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

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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 cutoffs 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.

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 >64.6 with joint space narrowing of ≥50% and age >49.7 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 0.28. The classification tree for knee OA is shown in Figure 2. Herein, joint space narrowing of ≥50% with a KOOS quality of life score >64.6 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)

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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. We measured the WOMAC scores at baseline and at follow-up from 0 to 4 years. 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: 0.02–0.5) 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 subgroups with consistent pain the WOMAC pain is not changing and the physical functioning deteriorates.