THE USE OF CLASSIFICATION TREES TO DETERMINE CRITERIA FOR "VIRTUAL TOTAL JOINT REPLACEMENT" FOR PATIENTS WITH HIP AND KNEE OSTEOARTHRITIS

K. Shurupoff1, D. Park2, M.C. Hochberg2. 1Univ. of Maryland Baltimore County, Baltimore, MD, USA; 2Univ. of Maryland, Baltimore, MD, USA

Purpose: An OARSI-OMERACT Task Force was charged with reviewing the literature and developing an outcome of "Virtual Total Joint Replacement (TJR)" for use in clinical trials and observational clinical studies. The Task Force conducted a study that used receiver operating characteristic (ROC) curves and logistic regression analysis and failed to identify satisfactory cutpoints for pain intensity and functional limitation that adequately predicted the orthopedic surgeon's decision to perform TJR (Gossec L et al: Osteoarthritis Cart 2011;147–54). We reanalyzed the data from this study to determine if variables other than pain and function could contribute to this decision.

Methods: The original dataset for the OARSI-OMERACT study was provided by Dr. Gossec. The dependent variable was the orthopedic surgeon's decision to perform TJR. Independent predictor variables including pain measured with the ICOAP and WOMAC pain scale, function measured with the short-form HOOS/KOOS and WOMAC function scales, as well as the HOOS/KOOS quality of life scale and demographic characteristics including age, gender, joint side and duration of disease. Radiographic data were available in only ~50% of subjects. The dataset was analyzed using Regression and Classification Trees (CART) (Breiman et al, 1984) with DTREG software including the Gini tree fitting algorithm. Missing values were imputed from surrogate variables. Logistic regression was used to compare prediction errors. Logistic regression was used to compare prediction errors.

Results: A total of 1909 subjects (779 hip OA and 1130 knee OA) were included in the original study. Of these, 574 (73.7%) and 628 (55.6%) hip and knee OA patients, respectively, were recommended for TJR. The classification tree for hip OA is shown in Figure 1. Herein, a KOOS quality of life score ≥46.4 with joint space narrowing of ≥50% and age ≥69.7 years predicts TJR with a sensitivity of 70%, specificity of 72%, positive predictive value (PPV) of 88%, negative predictive value (NPV) of 46% and prediction error of 0.26. The classification tree for knee OA is shown in Figure 2. Herein, joint space narrowing of ≥50% with a KOOS quality of life score ≥46.4 predicts TJR with a sensitivity of 71%, specificity of 62%, positive predictive value (PPV) of 71%, negative predictive value (NPV) of 63% and prediction error of 0.33. Sensitivity analyses excluding the radiographic data resulted in more complex trees (results not shown).

Conclusions: The results from an analysis using classification and regression tree methodology suggest that an outcome of "Virtual TJR" can be modeled from knowledge of a patient's HOOS/KOOS Quality of Life score, age and radiographic severity of the affected joint. Further research and analyses are needed to determine if the generated classification trees accurately predict a surgeon's recommendation for TJR in an independent dataset.

IDENTIFYING PAIN PHENOTYPES IN EARLY SYMPTOMATIC OA; DATA FROM THE CHECK STUDY (COHORT HIP & COHORT KNEE)

J. Wesseling, J.W. Bijlsma, on behalf of the CHECK steering group. Univ. Med. Ctr. Utrecht, Utrecht, Netherlands

Purpose: Pain and disability related to osteoarthritis (OA) may generally be considered to be chronic, but it is known that its course can be very different between patients. In this study, it is investigated whether there are phenotypes in the disease with a more homogeneous course of pain and disability. The objective is to describe the course of pain and physical functioning after 4 years follow-up in early symptomatic OA and to identify different phenotypes in these courses.

Methods: For the current study, longitudinal data of four years follow-up of the CHECK study were used. The CHECK study is a Dutch prospective 10-year follow-up study, initiated by the Dutch Arthritis Association, to study progression of OA in participants with early symptomatic OA of knee or hip. Individuals were eligible if they had pain of knee or hip, were aged 45–65 years, and had not yet consulted their physician for these symptoms. The WOMAC was utilized to measure pain during activities (range 0–20) and physical functioning (range 0–68). Phenotype is based on presence of consistent knee pain (knee pain at baseline and knee pain at least at 3 time points in 4 years follow-up) versus inconsistent knee pain (knee pain at baseline and knee pain at maximum 2 time points in 4 years). We evaluated whether the two phenotypes modified the course of pain and function measured with the WOMAC. Generalized estimating equations were used to account for correlations within individuals (GEE) and the interaction term (in)consistent pain-follow-up time was also investigated within the model.

