



Original Article

Risk factor for first-incident hip fracture in Taiwanese postmenopausal women

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ABSTRACT

Objective: The variation in hip fracture risk between countries is greater than 10-fold. The present study aimed at identifying risk factors that resulted in the first occurrence of hip fracture in Taiwanese postmenopausal women.**Materials and Methods:** A case–control study with a patient group of 50 postmenopausal women, who were admitted to Keelung Chang Gung Hospital, Keelung, Taiwan due to the first incident of accidental hip fracture, was used to examine potential risk factors, including bone mass. Fifty women without hip fracture, selected from those undergoing general health evaluation at the Gynecology Outpatient Clinic at Keelung Chang Gung Hospital, were used as the control group and were matched to the case patients according to age. Evaluation consisted of a questionnaire, interview to document risk factors, physical examination (to record body height and body weight), and examination [dual-energy X-ray absorptiometry used to measure bone mineral density (BMD) of the hip and spine].**Results:** The average age of participants of both groups was 79.6 years. Lower level of education, younger age at menopause, increased body height, weight-bearing exercise less than three times per week, and lower BMD were associated with first-incident hip fracture. Total hip BMD was a stronger predictor than the BMD of different sites. Participants in the control group had a significantly higher prevalence of chronic diseases and a history of cataracts or glaucoma compared with those in the patient group.**Conclusion:** While total hip BMD is the strongest predictor of hip fracture, increasing awareness of osteoporosis prevention by educating people about good lifestyle habits and how to maintain BMD is prioritized for preventing the first-incident hip fracture in Taiwanese women.Copyright © 2016, Taiwan Association of Obstetrics & Gynecology. Published by Elsevier Taiwan LLC. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Osteoporosis has been recognized as a major threat for public health because it may progress without symptoms until a fracture occurs. Due to estrogen deficiency, postmenopausal women have a higher incidence of osteoporosis and fracture than men. The hip, spine, and wrist are the most susceptible areas to fracture in

postmenopausal women. Furthermore, hip fractures are considered to be of greater concern because these may result in personal disability and mortality, and therefore, place a higher burden on family and society expenditure.

According to the inpatient database of Taiwan's National Health Insurance (NHI) program from 1996 to 2000, the incidence of hip fracture was 1.6 times higher and occurred 5 years earlier among women than men [1]. The 5-year age-adjusted incidence of hip fracture in Taiwan was 505 per 100,000 women [1]. According to an analysis of Taiwan's NHI database from 1996 to 2002, it has been estimated that approximately one-third of women would

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experience at least one vertebral, hip, or wrist fracture in their lifetime [2]. Moreover, Taiwan not only is considered to be a high-risk area for hip fracture, but also has the highest incidence of hip fracture compared with other Asian countries [3]. According to records from the NHI, the rate of mortality following hip fractures in the elderly within the 1st year is about 15% for women [1], which is almost equivalent to the mortality rate of patients with Stages III and IV breast cancer. Hip fractures not only result in personal disability and have a high mortality rate, but also account for a heavy monetary burden. The average medical expenditure for an inpatient with a hip fracture is United States (US) \$3243 per patient [4], along with a financial burden on the patient's family and society that is difficult to estimate.

The risk for subsequent fracture in women with a hip fracture is 2.5 times higher than for those without a hip fracture [5]. Potential risk factors for hip fracture, which were previously evaluated in Caucasian women, include low bone density, lower body weight, cigarette smoking, caffeine intake, use of long-acting sedatives, and inactivity [6,7]. Since the prevalence of hip fracture in Taiwanese postmenopausal women is higher than that of their Western counterparts, except for in Northern Europe, the risk factors for first-incident hip fracture in Taiwanese postmenopausal women should be reassessed. Risk factor identification is critical so as to optimize treatment to prevent first-incident hip fracture, avert subsequent fractures, and improve both outcome and quality of life after a hip fracture.

This study was designed as a case–control study to identify those with potential risk factors and to measure bone mass for postmenopausal women with first-incident hip fracture.

