We analyzed the Risk Factors for Lumbar Intervertebral Disc Height Narrowing -Ten Years Retrospective Cohort Study- by Akeda, K; Yamada, T; Inoue, N; Kasai, Y; Sudo, A from the Department of Orthopaedic Surgery and Translational Medical Science, Social and Environmental Medicine, Mie University Graduate School of Medicine, Mie, Japan; Department of Orthopedic Surgery, Rush Medical College at Rush University Medical Center, Chicago, IL.

INTRODUCTION: The intervertebral disc (IVD) is fibro-cartilaginous structures, composed of two major regions; the outer ring, called annulus fibrosus and the inner part, called the nucleus pulposus. These different tissues including cellular components maintain the metabolism of IVD and play an important role in mechanical function of spine. IVD is well known to degenerate by age, however the cause and pathophysiology of IVD degeneration has not been completely elucidated.

Clinically, disc-space narrowing is the most commonly used specific finding to indicate IVD degeneration. It is generally believed that the progression of disc degeneration is associated with lower back pain and with the progression of degenerative lumbar diseases. However, few data exist concerning the natural history of lumbar disc degeneration and its associated risk factors. To date, there are only a few reports of longitudinal studies on the progression of lumbar disc degeneration [1-3]. In addition, no cohort study has been reported in which lumbar disc height was quantitatively evaluated.

The purpose of this study was (1) to quantitatively evaluate the change in lumbar disc height by radiographic measurement during ten years in a population-based cohort study and (2) to investigate risk factors for the development of disc height narrowing.

MATERIALS AND METHODS: Study population: We analyzed the data from a population-based, longitudinal, prospective study of osteoporosis and knee osteoarthritis in a typical mountain village, Miyagawa, in central Mie Prefecture, Japan [4]. For the inhabitants at least 60 years-old, a medical examination was conducted every second year since 1997. During ten years from 1997 to 2007 (a total of six possible medical examinations), 209 inhabitants who were examined more than four times (67 males, 142 females, mean age: 70.2 years-old) were subject of this study.

Clinical interview and physical examination: During a clinical interview, the following items were obtained at baseline and at all follow-up examinations: age, sex, presence of low back pain and knee pain, smoking and working history. Past histories of rheumatoid arthritis, kidney and liver disorders, heart disease, hypertension, gout, thyroid disease, tuberculosis, and malignant tumor were recorded. Body height, body weight, BMI, and bone mineral density measurements were included in the physical examination. Vertebral compression fractures and calcification of the abdominal aorta was evaluated by lateral thoracic and lumbar radiographs. Knee osteoarthritis was evaluated by radiographs of the knee.

Radiographic Assessments of lumbar spine: Lateral lumbar spine radiographs of each subject were taken and digitally scanned at each examination. The criterion for positioning the landmarks for the discs was that the marks should be on the extreme anterior and posterior margins of the vertebral end-plates. A single trained observer assessed all lumbar radiographs from L1-L2 to L5-S1 discs using an image analysis software. Anterior disc height (Ha), posterior disc height (Hp), superior disc depth (Ds) and inferior disc depth (Di) were measured.

Disc height was expressed as the DHI, which was calculated as: [(Ha+Hp) divided by (Ds+Di)] x 100 [5]. Within-observer reproducibility was good (ICC = 0.95).

Classification of %DHI: The %DHI was calculated as the rate of change in DHI compared to the baseline as follow: [%DHI at follow-up – DHI at baseline]/ DHI at baseline] x 100. A two-way repeated measure of analysis of variance was used to compare the IVD levels with respect to %DHI and time-points of examinations. According to the rate of change in disc height, the subjects were divided into two groups: the mildly decreased group (more than or equal to -20%) and the severely decreased group (less than -20%) (Figure). Risk factor analysis: The influence of baseline risk factors on the progression of disc height narrowing during ten years was statistically analyzed. According to the number of affected discs, the severely decreased group was divided into two groups (1-2 discs and 3-5 discs group). The Polychotomous stepwise logistic regression analysis was used to identify the risk factors among the three groups.

RESULTS: Changes in Disc Height: The DHI was greatest at L1-L2 and decreased in order to L5-S1 (Base line; L1-L2: 22.0, L2-L3: 24.0, L3-L4: 26.2, L4-L5: 26.9, L5-S1: 28.0). The %DHI of each showed gradual decreases over the ten year period (Time point: p<0.0001). An analysis of variance revealed no significant disc level and time-point interactions (p=0.63). The %DHI of each level had similar changes over ten years and did not differ significantly among the discs (p=0.78).

Prediction of disc height narrowing: Results of the Polychotomous stepwise logistic regression analysis were summarized in Table. Being female and the presence of low back pain at baseline were associated with an increased risk of disc height narrowing. Among the past histories, hypertension has significantly related to the progression of disc height narrowing. However, the BMI showed an inverse association.

DISCUSSION: This is the first population-based cohort study that quantitatively evaluated lumbar disc height by radiographic measurement over ten years. The lumbar disc height of the inhabitants of Miyagawa village gradually decreased over ten years and did not differ significantly among disc levels. The results of this study indicate that being female and having low back pain and hypertension are significant risk factors for the development of lumbar disc height narrowing.


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