



ORIGINAL ARTICLE

Postmenopausal Chinese women show accelerated lumbar disc degeneration compared with Chinese men



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Summary *Background/Objective:* Postmenopausal women may have accelerated disc degeneration due to relative oestrogen deficiency. Two new studies supporting this concept were carried out.

Methods: Study I: The data were from the Osteoporotic Fractures in Men (Hong Kong) and Women (Hong Kong) studies. Both were population-based studies on bone health for elderly Chinese men and women (age ≥ 65 years, $n = 2000$ for men and $n = 2000$ for women). Based on lumbar spine radiographs, changes in L1/2–L4/5 disc space height were classified into four categories: 0 = normal; 1 = mild narrowing ($< 30\%$ reduction in disc height); 2 = moderate narrowing (30–60% reduction in disc height); and 3 = severe narrowing ($> 60\%$ reduction in disc height). Sums of the disc space narrowing scores of each participant were plotted against their age. Study II: 12 healthy individuals and 53 persons who had mild nonspecific low back pain (30 males and 35 females; mean age, 53.4 years; age range, 23–76 years) were recruited. Magnetic resonance imaging was performed on a 3-T system. A multiecho turbo spin echo pulse sequence was used for lumbar disc T2 mapping. Regions of interest were manually drawn over nucleus pulposus on the T2 map of the discs. The means of T2 relaxation times of discs L1/2–L4/5 of the participants were plotted against their age.

Results: Study I: Elderly women had a higher disc space narrowing score than elderly men, and the slope of the plot was steeper for females than for males. When the plots were extrapolated to younger age, they intersected at 59.67 years. Study II: An age-related reduction of T2 value in the nucleus pulposus was demonstrated, which was faster in females than in males. Although females tended to have initial higher T2 value before 50 years, this trend was reversed in elderly persons, with an intersection at 52.4 years.

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Conclusion: Postmenopausal Chinese women show accelerated lumbar disc degeneration compared with Chinese men.

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Introduction

Intervertebral disc degeneration begins early in life and is the consequence of a variety of genetic, mechanical, traumatic, and nutritional factors, as well as normal ageing [1–3]. Disc degeneration can progress to disc herniation, spinal canal stenosis, and, in conjunction with facet joint arthrosis, degenerative spondylolisthesis. Disc degeneration can be associated with low back pain, which decreases the quality of life and increases health care costs. The factors that initiate and influence the progression of disc degeneration are not yet fully understood. Nevertheless, there is a general agreement that spinal mechanical stress accelerates the development of disc degeneration and increases the likelihood of disc herniation [4].

Young men are more susceptible to disc degeneration than young women, most likely due to increased mechanical stress and physical injury. In an analysis of published data of 600 autopsy specimens of young and middle-aged individuals younger than 50 years, intervertebral disc degeneration was observed in men in the 2nd decade of life, occurring at an earlier age than in women; the severity of aged-matched disc degeneration was also generally greater in men [5]. In a later independent histologic study, Łebkowski [6] investigated 308 lumbar intervertebral discs collected during autopsy from 57 women (mean age, 41.8 years) and 79 men (mean age, 42.1 years). Disc degeneration first became readily apparent during the 2nd decade of life, although it was observed to occur in men almost a decade earlier than in women. In a magnetic resonance imaging (MRI)-based survey of young adults aged 20–22 years, lumbar disc degeneration was significantly more frequent in men than in women [7]. These results reinforce the general perception that young men are more susceptible to disc degeneration than young women, most likely due to increased mechanical stress and physical injuries.

However, recent evidence suggests that disc degeneration is common or more severe in elderly women than in elderly men [8,9]. It was suggested that postmenopausal women might have accelerated disc degeneration due to relative oestrogen deficiency [10]. However, until now there is no direct clinical data to show at what age women start to have as severe disc degeneration as, or more severe disc degeneration than, men. We performed two cross-sectional analyses on two data sets to further test this hypothesis of the effect of menopause on disc degeneration, and seek to understand the average age when Chinese women start to have as severe disc degeneration as that in Chinese men.

Materials and methods

Study I

The detailed participant information of Study I has been described elsewhere [11]. In brief, 2000 Chinese men and 2000 Chinese women, aged ≥ 65 years, were prospectively recruited from local communities for a prospective cohort study from August 2001 to March 2003, with the aim to follow them up again in 4 years' time. All participants were community dwelling, able to walk without assistance, without bilateral hip replacement, and with the potential to survive the duration of the primary study, as judged by their pre-existing medical status. The study protocol was approved by the Chinese University of Hong Kong Ethics Committee. Written informed consent was obtained from all participants. The baseline results were analysed in this study.

Left lateral lumbar spine radiographs were obtained by adjusting exposure parameters according to participants' body weight and height. Hard copies of lumbar spine radiographs were analysed in this study. Changes in L1/2–L4/5 intervertebral disc space height were classified into four categories: 0 = normal; 1 = mild narrowing (< 30% reduction in disc height); 2 = moderate narrowing (30–60% reduction in disc height); and 3 = severe narrowing (> 60% reduction in disc height), as described by de Schepper et al [8] and other authors [12–14] and also applied by the current author in previous studies [11]. The readers were blinded to the clinical characteristics of the participants. Reader 1 was a senior radiologist with > 10 years of experience in reading lumbar radiographs. Reader 2 was a junior radiologist with 5 years of experience in reading radiographs. For discs L1/2–L4/5, the intrareader reproducibility of Reader 1 had a kappa value of 0.81 for Grade 1, 0.912 for Grade 2, and 1 for Grade 3, with an overall kappa value of 0.872. The inter-reader reproducibility between Readers 1 and 2 had a kappa value of 0.72, indicating good agreement. Two readers showed similar results [11], and the results of Reader 1 were further analysed. The current analysis was a retrospective analysis. Sums of the disc space narrowing scores of the study participants were plotted against their age using GraphPad Prism software (GraphPad Software, Inc., La Jolla, CA, USA).

Study II

All the data were collected during 2014 prospectively. Twelve healthy individuals and 53 consecutive patients who had mild nonspecific low back pain (30 males and 35 females; mean age, 53.4 ± 13.5 years; age range, 23–76

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