Materials and methods

Study design and participants

In this case–control study, women with a hip fracture (case group) were compared with those without a hip fracture (control group) to determine if potential risk factors and bone mass differed between the two groups. This study was approved by the Ethical Medicine Committee at Chang Gung Memorial Hospital, Keelung, Taiwan. All participants signed an informed consent form.

The case patients were admitted to Keelung Chang Gung Hospital for the first incident of accidental hip fracture from March 2014 to February 2015. Patients were excluded if they were (1) severely cognitively impaired and completely unable to follow orders, (2) terminally ill, or (3) refused to participate. A total of 50 postmenopausal women were enrolled in the patient group.

To achieve a control group with a similar background to the patient group, 50 postmenopausal women (without a hip fracture) undergoing general health evaluation were recruited from the gynecology outpatient clinic at Keelung Chang Gung Hospital from March 2014 to February 2015 and were matched to the patient group according to age.

Assessment of risk factors

Questionnaire and interview

All participants were questioned and examined—the patient group during admission and the control group while at the outpatient clinic. All the interviews were conducted in person. We ascertained their level of education, body height and weight, age at menopause, parity, whether they underwent bilateral oophorectomy prior to the age of 45 years, history of fracture, parental history of fracture, current or previous therapy with estrogen within the past year, smoking habits, alcohol and coffee intake, calcium supplement, sun exposure for > 30 min/d, and weight-bearing

exercise three or more times per week. We also inquired about physician-diagnosed fractures, hyperthyroidism, diabetes mellitus, chronic diseases (including coronary heart disease, renal disease, epilepsy, parkinsonism, and cancer), rheumatoid arthritis, stroke, cataracts or glaucoma, visual impairment, and walking aids. Furthermore, participants were asked about their current medication, including hormone therapy, steroid, psychological medications (including tranquilizers, and antianxiety and antipsychological medications), osteoporosis medication, and diuretics (including thiazide and behyd).

Examination

Body weight, height, and bone mineral density (BMD) were measured. Baseline lumbar spine and hip BMD were measured by dual-energy X-ray absorptiometry (GE-Lunar; iDAX, Madison, WI, USA) installed at Keelung Chang Gung Memorial Hospital.

Statistical analyses

Summary statistics for the study variables were calculated and compared between the hip fracture and no hip fracture groups. Mean and standard deviation for continuous variables, frequency, and percentage for categorical variables were applied to descriptive statistics. Independent *t* tests were used to assess differences of numerical variables between the two study groups, and the Chi-square test was used to examine differences between categorical variables. Multiple logistic regression analysis was used to calculate multivariate-adjusted odd ratios of the study variables associated with hip fracture. In the multiple regression analyses, regression diagnostics, such as residual analysis, and multicollinearity were performed to ensure model robustness. All analyses were performed using SAS software, version 9.1 (SAS Institute, Cary, NC, USA).

Results

The characteristics of the study population are presented in Table 1. The average age of both groups was 79.6 years. A number of risk factors were associated with first-incident hip fracture, which included lower level of education, younger age at menopause, increased body height, weight-bearing exercise for less than three times per week, and poor BMD. However, patients in the control group had a significantly higher prevalence of chronic diseases, including coronary heart disease, renal disease, epilepsy, Parkinsonism, and cancer, and a prior history of cataracts or glaucoma compared with those in the patient group.

Many putative risk factors for osteoporosis were not associated with first-incident hip fracture risk. These factors included body weight, body mass index, parity, bilateral oophorectomy prior to the age of 45 years, estrogen therapy, a prior history of fracture, parental fracture, hyperthyroidism, diabetes mellitus, stroke, visual impairment, and rheumatoid arthritis. Furthermore, aside from weight-bearing exercise, other life-style risk factors were not related to first-incident hip fracture. These life-style risk factors included walking aids, current smoking, alcohol, sun exposure for > 30 min/d, calcium supplement, and both coffee and alcohol consumption. Use of psychological medication, including tranquilizers, antianxiety and antipsychological medications, and diuretics (including thiazide diuretics and behyd) also did not increase hip fracture risk.

As aforementioned, BMD was a strong predictor of first-incident hip fracture. The correlation between femoral neck and total hip BMD and the risk of hip fracture was stronger than that between spine BMD and the risk of hip fracture (Table 2). When all the

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