

Osteoarthritis and Cartilage



Presence and extent of severe facet joint osteoarthritis are associated with back pain in older adults



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SUMMARY

Objective: To determine whether the presence and extent of severe lumbar facet joint osteoarthritis (OA) are associated with back pain in older adults, accounting for disc height narrowing and other covariates.

Design: Two hundred and fifty-two older adults from the Framingham Offspring Cohort (mean age 67 years) were studied. Participants received standardized computed tomography (CT) assessments of lumbar facet joint OA and disc height narrowing at the L2–S1 interspaces using four-grade semi-quantitative scales. Severe facet joint OA was defined according to the presence and/or degree of joint space narrowing, osteophytosis, articular process hypertrophy, articular erosions, subchondral cysts, and intraarticular vacuum phenomenon. Severe disc height narrowing was defined as marked narrowing with endplates almost in contact. Back pain was defined as participant report of pain on most days or all days in the past 12 months. We used multivariable logistic regression to examine associations between severe facet joint OA and back pain, adjusting for key covariates including disc height narrowing, sociodemographics, anthropometrics, and health factors.

Results: Severe facet joint OA was more common in participants with back pain than those without (63.2% vs 46.7%; $P = 0.03$). In multivariable analyses, presence of any severe facet joint OA remained significantly associated with back pain (odds ratio (OR) 2.15 [95% confidence interval (CI) 1.13–4.08]). Each additional joint with severe OA conferred greater odds of back pain [OR per joint 1.20 (95% CI 1.02–1.41)].

Conclusions: The presence and extent of severe facet joint OA on CT imaging are associated with back pain in community-based older adults, independent of sociodemographics, health factors, and disc height narrowing.

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Introduction

Back pain is a common reason prompting older adults to seek medical care, and a leading cause of disability in developed countries^{1–5}. The spinal facet ('zygapophyseal') joints are a widely

treated source of back pain, and rates of nonoperative yet invasive percutaneous facet joint procedures in older adults have increased more than four-fold over the past decade⁶. Facet joint osteoarthritis (OA) is often presumed to be the cause of pain in some older adults with facet-mediated pain confirmed by anesthetic blocks⁷. Nevertheless, some patients with facet joint OA may have no back pain at all, and patients without facet joint OA may have substantial back pain^{8–10}. This discordance between the appearance of facet joint OA on imaging and the symptom of pain is analogous to the high prevalence of asymptomatic radiographic findings observed in the setting of knee OA^{11,12}.

Cross-sectional imaging using computed tomography (CT) or magnetic resonance imaging (MRI) is necessary for complete evaluation of facet joint morphology in multiple planes, including

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the axial plane. Remarkably few population-based studies have examined relationships between facet joint OA on cross-sectional spinal imaging and the presence of back pain^{8–10} (Table 1), and no studies have found significant associations. However, characteristics of these earlier works may explain why relevant associations between facet joint OA and back pain might not have been detected. Prior studies used either mild or moderate facet joint OA at any spinal level as the threshold for defining prevalent facet joint OA. It is possible that more advanced (severe) facet joint OA would be more strongly associated with back pain, such as is seen in the context of knee OA¹¹. Also, prior studies did not examine the number of levels affected by severe facet joint OA, ignoring this important aspect of disease burden. Furthermore, earlier studies examined younger and middle-aged samples. This largely excludes older adults, in whom advanced facet joint OA on imaging as well as facet-mediated pain is most prevalent^{13,14}, and in whom facet joint interventions are most commonly performed⁶. Last, some prior studies have not utilized well-described and reliable scales for facet joint OA^{8,9}.

We attempted to overcome these limitations by conducting a study to examine associations between lumbar facet joint OA on imaging and back pain in a sample representative of community-based older US adults. The aim of this study was to determine whether definitions of facet joint OA incorporating the presence and extent of severe facet joint OA are associated with back pain in older adults, with and without adjustment for other sociodemographic factors, clinical factors, and disc height narrowing.

Methods

Participants

This study was an ancillary investigation to the Framingham Heart Study, and 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 5124 young adults¹⁵. 1418 individuals from the Offspring cohort underwent CT scanning as part of the multi-detector CT (MDCT) substudy of Framingham, which has been described elsewhere^{16,17}. Two hundred and seventy-two participants randomly selected from the MDCT cohort study received standardized CT assessments of facet joint OA as part of this ancillary study (Fig. 1). Of this subgroup, 252 participants also attended Framingham Examination 8, and comprised our study sample. This represents a separate study sample from that reported in an earlier publication on facet joint OA by our research group¹⁰. Whereas the earlier study examined participants from both the Offspring and Generation 3 cohorts of Framingham, the present study sample is drawn from the Offspring cohort only, enriching the sample for older adults. Furthermore, the present study includes separate CT assessments conducted by different readers, and different pain assessments. In addition, our *a priori* analytic approach is distinct from that taken in our earlier work in that it

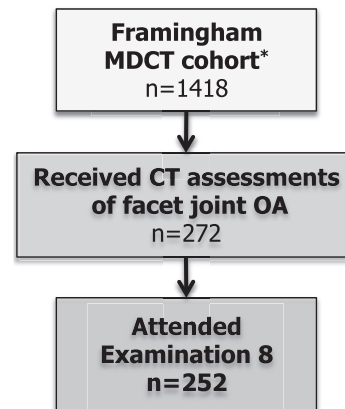


Fig. 1. Flowchart of participation.

examines the presence and extent of severe facet joint OA, rather than the finding of any moderate facet joint OA.

Assessment of facet joint OA

All CT imaging assessments were performed using eFilm Workstation (Version 2.0.0) software, with blinding to socio-demographic and health-related factors, and pain information. Facet joint OA was graded at both the left and the right side at the spinal levels L2–L3, L3–L4, L4–L5, and L5–S1. We applied the Framingham Scale for grading of facet joint OA, a semi-quantitative measure we designed for these research purposes, based on earlier scales by Pathria *et al.*¹⁸ and Weishaupt *et al.*¹⁹ The Framingham Scale grades facet joint OA according to the degree of pathoanatomic change in the separate subcategories of joint space narrowing, osteophytosis, articular process hypertrophy, sclerosis, subarticular erosion, subchondral cystic change, and presence of vacuum phenomenon (Appendix 1). Because we were specifically focused on examining associations with severe or advanced facet joint OA, we considered the presence of severe facet joint OA to be at least grade IV facet joint OA in either the left or right facet joints at one or more lumbar spinal levels L2–S1 (Appendix 1). We defined the extent of severe facet joint OA as the number of joints with severe facet joint OA at the lumbar spinal levels L2–S1 (range 0–8). The Framingham CT scans did not consistently include the L1–L2 level, and this level therefore was not read as part of these structured assessments.

Assessment of disc height narrowing

Disc height narrowing was graded at spinal levels L2–L3, L3–L4, L4–L5, and L5–S1, using grading criteria developed for research purposes by Videman *et al.*, that have been used previously in studies of spinal degeneration on MRI^{20–22}. Using sagittal CT reformatting, the midsagittal plane was identified at each level, and

Table 1
Prior studies of lumbar facet joint OA and back pain

	Imaging modality	Mean age (yrs)	Sample size	Country	Year	Use of a well-characterized scale for facet joint OA	Threshold for facet joint OA severity	Association with back pain†
Kjaer <i>et al.</i> ⁸	MRI	40	412	Denmark	2005	No	Mild	1.1 (0.7–1.6)
Savage <i>et al.</i> ⁹	MRI	36	149	United Kingdom	1997	No	Unclear	4.4 (0.9–21)
Kalichman <i>et al.</i> ¹⁰	CT	53	188	United States	2008	Yes	Moderate	1.0 (0.5–2.1)

† OR (95% CI).

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