over 1 year.

Methods: 1.0mm coronal FLASHwe MR images of the knee were acquired at baseline, 12 months and 24 months in 148 female participants at 7 clinical centers with Siemens and GE 3.0T scanners. 90 participants had symptoms and no evidence of radiographic OA; 58 had medial femorotibial OA on conventional standing AP radiographs (30 KLG 2 and 28 KLG 3). Baseline and followup images were read as pairs, with blinding to order of acquisition. The mean cartilage thickness over the entire subchondral bone area (TAB) was computed (ThCtAB). Subregional cartilage thickness was determined for central (20% of TAB), anterior, posterior, internal and external subregions of the medial (MT) and lateral (LT) femorotibial OA on conventional standing AP radiographs (30 KLG 2 and 28 KLG 3). Baseline and followup images were read as pairs, with blinding to order of acquisition. The mean cartilage thickness over the entire subchondral bone area (TAB) was computed (ThCtAB). Subregional cartilage thickness was determined for central (20% of TAB), anterior, posterior, internal and external subregions of the medial (MT) and lateral (LT) femoral condyle (cMF), using proprietary software (Chondrometrics). A false discovery rate of 0.1 was applied to p-values.

Results: At 2 years, significant decreases in the ThCtAB were observed in control subjects (KLG 0) in the anterior and central subregions of the MT (SRM=−0.26 and −0.27, respectively) (Table 1). In KLG 2 participants, cartilage loss in cMF (−2.1% in MT (−1.4%) but the highest SRMs were observed in MT. eMT and cMT displayed the relatively greatest changes in MT (SRM=−0.53 and −0.57, respectively). Consistent with the 1 year data, the greatest annual reductions in ThCtAB (2 to 4%) were observed in the KLG0 subjects in both MT and cMF. The greatest reduction in ThCtAB was observed in the central and external subregions of MT (SRM=−0.53 and −0.57).

Conclusions: As over one year, the annual rate of cartilage loss in MT exceeded that in cMF in KLG 2 subjects. However, over 2 years the KLG 1 and 2 participants did not show greater changes than healthy controls and MT cMT showed a similar change as cMT. In KLG 3 subjects, the annual rate of cartilage loss was greater in cMF than in MT at 1 year and 2 years, but over 2 years the highest SRMs were observed in eMT and cMT rather than cMF.

A NEW EXTENDED ACTIVE SHAPE MODEL TO PREDICT TOTAL HIP REPLACEMENT IN PATIENTS WITH OSTEOARTHRITIS (OA)

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Purpose: The rate of OA progression varies greatly among affected individuals, making it difficult to diagnose early disease and to predict which patients will progress rapidly to joint replacement. In a previous study we demonstrated that Active Shape Modelling (ASM) of the femur in radiographs can help separate OA patients by disease severity and may predict OA progression. ASM uses principal components analysis to express shape variation in a series of images in terms of independent modes of variation. Each image is scored in terms of standard deviations of each mode from the mean shape for that mode. The aim of the current study was two fold; to test if our previous findings could be reproduced in a different study population, using both our original 16 point model and a newly developed extended model, and to assess if both models could identify baseline differences in shape of the proximal femur predictive of future Total Hip Replacement (THR).

Methods: The Primary Care Rheumatology Hip study is a five-year prospective cohort study of patients presenting to primary care with pain, which their physician considered to be originating from the hip. Anteroposterior pelvic radiographs were taken and radiographic severity of OA was assessed using the Kellgren Lawrence (KL) scoring system. Subjects were divided into two groups: those who did not undergo THR and did not show change in the KL grade during the study (n=72; non-THR group), and those who had a THR during the study (n=15; THR group). Radiographs were assessed using a new 44-pt ASM that included both trochanters, part of the acetabulum and osteophytes. The original 16-point model was included as a sub-model. Logistic regression was used to assess the associations between ASM modes, KL scores and THR. Results: Both the new 44-pt model and the 16-point sub-model identified significant differences between the THR and non-THR groups at baseline. Two of the first 10 modes in the 44-point model identified significant