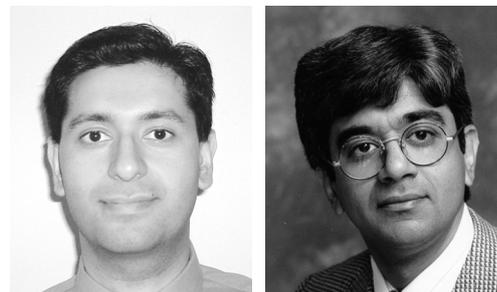


Can Magnetic Resonance Imaging of the Knee Predict Future Malalignment?



Osteoarthritis (OA) of the knee joint is a prevalent problem in today's aging population. Many factors that predispose patients to OA are known; however, the role of these individual factors in development of the illness and its progression is an evolving area of study. Variables such as knee malalignment¹ and body mass index (BMI)² have been implicated in progression of knee OA. In this issue of *The Journal*, Hunter, *et al* report their investigation into specific structural factors seen on magnetic resonance imaging (MRI) that predict malalignment of the knee³.

Varus and valgus malalignment are often seen in OA of the knee. Valgus malalignment is associated with lateral compartment arthritis, while varus malalignment is seen with medial compartment arthritis. The alteration in normal alignment leads to altered mechanics in the knee joint, which in turn alter the axis of weight-bearing in the knee joint. Malalignment has been shown to be associated with progression of OA in knees with moderate OA¹. Hunter, *et al* have attempted to identify the structural factors on MRI that are most strongly associated with malalignment of the knee. They state that these structural factors would be associated with progression of OA in these knees.

The Whole Organ MRI Score (WORMS) for assessing knee arthritis has been described by Peterfy, *et al* and is a good tool for assessing knee OA, with high interobserver reliability⁴. WORMS incorporates 14 features of conventional MRI of the knee to assess arthritis and grade its severity. Peterfy, *et al* found that cartilage loss was the most common abnormality in osteoarthritic knees on MRI. The WORMS method was used by Hunter, *et al* to assess knee MRI. They utilized the individual features measured by WORMS and correlated these features with the presence of knee malalignment on long-leg radiographs. They were then able to determine which of these features were most predictive of malalignment and hence of progression of disease. In

their univariate analysis of varus knees, they found that medial bone attrition, medial meniscal degeneration, medial meniscal subluxation, and medial tibiofemoral cartilage loss were the most predictive of malalignment. Similarly, in valgus knees, lateral tibiofemoral cartilage loss, lateral osteophyte score, and lateral meniscal degeneration were most strongly associated with malalignment. Previous studies have shown that central cartilage loss, meniscal tear, and meniscal extrusion are strongly associated with progression of knee OA^{5,6}.

Hunter's cross-sectional study correlated features of MRI scan performed at baseline in patients with knee OA (based on American College of Rheumatology guidelines) and knee alignment based on a 3-foot standing radiograph performed at 15 month followup. They utilized presence of malalignment as a surrogate marker for progression of OA in these patients. Their study does not, however, utilize any direct observation of progression of OA. They did not utilize any measure of functional outcome or clinical assessment. Their assessment is based entirely on one MRI scan and one 3-foot standing radiograph. The authors themselves acknowledge that since the 2 investigations are separated by 15 months, it is unknown what changes in alignment or MRI occurred during that interval. This requires a longitudinal study with simultaneous MRI and alignment measurements performed at several time intervals. There is also no information available regarding initial alignment of the knees at baseline.

Another issue in this study is the choice of subjects. The study is based on a US Veterans Administration population. Without data on previous injuries and surgeries performed on the knees of the patients in the study, it is not clear whether the arthritis present is idiopathic or posttraumatic in nature. Indeed, if the predominant type of arthritis in the subjects is posttraumatic, then the conclusions from the

See Structural factors associated with malalignment in knee osteoarthritis, page 2192

study may not be applicable to the general population, who predominantly have idiopathic OA.

The lack of a control group is also an important issue. A study of asymptomatic volunteers using MRI showed that a high percentage of these individuals had meniscal abnormalities⁷. Forty-three out of 44 volunteers had at least one meniscal abnormality and 61% had abnormalities in more than one area of the knee. Inclusion of non-OA patients in the study and MRI assessment and alignment measurement of their knees would have provided a control group for comparison. Indeed, the authors acknowledge this limitation in their discussion.

Their report is a first step in studying the correlation between structural abnormalities in osteoarthritic knees and malalignment. However, OA is progressive, as is malalignment of the knee. As the authors indicate in the final paragraph, to establish causation and to clarify the role of individual structural factors on malalignment, a prospective longitudinal study is required with multiple measurements of alignment, MRI scans, a control group, and some clinical and functional assessment. Only then can we identify the structural abnormalities of the knee that predict malalignment, which may in turn allow prediction of the rate or degree of progression of OA in an individual knee. Indeed, this information would be very valuable in both research and clinical practice.

KHALID A. SYED, MD;

NIZAR N. MAHOMED, MD,

Division of Orthopedic Surgery,
Clinical Epidemiology and Health Care Research Program,
Toronto Western Hospital,
399 Bathurst Street, ECW 1-002,
Toronto, Ontario M5T 2S8, Canada

Address reprint requests to Dr. K. Syed. E-mail: khalid.syed@utoronto.ca

REFERENCES

1. Sharma L, Song J, Felson DT, Cahue S, Shamiyeh E, Dunlop DD. The role of knee alignment in disease progression and functional decline in knee osteoarthritis. *JAMA* 2001;286:188-95.
2. Felson DT, Goggins J, Niu J, Zhang Y, Hunter DJ. The effect of body weight on progression of knee osteoarthritis is dependent on alignment. *Arthritis Rheum* 2004;50:3904-9.
3. Hunter DJ, Zhang Y, Niu JB, et al. Structural factors associated with malalignment in knee osteoarthritis: The Boston Osteoarthritis Knee Study. *J Rheumatol* 2005;32:2192-9.
4. Peterfy CG, Guermazi A, Zaim S, et al. Whole-Organ Magnetic Resonance Imaging Score (WORMS) of the knee in osteoarthritis. *Osteoarthritis Cartilage* 2004;12:177-90.
5. Boegard T, Rudling O, Petersson IF, Jonsson K. Correlation between radiographically diagnosed osteophytes and magnetic resonance detected cartilage defects in the tibiofemoral joint. *Ann Rheum Dis* 1998;57:401-7.
6. Berthiaume MJ, Raynauld JP, Martel-Pelletier J, et al. Meniscal tear and extrusion are strongly associated with progression of symptomatic knee osteoarthritis as assessed by quantitative magnetic resonance imaging. *Ann Rheum Dis* 2005;64:556-63. Epub 2004 Sep 16.
7. Beattie KA, Boulos P, Pui M, et al. Abnormalities identified in the knees of asymptomatic volunteers using peripheral magnetic resonance imaging. *Osteoarthritis Cartilage* 2005;13:181-6.