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Osteoarthritis-related difficulty walking and risk for diabetes complications

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SUMMARY

Objectives: To examine the effect of Osteoarthritis (OA)-related difficulty walking on risk for diabetes complications in persons with diabetes and OA.
Design: A population cohort aged 55+ years with symptomatic hip and knee OA was recruited 1996–98 and followed through provincial administrative data to 2015 (n = 2,225). In those with confirmed OA (examination and radiographs) and self-reported diabetes at baseline (n = 359), multivariate Cox regression modeling was used to examine the relationship between baseline difficulty walking (Health Assessment Questionnaire (HAQ) difficulty walking score; use of walking aid) and time to first diabetes-specific complication (hospitalization for hypo- or hyperglycemia, infection, amputation, retinopathy, or initiation of chronic renal dialysis) and cardiovascular (CV) events.
Results: Participants' mean baseline age was 71.4 years; 66.9% were female, 77.7% had hypertension, 54.0% had pre-existing CV disease, 42.9% were obese and 15.3% were smokers. Median HAQ difficulty walking score was 2/3 indicating moderate to severe walking disability; 54.9% used a walking aid. Over a median 6.1 years, 184 (51.3%) experienced one or more diabetes-specific complications; 191 (53.2%) experienced a CV event over a median 5.7 years. Greater baseline difficulty walking was associated with shorter time to the first diabetes-specific complication (adjusted HR per unit increase in HAQ walking 1.24, 95% CI 1.04–1.47, P = 0.02) and CV event (adjusted HR for those using a walking aid 1.35, 95% CI 1.00–1.83, P = 0.04).
Conclusions: In a population cohort with OA and diabetes, OA-related difficulty walking was a significant – and potentially modifiable – risk factor for diabetes complications.

Introduction

North Americans are witnessing an unprecedented rise in the numbers living with obesity and well into old age[1,2], and thus with multiple chronic conditions. Among the most common conditions are type 2 diabetes[3,4] and osteoarthritis (OA)[5], which commonly co-occur[6–14]. In a cross-sectional study of 543 primary care patients aged 65 years or older, 47.3% had OA and 14.2% had diabetes[15]. Almost half with diabetes also had OA (44%). In a study of Hispanics, the prevalence of OA was two-fold greater in those with vs without diabetes, even after controlling for OA risk factors[8].

Despite the frequent occurrence of OA in people with diabetes, little is known about the impact of comorbid OA on diabetes outcomes. OA commonly affects the hips and knees causing joint pain, stiffness, and reduced range of motion, which result in fatigue, depressed mood and functional limitations, including difficulty walking[16]. Although effective management strategies exist for OA[17], qualitative and quantitative studies indicate that people with persistent OA-related joint pain often avoid activities that exacerbate the pain (e.g., walking) as their primary management

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strategy[18–22]. This is problematic as physical inactivity in people with OA worsens joint symptoms and contributes to deconditioning, weight gain, muscle weakness[23,24], increasing risk for other health conditions.

In people with hip and knee OA, difficulty walking has been independently linked with higher risk for all-cause death and cardiovascular (CV) events[10,13]. Moreover, receipt of hip or knee joint replacement surgery reduced these risks[25], suggesting a direct relationship between difficulty walking and CV morbidity in patients with OA. By limiting mobility, comorbid symptomatic OA may also contribute to adverse outcomes in people with diabetes. Given the high co-prevalence of OA with diabetes, understanding the potential impact of OA-related pain and disability on diabetes outcomes is clinically important. The current study therefore examined the relationship between baseline difficulty walking and subsequent risk for diabetes complications in an established cohort with symptomatic hip and knee OA and diabetes.

Methods

Study participants

The Ontario Hip and Knee Cohort was recruited from 1996 to 98 through a screening survey of 100% of the population aged 55+ years in two regions of Ontario, Canada[26]. Of 28,451 respondents (72.3% response rate), those reporting difficulty in the last 3 months with stair climbing, rising from a chair, standing or walking and swelling, pain, stiffness or aching in a hip or knee lasting at least 6 weeks were invited to participate. Of 3,307 eligible for participation, 2,411 agreed (72.9%); of these, 97.5% were Caucasian and 2,225 had hip and/or knee OA on both joint examination and radiographs (Fig. 1). The current study included participants with confirmed hip or knee OA who self-reported physician-diagnosed diabetes at their baseline assessment.

