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Ethnic Differences between Asians and Caucasians in the Incidence of Osteoporotic Fractures: A Review

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Summary. **The aim of this mini-review was to address the question of whether there are differences between Asian and Caucasian women in the incidence of osteoporotic fractures. The online PubMed web site was used to search for papers on epidemiologic studies designed to compare ethnic differences between Asians and Caucasians in osteoporotic fractures, and nine original papers regarding this issue were retrieved. There is a body of evidence that the incidence of hip fractures in Asians, including Japanese, is lower than in Caucasians. By contrast, no Asian-Caucasian difference in incidence of vertebral fractures has been found, although Japanese living in Japan seem to have a higher incidence of vertebral fractures than Caucasians. More epidemiologic studies comparing vertebral fractures in Asians and Caucasians are needed.**

Key words — Asians, Caucasians, ethnicity, hip fracture, osteoporosis, vertebral fracture.

INTRODUCTION

Osteoporosis is a multifactorial disease characterized by generalized skeletal fragility, in which bone strength is so weak that fractures occur as a result of minimal trauma.[1)] Because some osteoporotic fractures dramatically decrease the activities of daily living (ADL) of elderly persons and increase medical costs, prevention of osteoporotic fracture has become very important.

While the risk factors for osteoporosis have not been fully elucidated, aging and sex are known to be important demographic factors that affect the incidence of osteoporosis. Ethnicity is known to be another demographic determinant of osteoporosis, and a detailed exploration of ethnicity might provide the key to a further understanding of this disease.

Some investigators have published review papers reporting that black people have a lower risk of osteoporotic fractures than Caucasians.[2,3)] The results of comparative epidemiologic studies suggested that Asians also have a lower incidence of osteoporotic fractures than Caucasians.[4,5)] However, to our knowledge there has been insufficient evidence on this issue. The aim of this mini-review was to answer the question of whether there are differences between Asian and Caucasian women in the incidence of osteoporotic fractures.

LITERATURE SEARCH

The online PubMed web site was used to search for epidemiologic studies comparing ethnic differences in osteoporotic fractures between Asians and Caucasians by using the terms "Fractures, Bone (MeSH term)", "Epidemiology (MeSH term) or Epidemiologic Studies (MeSH term)", and "Asian Continental Ancestry Group (MeSH term), Ethnic Groups (MeSH term), Ethnology (MeSH term), Race, or Asians", limiting to "Age ≥ 45 years", "Humans", and "English literature"; 351 papers were retrieved. Our criterion for inclusion of an epidemiologic study in this review was that it had been specifically designed to compare the incidence of hip or vertebral fractures in elderly people in Asian and Caucasian populations. Ultimately, nine original papers were retrieved (Table 1). Vertebral and hip fractures

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Abbreviations – ADL, activities of daily living; BMD, bone mineral density; RR, relative risk; SD, standard deviation.

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Table 1. Relative risk (RR) (95% confidence intervals in parentheses) of hip and vertebral fractures in Asian versus Caucasian women

Authors	Year	Subjects (Patients)	Relative risk (Asian / Caucasian) Hip fracture	Vertebral fracture	Comments
Silverman et al.[6]	1988	Patients whose data were obtained from statewide hospital discharge records in California	0.61	-	
Ross et al.[4]	1991	Female Japanese-American patients in six major hospitals on Oahu Island, Hawaii, and female Caucasian patients at the Mayo Clinic in Minnesota	0.48 (0.41 - 0.57)	-	
		Female Japanese patients from 23 hospitals in Okinawa, and female Caucasian patients at the Mayo Clinic in Minnesota	0.48 (0.38 - 0.60)	-	
Calder et al.[7]	1994	All patients with hip fracture in Leicestershire, England	0.84 (0.54 - 1.32)*	-	
Ross et al.[8]	1995	803 female Japanese from a random sample of 4000 participants in a health checkup in Hiroshima, and 561 Caucasian women who participated in the Rochester Epidemiology Project in Minnesota	-	1.2 (0.9 - 1.6)†	Using a fracture definition of > 3 SD‡
			-	1.8 (1.2 - 2.7)†	Using a fracture definition of > 4 SD‡
		839 female American-born Japanese-American participants in the Hawaii Osteoporosis Study, and 561 Caucasian women in the Rochester Epidemiology Project in Minnesota	-	0.7 (0.5 - 0.9)†	Using a fracture definition of > 3 SD‡
			-	1.1 (0.8 - 1.7)†	Using a fracture definition of > 4 SD‡
Lauderdale et al.[9]	1997	A 50% sample of Asian-American and a 10% sample of Caucasian Medicare enrollees in the U.S.			
		Chinese-American v.s. Caucasian	0.30 (0.25 - 0.36)	-	
		Japanese-American v.s. Caucasian	0.73 (0.62 - 0.87)	-	
		Korean-American v.s. Caucasian	0.53 (0.33 - 0.80)	-	
Ross et al.[10]	2000	All female Japanese-American and Caucasian patients whose data were available in hospital discharge records on Oahu Island, Hawaii	1.19	-	
Ellis et al.[11]	2001	First hospitalization female patients of in all non-federal California hospitals	0.37	-	Pacific Islanders were included as Asians
Walter et al.[12]	2003	A cohort of 718 Asians and 2548 Caucasians with disability in the Program of All-Inclusive Care for the Elderly (PACE) in the U.S.	0.52 (0.34 - 0.80)*	-	
Fang et al.[13]	2004	Female Asian and Caucasian patients in New York City whose data were obtained from the Statewide Planning and Resource Cooperative System of the New York State Department of Health	0.38 (0.34 - 0.42)*	-	Hospital discharge data were used for cases

*95% confidence interval calculated by the authors of this review; †Relative risk estimated from the prevalence ratio; ‡Vertebral fractures were evaluated by vertebral height measurement and were not acute (traumatic) fractures.

