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Clinical Study

The prevalence of cervical myelopathy among subjects with narrow cervical spinal canal in a population-based magnetic resonance imaging study: the Wakayama Spine Study

Keiji Nagata, MD, PhD[a], Noriko Yoshimura, MD, PhD[b], Hiroshi Hashizume, MD, PhD[a,*], Shigeyuki Muraki, MD, PhD[c], Yuyu Ishimoto, MD, PhD[a], Hiroshi Yamada, MD, PhD[a], Noboru Takiguchi, MD, PhD[a], Yukihiro Nakagawa, MD, PhD[a], Akihito Minamide, MD, PhD[a], Hiroyuki Oka, MD[b], Hiroshi Kawaguchi, MD, PhD[d], Kozo Nakamura, MD, PhD[e], Toru Akune, MD, PhD[c], Munehito Yoshida, MD, PhD[a]

[a]*Department of Orthopaedic Surgery, Wakayama Medical University, 811-1, Kimiidera, Wakayama City, 641-8510, Japan*

[b]*Department of Joint Disease Research, 22nd Century Medical and Research Center, Graduate School of Medicine, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo, 113-8654, Japan*

[c]*Department of Clinical Motor System Medicine, 22nd Century Medical & Research Center, Faculty of Medicine, The University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo, 113-8654, Japan*

[d]*Japan Community Health Care Organization Tokyo Shinjuku Medical Center, 6-1-1 Shinjuku, Shinjuku-ku, Tokyo 160-8402, Japan*

[e]*Rehabilitation Services Bureau, National Rehabilitation Center for Persons with Disabilities, 1, Namiki 4-chome, Tokorozawa City, Saitama Prefecture 359-8555, Japan*

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Abstract

BACKGROUND CONTEXT: A narrow cervical spinal canal (CSC) is a well-known risk factor for cervical myelopathy (CM). However, no epidemiologic data of the CSC based on a population-based cohort are available.

PURPOSE: The purpose of the study was to investigate the age-related differences in CSC diameters on plain radiographs and to examine the associated magnetic resonance imaging (MRI) abnormalities including cervical cord compression and increased signal intensity (ISI) as well as the clinical CM with the narrow CSC.

STUDY DESIGN/SETTING: This was a cross-sectional study.

PARTICIPANT SAMPLE: Data were obtained from the baseline survey of the Wakayama Spine Study that was performed from 2008 to 2010 in a western part of Japan. Finally, a total of 959 subjects (319 men and 640 women; mean age, 66.4 years) were included.

OUTCOME MEASURES: The outcome measures included in the study were the CSC diameter at C5 level on plain radiographs, cervical cord compression and ISI on sagittal T2-weighted MRI, and physical signs related to CM (eg, the Hoffmann reflex, hyperreflexia of the patellar tendon, the Babinski reflex, sensory and motor function, and bowel/bladder symptoms).

FDA device/drug status: Not applicable.

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* Corresponding author. Department of Orthopaedic Surgery, Wakayama Medical University, 811-1 Kimidera, Wakayama City, Wakayama 641-8510, Japan. Tel.: +81-73-441-0645; fax.: +81-73-448-3008.

E-mail address: hashizum@wakayama-med.ac.jp (H. Hashizume)

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METHODS: The age-related differences of CSC diameters in men and women were investigated by descriptive statistics. The prevalence of MRI abnormalities and clinical CM was compared among the groups divided by the CSC diameter (less than 13, 13–15, and 15 mm or more). In addition, a logistic regression analysis was performed to determine the association of the CSC diameter with cervical cord compression/clinical CM after overall adjustment for age, sex, and body mass index.
RESULTS: The CSC diameter was narrower with increasing age in both men and women. The prevalence of cervical cord compression, ISI, and the clinical CM was significantly higher in the narrower CSC group. The prevalence of cervical cord compression, ISI, and CM among subjects with CSC diameter less than 13 mm was 38.0%, 5.4%, and 10.1%, respectively. In the logistic model, the CSC diameter was a significant predictive factor for the clinical CM ($p<.0001$).
CONCLUSIONS: This study firstly confirmed the age-related differences in CSC diameters and the significant association of the narrow CSC diameter with CM in a population-based cohort.