Results: For this study, the data of 714 participants with knee pain at baseline and with follow-up data at 4 time points were analyzed. The mean age is 56 years and 80% is female. In the GEE model without effect modifier, there is a significant decrease yearly of 0.08 points on the WOMAC pain and no significant decrease or increase on the WOMAC function (this indicates a better health). The effect modifier (presence of knee pain during 4 years follow-up) played a statistically significant role in both outcomes. We found a significant difference between the group with consistent knee pain and inconsistent knee pain of 0.6 points (CI: 0.4–0.7) on WOMAC pain (worse health) and 1.6 points (CI: 1.1–2.0) on WOMAC function. Within the group with consistent knee pain there was no change in WOMAC pain, but a deterioration on WOMAC function of 0.3 points (CI: 0.2–0.5) yearly. Within the group of inconsistent knee pain there was a significant improvement of WOMAC pain and function of respectively 0.5 (CI: -0.6–0.4) and 1.3 (CI: -1.7–0.9) during 4 years of follow-up.

Conclusions: In the course of pain and physical function of early symptomatic OA of knee it is important to distinguish phenotypes, based on the presence of knee pain. The course of pain and physical function during follow-up is different between individuals with consistent and inconsistent knee pain. Within the subgroup with consistent pain the WOMAC pain is not changing and the physical functioning deteriorates.
little. Within the subgroup of inconsistent pain, the pain during activities and physical function improves. Therefore, identifying different phenotypes in early symptomatic OA may help to better understand the progression in OA.

286

INTERMITTENT AND CONSTANT KNEE PAIN PATTERNS: AN INDICATOR FOR RADIOGRAPHIC KNEE OA DURATION AND SEVERITY?

T. Neogi1, J. Ni1, D. Felson1, M. Nevitt1, C. Lewis3, J. Torner4, M. French3, G. Hawker5, for the MOST Group. 1BISUM, Boston, MA, USA; 2UCSF, San Francisco, CA, USA; 3UBA, Birmingham, AL, USA; 4U of Iowa, Iowa City, IA, USA; 5U of T, Toronto, ON, Canada

Purpose: Knee OA-related pain changes over time, but specific pain patterns in relation to stage of radiographic disease is not known. It is hypothesized that at the earliest stage of disease, persons experience intermittent activity-related pain, while at later stages of disease the pain becomes more constant, eventually becoming constant with episodes of intermittent unpredictable pain. A new pain assessment tool for knee OA, the Intermittent and Constant OA Pain (ICOAP) instrument was developed to capture these pain patterns, but has not been tested for this hypothesized correlation with OA duration or severity. To address this knowledge gap, we evaluated the relationship of ICOAP-defined progressive pain patterns with radiographically-defined OA duration and severity.

Methods: The Multicenter Osteoarthritis (MOST) Study is a NIH-funded cohort study of persons with or at high risk of knee OA. Participants underwent bilateral radiographic radiology at baseline, 30, and 60 months, which were read for OA severity according to Kellgren and Lawrence (KL) grade. Radiographic knee OA (ROA) was defined as KL≥2. OA duration was defined as the interval to clinic visit at which ROA was first noted. At the 60-month visit, knee-specific ICOAP scores were ascertained, which assess presence and severity of intermittent and constant pain, and for intermittent pain, its frequency (5-point Likert scale for each). Using the knee-specific ICOAP, pain stages were defined from early to late OA as: (1) no pain; (2) at least mild intermittent pain occurring at least sometimes; (3) at least mild constant pain; and (4) a combination of the latter two categories. We evaluated the relationship between ROA duration and severity, respectively, and ICOAP pain pattern using proportional odds logistic regression with generalized estimating equations. We also assessed the relation of OA duration and severity to presence of constant or constant plus intermittent pain vs. intermittent pain alone.