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cause a substantial reduction in the ADL of the elderly, and thus prevention of these two types of fractures must be given high priority to maintain their quality of life.

Hip fractures in Asian and Caucasian women

Eight papers dealing with hip fractures that are listed in Table 1 were used. Seven of the eight studies compared the incidence of hip fractures between Asian-Americans and Caucasians, and one study concerned elderly Japanese women and Caucasians. Five of the eight papers reported that the relative risk (RR) of hip fractures for Asians was significantly lower than that for Caucasians. The RRs reported ranged from 0.37 to 1.19, the simple average of the RRs in the eight studies being around 0.6.

The findings shown in Table 1 revealed that Asians have a lower risk of hip fractures than Caucasians. Since the bone mineral density (BMD) of the proximal femur of Asians is no higher than in Caucasians,[14,15] protective factors must exist. They may be genetic or race-related factors, such as skeletal structure and body size. The Asian-Caucasian difference in hip geometry may explain the ethnic difference in the incidence of hip fractures, i.e., the shorter hip axis or femoral neck length of Asians may contribute to their lower risk.[16,17] Falls, possibly related to body size or body composition, may be another contributing factor. Falls are an important risk factor for hip fracture, and their incidence among Japanese-Americans in Hawaii has been reported to be lower than among Caucasians in Hawaii.[18]

Non-genetic factors may also lower Asians' risk of hip fractures. Lauderdale et al.[9] reported that there appears to be an ethnic difference among Asian-Americans (Table 1). Japanese-Americans had the highest RR, 0.73, while Chinese-Americans had the lowest, 0.30. Their paper suggested that non-genetic factors, such as diet, may contribute. Moreover, Ross PD and Huang C [10] reported that the incidence of hip fractures among Japanese and Caucasians in Hawaii is similar and that the incidence of hip fractures in Hawaiians is lower than in other reports worldwide. These papers suggested that non-genetic factors, such as diet and lifestyles, may be responsible for the differences observed in hip fracture incidence between ethnic groups.[10]

As stated above, genetic or non-genetic factors, or both may explain the ethnic difference in osteoporotic fractures. Because Asians living outside Asia tend to maintain their original lifestyle, as typically observed in first-generation Asian Americans, genetic and lifestyle factors are linked, and thus their effects cannot be evaluated separately. Comparative studies targeting later-generation Asians should be conducted to resolve this problem.

Vertebral fractures in Asian and Caucasian women

Only one relevant paper comparing the incidence of vertebral fractures in Asian and Caucasian women was found. It reported that Japanese living in Japan have a higher prevalence of vertebral fractures than Caucasians in the mainland United States, while Japanese-Americans in Hawaii have a lower prevalence (Table 1).[8] It also reported that their prevalence in native Japanese is significantly higher (RR = 1.7) than in Japanese-Americans in Hawaii. The higher incidence of vertebral fractures in native Japanese than Japanese-Americans in Hawaii was accounted for by the lower BMD of native Japanese.[19,20]

The prevalence of osteoporotic vertebral fractures in Hong-Kong Chinese has been reported to be similar to that in American Caucasians,[21] whereas the prevalence in Chinese in Beijing is slightly lower than in American Caucasians,[22] although the studies were not designed as comparative studies and the results have not been included in Table 1. The findings in these studies did not support an ethnic difference in the incidence of vertebral fractures between Asians and Caucasians.

Caution is required when comparing the incidence or prevalence of vertebral fractures between two populations because vertebral compression fractures are not always symptomatic. If the participation rate in an epidemiologic study is low, selection bias could easily result in false values, making it difficult to detect ethnic differences in the occurrence of vertebral fractures. Future comparative studies should take into account the possibility of false values.

The incidence of vertebral fractures among native Japanese seems to be higher than among Caucasians, but the evidence is insufficient, and no overall Asian-Caucasian difference in the incidence of vertebral fractures was evident.

CONCLUSIONS

There is a body of evidence that the incidence of hip fractures in Asians, including Japanese, is lower than in Caucasians. The number of hip fractures in Japan has been reported to have more than doubled over the last two decades, and this steep increase is independent of the aging factor[23]. Thus, the difference in the incidence of hip fractures between Japanese and Caucasians may be decreasing. There is no clear Asian-Caucasian difference in the incidence of vertebral fractures although Japanese living in Japan seem to have a higher incidence. More epidemiologic studies comparing vertebral fractures in Asians and Caucasians need to be conducted.

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