

Clinical Study

Physical activity and associations with computed tomography–detected lumbar zygapophyseal joint osteoarthritis

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Received 21 November 2013; revised 25 March 2014; accepted 30 June 2014

Abstract

BACKGROUND CONTEXT: There are no previous epidemiologic studies examining associations between physical activity and imaging-detected lumbar zygapophyseal joint osteoarthritis (ZJO) in a community-based sample.

PURPOSE: To determine whether physical activity is associated with prevalent lumbar ZJO on computed tomography (CT).

STUDY DESIGN/SETTING: A community-based cross-sectional study.

PATIENT SAMPLE: Four hundred twenty-four older adults from the Framingham Heart Study.

OUTCOME MEASURES: Participants received standardized CT assessments of lumbar ZJO at the L2–S1 levels. Severe lumbar ZJO was defined according to the presence and/or degree of joint space narrowing, osteophytosis, articular process hypertrophy, articular erosions, subchondral cysts, and intra-articular vacuum phenomenon. This definition of lumbar ZJO was based entirely on CT imaging findings and did not include any clinical criteria such as low back pain.

METHODS: Physical activity was measured using the Physical Activity Index, which estimate hours per day typically spent in these activity categories: sleeping, sitting, slight activity, moderate activity, and heavy activity. Participants reported on usual frequency of walking, running,

FDA device/drug status: Not applicable.

Author disclosures: **PS:** Grant: National Institutes of Health (K12 HD 01097) (F, Paid directly to institution), New England Baptist Hospital Research Funding Award and the Elizabeth Stent Fund (C, Paid directly to institution). **DJH:** Royalties: DJO (C); Grants: National Health and Medical Research Council (APP1021655) (H), ARC (DP130104407) (G, Paid directly to institution). **EJB:** Speaking and/or Teaching Arrangements: Merck (B). **JR:** Nothing to disclose. **AG:** Stock Ownership: Boston Imaging Core Lab, LLC (A); Consulting: MerckSerono (C), Sanofi-Aventis (B), TissueGene (B, Paid directly to institution). **JNK:** Nothing to disclose.

The disclosure key can be found on the Table of Contents and at www.TheSpineJournalOnline.com.

Funding Sources: From the Framingham Heart Study of the National Heart Lung and Blood Institute of the National Institutes of Health and Boston University School of Medicine. The National Heart, Lung, and Blood Institute's Framingham Heart Study contract (No.

N01-HC-25195) supported the recruitment, enrollment, and examination of the Offspring and Third-Generation Cohorts and the computed tomography scans. Dr PS and this research were funded by the Rehabilitation Medicine Scientist Training Program and the National Institutes of Health (K12 HD 01097), with supplemental funding from the New England Baptist Hospital Research Funding Award and the Elizabeth Stent Fund. VA Puget Sound provided support for Dr PS's participation in this research. Dr JNK was funded in part by National Institutes of Health/National Institute of Arthritis and Musculoskeletal and Skin Diseases P60 AR 47782. Dr DJH was funded by an Australian Research Council Future Fellowship. VA Puget Sound provided support for Dr EJB's participation in this research. There were no study-specific conflict of interest–associated biases.

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swimming, and weightlifting. We used multivariable logistic regression to examine associations between self-reported activity and severe lumbar ZJO, while adjusting for key covariates including age, sex, height, and weight.

RESULTS: In multivariable analyses, ordinal categories of heavy physical activity duration per day were significantly associated with severe lumbar ZJO (p for trend = .04), with the greatest risk observed for the category 3 or more hours per day, odds ratio 2.13 (95% confidence interval [CI] 0.97–4.67). When heavy activity was modeled as a continuous independent variable, each hour was independently associated with 1.19 times the odds of severe lumbar ZJO (95% CI 1.03–1.38, p = .02). Less vigorous types of physical activity and the type of exercise were not associated with severe lumbar ZJO. Older age, lesser height, and greater weight were independently and significantly associated with severe lumbar ZJO. In multivariable models predicting lumbar ZJO, neither model discrimination nor reclassification improved with the addition of physical activity variables, compared with a multivariable model including age, sex, height, and weight.

CONCLUSIONS: Our findings demonstrate a statistically significant cross-sectional association between heavy physical activity and CT-detected severe lumbar ZJO. However, the additional discriminatory capability of heavy physical activity above and beyond that contributed by other factors was negligible. Published by Elsevier Inc.

Keywords: Facet; Lumbar; Arthritis; Rehabilitation; Computed tomography; Exercise

Introduction

The lumbar zygapophyseal (or “facet”) joints are a commonly treated source of back pain in the United States [1]. Lumbar zygapophyseal joint osteoarthritis (ZJO) is thought to be a potential cause of low back pain in instances where pain can be isolated to the zygapophyseal joints using diagnostic anesthetic blocks [2]. Population-based epidemiologic studies have identified several potential risk factors for imaging-detected lumbar ZJO, including older age, female sex, and obesity [3,4]. No studies to date have examined associations between lumbar ZJO on diagnostic imaging and physical activity exposures such as general physical activity or performance of leisure-time exercise or sports [4].

The effects of physical activity on spinal degeneration and low back pain are complex, and our understanding of the interrelationships between these factors continues to evolve [5–7]. The magnitude of associations between spinal degeneration (spondylosis) in the lumbar intervertebral discs and zygapophyseal joints and low back pain, when present, is relatively modest [8,9]. Physical activity is generally thought to have beneficial effects on the severity of low back pain, and therapeutic exercise is a standard-of-care conservative treatment for nonspecific back pain [10–12]. On the other hand, views on the effects of physical activity on spinal degeneration are mixed, with both positive and negative putative effects attributed to physical activity [6,13–15]. The effects of physical activity on spinal degeneration may be dependent on the type, intensity, and cumulative exposure of the specific physical activity involved. Of note, well-designed studies of lumbar disc degeneration have illustrated that deleterious effects of physical activity on prevalent and incident lumbar disc degenerations are small in magnitude, when present at all [6,16,17]. These facts underscore the need for better

understanding of the role of physical activity in spinal degeneration. To date, all epidemiologic research in this area has examined putative effects of physical activity on the intervertebral discs, without consideration of effects on the lumbar zygapophyseal joints.

We conducted a study to examine cross-sectional associations between physical activity and computed tomography (CT)-detected lumbar ZJO in a sample of community-based US adults. The aim of this study was to determine whether general physical activity or specific types of exercise are associated with prevalent lumbar ZJO, when adjusting for demographic factors, and potential contributions to physical loading from anthropometric factors. For the purposes of this article, the term “ZJO” refers specifically to CT-detected ZJO, irrespective of clinical symptoms, such as low back pain, which were not evaluated in this study.

Materials and methods

Study participants

This ancillary study to the Framingham Heart Study was approved by the institutional review board of New England Baptist Hospital. The Offspring cohort of the Framingham Heart Study was initiated in 1971 as a prospective epidemiologic study of 5,124 young adults [18]. The Generation 3 cohort was established in 2002 and included 4,095 adults who were children of the Offspring cohort members [19]. A total of 3,529 participants from the Offspring and Generation 3 cohorts underwent abdominal CT scanning to assess abdominal aortic calcification, as described in detail elsewhere [20,21]. These scans also underwent standardized imaging evaluations for features of lumbar spondylosis, including lumbar ZJO. Subjects for this ancillary investigation were randomly selected from those individuals within the CT cohort, on the

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