Results: We studied 2112 participants (3963 knees) at the 60-month exam who had at least one native knee (mean age 67.7±7.9, mean BMI 30.6±6.0, 60% female). The majority of knees (63%) had no pain, 30% had intermittent pain (as defined above), 3% had constant pain (as defined above), and 4% had both. 60% of knees had no ROA, 5.5% had incident ROA at the 60-mo visit (i.e., shortest duration of OA), 5.5% had incident ROA at the 30-mo visit, and 29.5% had ROA at the baseline visit (i.e., longest duration of ROA). Those with longer disease and greater radiographic severity were more likely to have the pain patterns thought to be associated with such a disease status (i.e., both intermittent and constant pain at the “highest” end of the ICOAP pain pattern) (Table). This relationship for OA duration persisted when limited to only those with ROA at any time point (Table). For constant pain vs. intermittent pain only, there was no association for those with the shortest duration of OA (OR 0.7, 95% CI 0.4–1.3), while those with longer durations of OA were more likely to have constant instead of intermittent pain (ORs 95% CI 1.5 (0.9–2.5) for incident ROA at 30-mo; 1.4 (1.0–2.0) for longest duration of ROA).

Conclusions: Longer duration and greater severity of ROA are associated with greater likelihood of constant plus intermittent pain. These findings support the prior qualitative data suggesting a progression from intermittent to constant pain punctuated by intermittent unpredictable pain with worsening knee OA over time. Further refinement of discerning at what stage of OA pain patterns change from being intermittent in nature to constant and then to constant with unpredictable intermittent pain will require further longitudinal data in which greater variety in duration (and severity of OA) is captured along with the unpredictability of the intermittent pain.

287

CLINICAL CHARACTERISTICS AND MEDICATION USE OF PATIENTS WITH KNEE OSTEOARTHRITIS SELECTED FOR TOTAL JOINT REPLACEMENT SURGERY

T.N. de Boer1, M.J. Stukstette1, P.M. Welsing2, A.M. Huisman3, A.A. Polak3, J.W. Bijlsma1, S.C. Mastbergen1, P.F. Lafeber1, Rheumatology & Clinical Immunology, Univ. Med. Ctr. Utrecht, Utrecht, Netherlands; 2Rheumatology, Sint Franciscus Gasthuis, Rotterdam, Netherlands; 3Orthopaedics, Sint Franciscus Gasthuis, Rotterdam, Netherlands

Purpose: Costs related to the final answer of progressive knee osteoarthritis (OA), total knee replacement (TKR) surgery, are tremendous and will increase further due to increasing prevalence of obesity and aging in developed countries. TKR is clearly effective in reducing pain and improving function. The outcome of revision surgery is less and even more costly. Postponing a first prosthesis and maintaining quality of life is at present the major goal in treatment of end stage OA. Specific indications for TKR surgery are not clearly defined or evidence based. Generally accepted indications are pain and restrictions in performance in spite of the use of (non-)pharmacological interventions. However, substantial variations in referral behaviour between health professionals exist. Experts in the field believe that in many patients with severe OA conservative treatment options are not optimally prescribed. It seems plausible that TKR surgery can be postponed or even prevented. The aim of this explorative study is to obtain insight in characteristics and previous pharmacological management of patients with end-stage knee OA submitted to TKR surgery, and to explore if patients without adequate pain medication still benefit from pain medication.

Methods: 172 successive patients at the Sint Franciscus Gasthuis, Rotterdam, referred for TKR were evaluated. Patients not using adequate analgesics, defined by no or occasional paracetamol (PCM), were randomized to an adequate dose of an NSAID (celecoxib; 2dd200mg daily or naproxen; 3dd250mg) or no medication for 6 weeks prior to surgery.

Patient characteristics, severity of symptoms (WOMAC pain, stiffness and physical function), medication use in past year and radiological features (K&L and Altman score) were collected. To calculate the percentage responders, modified OMERACT/OARSI responder criteria were used. A responder was defined as an improvement of ≥50% in function or pain, or an improvement of ≥20% in pain and function. The study was conducted according to the declaration of Helsinki and received ethics approval of the hospital.

Results: In the year prior to referral for TKR 26% (n=44) of patients used daily NSAIDs, another 27% (n=47) used daily PCM, or occasional NSAID, and nearly half (47%; n=81) of patients used an occasional PCM or no medication at all. No significant differences in baseline characteristics or radiographic features were found between these three groups. Of the 81 patients not using adequate analgesics, 46 patients were randomized to NSAID treatment and 35 were randomized to no treatment. Patients without prior adequate pain medication treated for 6 weeks with an NSAID improved on average statistically significant in pain and stiffness (−5.7 [-10.9;−0.5] and −9.6 [-16.4;−2.8], resp. both p<0.05). 27% of the patients could be classified as an actual responder.