The Prevalence of Knee Pain and Symptomatic Knee Osteoarthritis Among Veteran Traumatic Amputees and Nonamputees

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ABSTRACT. Norvell DC, Czerniecki JM, Reiber GE, Maynard C, Pecoraro JA, Weiss NS. The prevalence of knee pain and symptomatic knee osteoarthritis among veteran traumatic amputees and nonamputees. Arch Phys Med Rehabil 2005;86: 487-93.

Objective: To determine whether amputees have an increased risk of knee pain or symptomatic osteoarthritis (OA) compared with nonamputees.

Design: Retrospective cohort study.

Setting: Veterans Administration Patient Treatment and Outpatient Care files.

Participants: All male unilateral (transtibial or transfemoral) traumatic amputee patients and a random sample of male nonamputees. Patients were excluded if they were younger than 40 years, had sustained a significant injury to their knee(s), or had a rheumatic disease.

Interventions: Not applicable.

Main Outcome Measures: The prevalence of knee pain and symptomatic knee OA.

Results: The age and average weight-adjusted prevalence ratio of knee pain among transtibial amputees, compared with nonamputees, was 1.3 (95% confidence interval [CI], 0.7–2.1) for the knee of the intact limb and 0.2 (95% CI, .05–0.7) for the knee of the amputated limb. The standardized prevalence ratio of knee pain in the intact limb and symptomatic OA among transfemoral amputees, compared with nonamputees, was 3.3 (95% CI, 1.5–6.3) and 1.3 (95% CI, 0.2–4.8), respectively.

Conclusions: Stresses on the contralateral knee of amputees may contribute to secondary disability. Possible explanations include gait abnormalities, increased physiologic loads on the knee of the intact limb, and the hopping and stumbling behavior common in many younger amputees.

Key Words: Amputees; Cohort studies; Knee; Osteoarthritis, knee; Pain; Rehabilitation.

LOWER-EXTREMITY AMPUTEES face significant physical disabilities and emotional challenges as a result of their amputation. Most traumatic amputees are successful ambulators; hence, most are exposed to long-term prosthetic use.[1] Gait abnormalities resulting from lower-extremity prosthetic use have been documented, including increased metabolic energy expenditure, decreased walking speed, larger stride width, shorter stride length with the intact limb, and increased stance time and ground reaction forces in the intact limb.[2-5] There is evidence that an increase in ground reaction forces may contribute to weight-bearing joint osteoarthritis (OA) in middle-age adults.[6] Hence, the gait abnormalities exhibited by amputees with a prosthesis may result in abnormal joint loading that, over time, may lead to joint pain and degeneration.

There is some evidence that amputees are at a greater risk than are nonamputees of developing OA in the knee of the intact limb.[7-9] Furthermore, the risk of knee OA appears to increase with amputation level. Hungerford and Cockin[9] reported that 63% of transfemoral amputees exhibited degenerative changes of the knee of the intact limb, compared with 41% of transtibial amputees and 21% of matched controls. The risk of pain and OA in the knee of an amputated limb among transtibial amputees is not known.

The experience of chronic pain after lower-extremity amputation is complex and multidimensional and is not limited to the amputated limb.[10,11] The functional impact of knee pain and symptomatic knee OA in the traumatic amputee population is currently not known. Furthermore, it is not known how this compares with the nonamputee population. Therefore, we sought to estimate the prevalence of knee pain and symptomatic knee OA in male veteran traumatic amputees and to compare this with the prevalence of knee pain and knee OA in male veteran nonamputees. We also sought to compare the functional impact of this knee pain among members of both populations.

METHODS

Design

We conducted a retrospective cohort study comparing intact knees and the knees of amputated limbs of male veterans with traumatic amputations with those of male veteran nonamputees.

Participants

All patients (N=497) with an *International Classification of Diseases*, 9th revision, code of 897 (traumatic transfemoral or transtibial amputation), who had an outpatient visit within the Veterans Affairs (VA) Puget Sound Health Care System between January 1997 and August 2001, were identified from the Patient Treatment and Outpatient Care files located at the Austin Automation Center. A random sample of 500 nonamputees who had visited an eye or dermatology clinic from the same system and time period was also identified. Subjects'

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mailing addresses and phone numbers were obtained from the Northwest comprehensive Consumer Health Information Performance Sets (CHIPS) Data Warehouse. This is a regional database that contains diagnostic, clinical, laboratory, pharmacy, and administrative information on veterans in the Veterans Integrated Service Network 20. We were able to identify 423 amputees and 474 nonamputees from the Austin database who had an address and phone number in the CHIPS database. The Patient Treatment File and the Beneficiary Identification and Records Locator System death file identified 26 amputees and 17 nonamputees who were deceased. We mailed study information packets to the remaining 397 amputees and 457 nonamputees, which included an information sheet for passive consent and a refusal card that potential subjects could return if they were not interested in participating. For those subjects whose packets were returned by the postal service or who were found to have a disconnected or incorrect phone number, we attempted to ascertain more up-to-date demographic data by querying the Department of Veterans Affairs medical record known as the Computerized Patient Records System. This is the primary source of medical documentation for all patient care activities and is updated at least every 30 days.