Baseline questionnaire

A standardized mail/telephone survey assessed sociodemographics, living circumstances, smoking, self-reported height and weight, non-steroidal anti-inflammatory drug (NSAID) use and comorbidity. For a list of conditions (lung disease, high blood pressure, heart problems, atherosclerosis, stomach ulcer, kidney disease, non-skin cancer, major neurologic problem, diabetes, depression, liver disease, inflammatory bowel disease), participants indicated if they had the condition, and, if so, if they had received treatment in the prior year. Mental health status was assessed with the SF-36 mental health subscale; scores <60/100 indicate probable depression[27]. The presence of troublesome (painful, stiff or swollen) joints was assessed using a joint homunculus. Hip and knee OA symptoms were assessed using the Western Ontario McMaster Universities OA Index (WOMAC) pain and function subscale scores[28].

Exposures

The reliable and valid Health Assessment Questionnaire (HAQ) walking subscale[29] assessed self-reported difficulty over the past week (no difficulty, some difficulty, much difficulty, unable to do) with walking on flat ground and climbing up five steps, and use of any aids (e.g., cane or walker) for these activities (yes/no) (score 0 to 3; higher scores indicate greater walking disability). In separate analyses, we also assessed the effect of use of a walking aid (yes/no).

Primary and secondary outcomes

Survey data were linked to provincial administrative databases to evaluate the occurrence of diabetes complications from 1991 to 2015. The following databases were used: a) physician services from the Ontario Health Insurance Plan Physician and Laboratory Billing Records; b) inpatient hospitalizations and same day surgeries from the Canadian Institute for Health Information hospital discharge abstract database and National Ambulatory Care Reporting System (NACRS) database; c) Emergency Department (ED) visits-prior to April 2002, extracted from the Physician Billing Records; as of April 2002, ED visits were obtained from the NACRS database; and d) prescription drug use from the Ontario Drug Benefits records, for those aged 65+ years and thus eligible for provincial drug benefits. These data sets were linked using unique encoded identifiers and analyzed at the Institute for Clinical Evaluative Sciences.

Our *primary outcome* was time from baseline assessment to the first post-baseline hospitalization for a diabetes-specific complication (hypo- or hyperglycemia, infection, amputation, retinopathy [laser photocoagulation or vitrectomy] or initiation of chronic renal dialysis). Our *secondary outcome* was time to the first post-baseline hospitalization for a CV event (acute myocardial infarction, stroke or transient ischemic attack, angina, congestive heart failure or a revascularization procedure). All outcomes were defined using published, validated algorithms[30,31]. Individuals were censored if they emigrated, died or at study end (March 31, 2015). Hospital discharge abstracts were used to identify in-hospital deaths. The Registered Persons Database was used to document deaths that occurred out of hospital.

Statistical analysis

Baseline cohort characteristics and the proportions that experienced each outcome were calculated using means, medians and proportions as appropriate. Missing baseline values for height, weight and smoking status were imputed using post-baseline information where possible. Otherwise, missing values were categorized as 'missing'. Body mass index, BMI, was calculated as self-reported weight ÷ (height in meters). Hypertension at baseline was considered present if self-reported or validated criteria were met for inclusion in the provincial hypertension registry[32]. Pre-existing CV disease was defined as 'present' if the participant had experienced a CV event, defined above, in the previous 5 years[33]. After excluding BMI, diabetes, hypertension, and CV disease, the number of *additional* self-reported physician-diagnosed conditions was determined. The number of ambulatory visits to specialists in the pre-baseline year, assessed using physicians' claims, was used as a measure of health care utilization. The occurrence of an ED visit or hospitalization for a diabetes-specific complication, defined above, in the 2-year pre-baseline period was used as a proxy for diabetes severity.

The relationships between baseline characteristics and each of HAQ walking score and use of a walking aid, separately, were assessed using one-way ANOVA or Kruskal–Wallis tests for continuous variables and chi-square tests for categorical variables. Multivariate Cox regression modeling was used to examine the contribution of each baseline measure of difficulty walking on time to our outcomes, controlling for other baseline covariates. Interactions between baseline age and sex were also considered. Backward elimination was used to identify a final model that did not include the walking score. The walking score was then added to the model, in order to determine whether it added significant additional information.