Predicting Symptomatic Progression of Osteoarthritis

INTRODUCTION:

Knee osteoarthritis (OA) is a major source of morbidity in the aging population with a prevalence of over 16% in people older than 45\(^1\). Prior studies typically define OA progression in terms of joint space narrowing or cartilage loss measured from radiographs or MRI\(^1\). However, these methods do not directly capture the impact of OA on the patient Direct measures of OA on the symptoms and function of the patient include patient-reported outcome measures such as the Knee Osteoarthritis Research Society (KOOS) and performance tests such as 20-meter walk pace and repeated chair stand pace\(^3\).

The goal of the proposed study is to analyze MRI’s from the OAI and determine which baseline MRI findings best correlate with symptomatic OA progression.

METHODS:

Data were taken from the progression subcohort of the Osteoarthritis Initiative (OAI). The OAI is a multi-center, four-year observational study focusing on OA incidence and progression\(^4\). Patient-reported outcomes included four KOOS subscores. Performance measures included the 20-meter walk pace and chair stand pace. Outcome measures at baseline and 3-year follow up were included in our analyses.

Baseline MRI images of 140 patients randomly selected from the OAI were scored using portions of the Boston-Leeds Osteoarthritis Knee Score\(^5\) (BLOKS). Cartilage, bone marrow lesions (BML), meniscus morphology and meniscus extrusion were scored (Table 1). Scores were weighted and combined within physiologic compartments (medial, lateral and patellofemoral). BML size was given the most weight within BML score and cartilage loss size was given the most weight within Cartilage score.

Linear regression modeling was implemented via the statistical software package JMP 9 (SAS Institute, Cary, NC). Each model consisted of one Outcome Measure and 14 predictor variables (3 demographic variables, 10 MRI scores, 1 baseline symptom score).

RESULTS:

Patients with higher scores at baseline tended to have higher scores at follow-up for all outcome measures. For 3-year follow-up, patellofemoral (PF) cartilage loss and lateral meniscus extrusion correlated with clinically significant worse KOOS Quality of Life (QOL) scores (Figure 1) and a trend towards significance for the remaining KOOS domains. Presence of patellofemoral bone marrow lesions correlated with better scores.

Table 1. Knee MRI Scoring Description

<table>
<thead>
<tr>
<th>MRI Finding</th>
<th>Description</th>
<th>Combined Scoring</th>
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<tbody>
<tr>
<td>Regional Subdivision</td>
<td>9 subregions: medial and lateral aspect of patella, medial and lateral aspect of trochlea, medial and lateral weight-bearing aspect of femur, medial and lateral aspect of tibia, subspinous aspect of tibia</td>
<td>N/A</td>
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<tr>
<td>Cartilage</td>
<td>Score of 0–3 for size of loss and percentage of loss in region that is full thickness</td>
<td>0 – 4</td>
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<tr>
<td>Bone Marrow Lesions</td>
<td>Individual lesions; 3 different aspects of BMLs scored: a) size of BML scored from 0 to 3. b) percentage of surface area adjacent to subchondral plate. c) percentage of BML that is noncystic</td>
<td>0 – 5</td>
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<tr>
<td>Meniscus Morphology</td>
<td>Status of anterior horn, body, and posterior horn scored separately in medial and lateral meniscus</td>
<td>0 – 6</td>
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<tr>
<td>Meniscus Extrusion</td>
<td>Scored as medial and lateral extrusion on coronal image and anterior extrusion for medial and lateral meniscus on sagittal image from 0 to 3</td>
<td>0 – 6</td>
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SIGNIFICANCE:

Our results suggest that patellofemoral and meniscal pathology are the strongest predictors of symptomatic OA progression. These findings are important when deciding clinical treatment for OA patients.

REFERENCES: