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ORIGINAL ARTICLE

The prevalence of elbow osteoarthritis in Japanese middle-aged and elderly populations: the relationship between risk factors and function

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Background: The aim was to investigate the prevalence of elbow osteoarthritis (OA) in populations aged 40 years or older and to clarify the risk factors and their relationship with elbow function.
Methods: The respondents were 354 residents of a single village who underwent general medical examinations in April 2016. The mean age was 67.2 years (range, 40-93 years), and 222 respondents (62.7%) were women. Anteroposterior radiographs of the bilateral elbow joints were obtained, and the subjects were classified into 4 groups (non-OA, mild OA, moderate OA, and severe OA) according to the modified Kellgren-Lawrence scale. With respect to risk factors for elbow OA, a logistic regression analysis was performed.
Results: Elbow OA was detected in 55.0% of the elbows. The prevalence of symptomatic elbow OA was 22.6%, and no correlation between elbow OA and daily function was observed. The risk of elbow OA increased according to age, with odds ratios for those in their 50s, 60s, 70s, and 80s or older against those in their 40s of 12.99, 11.26, 14.45, and 26.85, respectively. In addition, male sex and a history of elbow trauma were significant risk factors, with odds ratios of 2.57 and 9.26, respectively.
Conclusions: The prevalence of elbow OA was 55.0%; the prevalence of symptomatic elbow OA was 22.6%; and the risk factors for elbow OA were older age, male sex, and a history of elbow trauma.
Level of evidence: Level III; Cross-Sectional Design; Epidemiology Study

Keywords: Elbow; osteoarthritis; risk factor; prevalence; logistic regression analysis; function

Elbow osteoarthritis (OA) is considered uncommon, accounting for 1%-3% of patients presenting with elbow arthritis,[6,18] but it has been found to be common in male patients and workers involved with heavy manual labor.[2,18] OA is a serious disease that reduces the activities of daily living (ADLs) and quality of life for elderly persons. Elbow OA has

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been said to cause elbow pain with forced flexion and extension, difficulty with ADLs, and loss of terminal extension.[15] There have been few reports on the prevalence of radiographic OA in the elbow joint, and only a few hospital-based studies targeting patients have reported the prevalence and etiology of elbow OA. There have been no epidemiologic studies for the general population in Japan. The prevalence and etiology of elbow OA have not been clarified, and fundamental questions remain regarding the clinical characteristics of elbow OA.

With this background, the aim of this study was to investigate the prevalence of elbow OA in Japanese individuals aged 40 years or older and to reveal the risk factors for elbow OA.

Materials and methods

Subjects

This epidemiologic study of elbow OA in middle-aged and elderly populations was designed as a cross-sectional study. We made a study plan using a statistical power analysis. The target sample size of this study was determined to be 288 persons, based on a medium effect size, a significance level of 5%, and a statistical power of 0.95, according to the χ^2 test. The research targets were populations aged 40 years or older with more than 300 subjects, with insufficient samples being taken into consideration.

The aim of this study was explained to residents receiving medical examinations among the general population of Katashina Village in Gunma Prefecture in April 2016, and signed informed consent was obtained from 354 subjects (132 men and 222 women) with 708 elbows.

According to the 2015 national census, Katashina Village is a rural mountainous community located north of Gunma and has a population of 4273, with 3140 being aged 40 years or older (1489 men and 1651 women); therefore, the subjects of this study accounted for 8.3% of the total population of the village. The proportion of aged persons (aged ≥ 65 years) in our sample accounted for 36.0% of the total aged population. The percentage of the population having jobs in primary industries (agriculture, forestry, or tourism), secondary industries (manufacturing and construction), and tertiary industries (service industries) was 21%, 18%, and 61%, respectively.

Diagnosis of elbow OA on radiography

An anteroposterior (AP) radiograph of the bilateral elbow joints was taken to diagnose elbow OA. When the participant was not able to achieve proper elbow joint extension, a position of partial flexion and partial supination was used. The AP view was taken with the forearm flat against the detector. All radiographic images were attached by a common identification number with the medical examination list and stored in DICOM (Digital Imaging and Communications in Medicine) format. Two orthopedic doctors (N.O., with 9 years of experience in elbow surgery, and T.T., with 18 years of experience in elbow surgery) who were blinded to each other's findings, as well as other assessment items, evaluated elbow radiographs using the DICOM viewer software program Natural View Portable (Hitachi Medical, Tokyo, Japan).

The modified Kellgren-Lawrence (KL) scale was used for the diagnosis of elbow OA.[8] This scale has been used in the Framingham Osteoarthritis Study and other studies to assess the existence and severity of osteophytes (OPs), joint space narrowing (JSN), sclerosis, and erosion.[5] The modified KL scale ranges from grade 0 to grade 4, where grade 0 is no OA; grade 1 is questionable OPs and/or JSN; grade 2 is definite small OPs and/or mild JSN; grade 3 is moderate OPs and/or moderate JSN and sclerosis and erosions may be present; and grade 4 is large OPs and/or severe JSN and sclerosis and erosions may be present.

For the diagnosis of elbow OA in 708 elbows on radiographs, the interobserver reliability between N.O. and T.T. was calculated; for the calculation of the intraobserver reliability, N.O. assessed the radiographs and then repeated all radiologic assessments 3 weeks later. The interobserver and intraobserver reliability of the modified KL scale for elbow OA was calculated by the κ statistic, giving values of 0.59 and 0.70, respectively. In the analysis, we used the measurements taken by N.O.

Investigation of elbow pain and function

The Japanese version of the Patient-Rated Elbow Evaluation (PREE-J) was used for the interview to investigate elbow pain and function. The Patient-Rated Elbow Evaluation (PREE) is a joint-specific, self-administered questionnaire consisting of a pain scale and a functional scale, with the latter consisting of specific function and usual function. The PREE-J, which is a translation of the PREE into Japanese, represents a reliable, valid, and responsive instrument and has evaluation capacities equivalent to those of the original PREE.[4,10] We measured elbow active range of motion to assess elbow function. Range of motion was measured using a goniometer during flexion and extension. We conducted measurements 3 times each for both elbows in a supine position, and the mean value was used for data analysis.

Diagnosis of symptomatic elbow OA

We used the previously reported method to determine the presence or absence of symptoms in or around the elbow joint.[19] Symptomatic elbow OA was defined as radiographic elbow OA with a score of greater than 0 on the PREE questionnaire.

Statistical analyses

The prevalence of elbow OA was calculated from the data acquired to clarify the characteristics according to age and OA classification, and demographic data between sexes were compared using the Student *t* test and Welch test for continuous variables and the Fisher exact test and χ^2 test for categorical data. To investigate the relationship between variables and elbow OA grades, we categorized the grade of elbow OA according to the modified KL scale into 4 groups: non-OA (grade 0-1), mild OA (grade 2), moderate OA (grade 3), and severe OA (grade 4). We then conducted comparisons between each elbow OA group to reveal the characteristics of the respondents with elbow OA, using the Student *t* test and Welch test for continuous variables and the Fisher exact test and χ^2 test for categorical data. An analysis of variance was used for continuous variables, followed by the Games-Howell test.