Purpose: Increasing evidence suggests associations between osteoarthritis (OA) and the metabolic syndrome and its components. However, these associations have been questioned with respect to their independence from obesity. Using a prospective cohort study, we examined whether individual components of the metabolic syndrome, either singly or additively, were associated with the incidence of total knee and hip replacement due to severe OA, and whether the associations were independent of obesity.

Methods: Eligible participants were selected from 21,837 Melbourne Collaborative Cohort Study (MCCS) participants who were recruited in 1990-1994 and had fasting blood lipids measured during 2003-2007. Metabolic syndrome was defined using the International Diabetes Federation definition; central obesity (defined by waist circumference) and any two of the four factors - raised serum triglyceride level, reduced serum high-density lipoprotein cholesterol level, hypertension and impaired fasting glycaemia. Primary knee and hip replacements for OA from the date of lipid measurement until 2011 were determined by linking the MCCS records to the Australian Orthopaedic Association National Joint Replacement Registry.

Results: 685 participants had total knee replacement and 580 participants had total hip replacement. Each of the 5 components of the metabolic syndrome and the metabolic syndrome itself were associated with increased risk of knee OA, adjusted for age, gender, country of birth, and level of education. After including body mass index in the regression models, the magnitude of the HRs attenuated, and central obesity (defined by waist circumference) remained significantly significant. There was a dose-response relationship between each additional component of the metabolic syndrome and the incidence of knee OA, independent of body mass index: one component HR 2.11 (95% CI 1.11-4.01), two components HR 2.94 (95% CI 1.57-5.52), three or more components HR 3.13 (95% CI 1.66-5.91), p for trend <0.001. Only central obesity was associated with the incidence of hip OA when adjusted for age, gender, country of birth, and level of education, but this association disappeared when body mass index was added to the model. Individual components of the metabolic syndrome were not additively associated with the incidence of hip OA.

Conclusion: Our results extend previous studies by relating the individual components of the metabolic syndrome and their total to the risk of knee and hip OA in the same large cohort independent of obesity. The risk of knee OA was associated singly and additively with components of the metabolic syndrome and the metabolic syndrome as a whole. In contrast, no relationship was seen for hip OA. The findings suggest different pathogenesis for OA of the knee and hip and that management of the metabolic syndrome has the potential to reduce the risk of knee OA.

437 PATTERN IN FEMORAL CARTILAGE THICKNESS MAP ALLOWS SUBTLE SCORING OF MEDIAL COMPARTMENT KNEE OSTEOARTHRITIS SEVERITY

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Purpose: Although change in cartilage thickness is a hallmark of knee osteoarthritis (OA), the low sensitivity of mean thickness measures to disease state remains a barrier to the evaluation of new interventions for OA. There is potentially important information in the spatial variations in thickness over the entire articular surface (ie. thickness map) that can enhance detection and understanding of OA progression. Computer vision and artificial intelligence algorithms offer opportunities to analyze thickness maps in their entirety and separate patterns that are characteristic of OA severity from subject-specific features.

The purpose of this study was to develop a pattern-based method to score femoral cartilage thickness maps according to their disease severity. To demonstrate the application of the method, the score attributed to medial OA knees were compared to Kellgren/Lawrence grades (KLG).

Methods: 140 knees, namely 60 asymptomatic knees and four groups of 20 medial OA knees with KLG of 1, 2, 3, and 4, were scanned at 1.5 T using a 3D-SPGR sequence after IRB-approved consent (67 male: 60±9 yrs; 1.70±0.1 m; 78±14 kg). 3D models of the femoral cartilage were built from segmentation of MR images. The models were then converted into 2D anatomically-standardized thickness maps (images) using a shape matching routine. A pattern recognition technique was developed to calculate a statistical model that links all the pixels of a thickness map to a single score and vice versa, based on a “learning” dataset of thickness maps with defined OA stage. The continuous pattern-based score was designed to increase with worsening of OA severity (0= typical asymptomatic knee and 4= typical end-stage medial OA knee).

In this study, knees were scored using a leave-one-out procedure, consisting of scoring each knee using a statistical model calculated based on all the other knees. For comparison, the mean thickness over the medial compartment was also calculated for each knee. ANOVA and Tukey tests were performed to compare pattern-based score and mean thickness between knee groups, while Spearman correlations were calculated across groups.

Results: The method isolated a characteristic progression in thickness with increasing medial knee OA over the entire plate (Fig.1). The progression notably involved differences in the medial compartment.