Subjects who did not return a card were telephoned to confirm eligibility and interest.

All subjects were considered eligible if they were male and 40 years of age or older. Amputees were included if they suffered a unilateral transfemoral or transtibial amputation as a result of trauma and had ambulated with a prosthesis for at least 5 years before the interview. Both amputees and nonamputees were excluded if they had ever sustained a significant injury to either knee, defined as one requiring medical consultation or surgery, or severe enough to impair weight bearing for 1 week or more. Subjects were also excluded if they had a rheumatic disease, such as rheumatoid arthritis, gout, pseudogout, or ankylosing spondylitis. Our investigation, dealing with the study of human subjects, was approved by the University of Washington Human Subjects Review Committee.

Data Collection

All data were collected by telephone interview. The basic structure of the interview was the same for amputees and for nonamputees, although amputees were asked more questions about the level of their amputation and use of a prosthetic limb. We called all amputees and those nonamputees who complained of knee pain a second time, to ascertain whether transtibial amputees had pain or symptomatic knee OA in the knee of the amputated limb and whether nonamputees had unilateral or bilateral pain, questions that were overlooked in the initial telephone interview.

Baseline data for all subjects included age, height, weight in 10-year increments starting at age 18, and current use of a gait aid (ie, cane, walker, crutch, other aid) for ambulating. Body mass index (BMI) was calculated. To account for body weight change over time, an average body weight for both amputees and nonamputees was calculated by averaging subject weight at ages 18 and 30. We did not include weight after age 30, because the mean age of amputation was 31.8 years. We were careful to attempt to account for weight before amputation as a risk factor for knee pain or OA, because some research indicates that traumatic amputees are at greater risk of obesity and increased body weight gain after their amputation.[12,13] If an amputation leads to an increase in weight gain, which leads to an increased incidence of knee pain or OA, then it may be part of the causal pathway. Therefore, controlling for weight after amputation could risk controlling for the exposure of interest. Furthermore, knee pain or OA may lead to inactivity with subsequent weight gain. Because it was difficult to identify exactly when knee symptoms began, we could be sure that knee pain or OA did not influence weight as a risk factor by using average body weight before mean age of amputation. Amputees were also asked the date of their amputation, the date they began using a prosthesis, and, if applicable, the date(s) they discontinued prosthetic use.

A series of questions was asked to determine whether the subject suffered from pain and symptomatic OA in either knee for transtibial amputees and nonamputees and the knee of the intact limb in transfemoral amputees. The difference between "actual" knee pain and phantom pain was described to each subject, and the subject was instructed to report only symptoms of actual knee pain. Patients were designated as having knee pain if they currently suffered knee pain "most of the time." This was defined as pain at least 15 days, either continuously or intermittently, during the previous month. Those subjects meeting these criteria were asked to estimate the date at which these symptoms began and were asked a series of questions to determine the diagnosis of symptomatic knee OA. Subjects were diagnosed with symptomatic knee OA if their knee bothered them most of the time and they answered "yes" to both of the following questions: (1) Do you have knee stiffness in the morning that lasts 30 minutes or less? (2) When you move your painful knee, does it either sound like or feel like it is rubbing or crunching? These questions are based on the classification criteria for idiopathic OA of the knee recommended by the American College of Rheumatology[14-16] (ACR).

Those subjects meeting the criteria for knee pain were asked to answer the 7 questions from the Chronic Pain Grade (CPG) questionnaire concerning the most painful knee in nonamputees if they had bilateral knee pain and the knee of the intact limb in amputees. This patient-reported functional outcome instrument was designed for interview-based studies because of its relatively simple and brief format. Smith et al[17] reported a Cronbach α greater than 0.9 and item-total correlations were all high, indicating good internal consistency and reliability. Validity was confirmed by highly significant correlations ($<.001$) with all dimensions of the Medical Outcomes Study 36-Item Short-Form Health Survey. The CPG has been used to grade hierarchically the severity of chronic pain in a variety of populations including amputees.[11,17,18] The 7 questions are divided into 3 measures of pain intensity (present, worst, average) and 3 pain interference items (with daily activities, with recreational/social/family activities, with work). Subjects were asked to rate these items on a scale of 0 to 10. Subjects were asked to estimate the number of days in the past 3 months they were kept from their usual activities because of pain ("disability days") by category (0–6d, 7–14d, 15–30d, >30d). The CPG classification combines the pain intensity items, disability days, and pain interference items to categorize subjects into 1 of 5 hierarchical categories: grade 0, no pain problem; grade I, low disability, low pain intensity; grade II, low disability, high pain intensity; grade III, high disability that is moderately limiting; and grade IV, high disability that is severely limiting.

Data Analysis

Descriptive statistics were calculated for baseline variables. We determined the prevalence of knee pain and symptomatic knee OA by dividing the number of cases by the total number of eligible subjects who were interviewed. Using negative binomial regression, we calculated the age and average body weight–adjusted prevalence ratios.[19] These 2 variables were entered as continuous linear variables. An additional analysis was performed that considered knees instead of subjects in the denominator. For this analysis, each transtibial amputee and