Keywords: Cervical spine; Spinal canal stenosis; Cervical myelopathy; Magnetic resonance imaging; Population-based cohort; Epidemiology

Introduction

In cervical spinal disorders such as cervical myelopathy (CM) and spinal cord injury, developmental cervical spinal canal (CSC) stenosis has been considered as an effective predictor of clinical outcome [1,2]. The spinal cord area should be evaluated after comparing with data obtained from asymptomatic subjects of each age group. Age-dependent data are required because the spinal cord may change with age, just as the cerebrum decreases in size with age in elderly subjects. The spinal canal should also be considered in asymptomatic subjects when treating cervical spinal disorders because patients with a tight spinal canal are more susceptible to spinal cord damage. However, the prevalence of spinal cord disorders and CM among patients with CSC of narrow diameter is not known. To date, few studies have focused on age-related differences in the cervical spinal cord and CSC [3,4]. Recent advances in magnetic resonance imaging (MRI) have made it possible to noninvasively obtain clear images of the cervical spinal cord, thereby making evaluation of traumatic spinal cord injury and cervical cord compression more applicable in routine practice. This study was undertaken to clarify age-related differences in the cervical spinal cord and CSC using magnetic resonance imaging (MRI) to establish the basis for morphometric evaluation of patients with cervical spinal cord disorders. More specifically, the purposes of this study were to investigate age-related changes of the CSC in a population-based cohort in Japan and to examine the associated MRI abnormalities including cervical cord compression and increased signal intensity (ISI) as well as the clinical CM with the narrow CSC diameters.

Participants and methods

Participants

The present study is a part of ‘‘The Wakayama Spine Study: a population-based cohort,’’ which was a large-scale population-based MRI study. Because a detailed profile of the Wakayama Spine Study has already been described elsewhere, only a brief summary is provided here [5,6]. The Wakayama Spine Study was conducted between 2008 and 2010 in a mountainous region in Hidakagawa, Wakayama, and a coastal region in Taiji, Wakayama. From inhabitants of the Hidakagawa and Taiji regions, 1,063 potential study subjects were recruited for MRI examinations. Among those 1,063 candidates, 52 declined the examination; therefore, 1,011 inhabitants were registered in the present study. Among those 1,011 participants, individuals with MRI-sensitive implanted devices (such as a pacemaker) and other disqualifiers were excluded. Ultimately, the cervical spine was scanned with MRI in 985 participants. Four participants who had undergone a previous cervical operation were excluded from the analysis, and another four participants whose MRI interpretation was difficult because of poor image quality were also excluded. After these exclusions, the present study had 977 participants. Radiographic evaluation of the cervical spine was also performed in 959 of the subjects. In total, both MRI and radiographic results were available for 959 participants (319 men and 640 women) with an age range of 21 to 97 years (mean, 67.3 years for men and 65.9 years for women). The participants completed an interviewer-administered questionnaire of 400 items that included lifestyle information; and anthropometric and physical performance measurements were taken. All study participants provided informed consent, and the study design was approved by the appropriate ethics review boards.

Anthropometric measurements included height (meter), weight (kilogram), and body mass index (BMI; weight [kilogram]/height^2 [m^2]). Medical information concerning neck pain, sensory disturbances, the Hoffmann reflex, the Babinski reflex, and the deep tendon reflex of the patellar tendon was gathered by an experienced orthopedic surgeon. The Hoffmann reflex was elicited with the hand in a neutral position by flicking the distal phalanx of the middle finger and observing flexion of the distal phalanx of the thumb [7,8].