

rate of first hip fracture decreased in both men and women. In most age groups, the actual number of fractures also decreased. A multitude of interventions for the elderly such as preventive home visits, fall prevention programs, optimized nutrition, and medication were suggested as possible reasons for the decrease [20]. Considering the percentages of people aged 60 years or over in these three countries, the changes during the study periods were not so great: 19.0% in 1995 and 21.4% in 2005 in Finland, 16.1% in 1995 and 16.7% in 2000 in Canada, and 19.8% in 1995 and 21.2% in 2005 in Denmark [16].

In the present study, hip fracture rates were very high in the older age groups. These results were in accordance with results for hip fracture incidence from 2004 to 2006 in Tottori, which is located in mid-western Japan [21]. However, we found that the incidences of hip fracture in 2007 were lowest in men aged 60–69 years and in women aged 60–79 years in the 15-year period from 1992 to 2007. As to the reason for that, we consider that persons 60–70 years old with osteoporosis might have come to medical attention and have been treated aggressively. In persons in their 80s and 90s and over, medical treatment for serious diseases such as stroke might be given priority over treatment of osteoporosis, resulting in hip fracture.

Focusing on the current situation of osteoporosis in Japan, it is difficult to obtain the incidence of osteoporosis nationwide at present. However, according to a cohort study based on the general population, Research on Osteoarthritis/Osteoporosis Against Disability by Yoshimura et al., the number of osteoporosis patients aged 40 years or over is estimated to be 6.4 million diagnosed by the lumbar spine or 10.7 million diagnosed by the femoral neck [22].

According to a questionnaire survey of diagnosis and treatment of osteoporosis for doctors specializing in orthopedics, internal medicine, and obstetrics and gynecology, 73% of the doctors in total and more than 95% of orthopedists diagnosed osteoporosis. The recognition rates of diagnostic criteria for osteoporosis in Japan were 61% in total and more than 90% by orthopedists [23].

Regarding first-line treatment for osteoporosis, for patients aged 65 years or over without existing fractures, 43% of doctors chose bisphosphonates and the next was activated vitamin D3 (29%). For patients aged 65 years or over with existing fractures, 55% of doctors chose bisphosphonates and the next was activated vitamin D (22%). It has been recognized among doctors that the ultimate goal of drug therapy for osteoporosis is to prevent fractures. Drug therapy might influence the incidence of hip fracture in the near future.

There has been a change in people's perspective on falling, from fear of fractures to fall prevention. Experiencing falling may lead to fear of falling and thus a decline in quality of life

for elderly people. Since falling is the primary risk factor for hip fractures, lessons for fall prevention started in 1997. Educational campaigns for fall prevention have been carried out in many parts of Japan since then [24]. Programs for fall prevention have been created for elderly persons with various risk levels and in different settings. Iwamoto et al. reported the beneficial effect of an exercise program aimed at improving flexibility, body balance, muscle power, and walking ability in preventing falls in the elderly [25]. A community exercise program for frail elderly people and an exercise intervention for community-dwelling elderly Japanese women showed that the combination of exercise classes and home-based exercise improved physical function and decreased the incidence of falls [26, 27]. Moreover, randomized controlled trials in the USA and Australia have shown the positive effects of Tai Chi programs, such as a decrease in the number of falls and the risk for falling and an improvement in functional balance [28, 29]. As a part of a health care project in a town, an exercise based on Tai Chi has been developed and practiced in Japan [30].

The results of the present study showed that the incidence of hip fracture was higher in the western areas than in the eastern areas of Japan for both men and women. This trend has not changed since 1987, when the first nationwide survey was carried out. According to a study on associations between hip fracture incidence and intake of four nutrients, calcium, magnesium, vitamin D, and vitamin K, intake of vitamin K showed a possibility of contributing to the regional differences more than did intake of calcium or vitamin D; high intake of vitamin K was associated with lower incidence of hip fracture, and vice versa [31]. Kaneki et al. found a large geographic difference in serum vitamin K2 levels in postmenopausal women and showed the relation between regional difference in intake of fermented soybeans, which contain a large amount of MK-7, and hip fracture incidence [32].

Although each country has unique factors that might influence the incidence of hip fracture besides the common factors related to hip fractures, there is a possibility that intakes of nutrients, especially intake of vitamin K, might explain the regional differences in some countries.

In countries that will face rapid aging of the population in the near future, such as Korea and China, the number of hip fracture patients will continue to increase. However, appropriate diagnosis of osteoporosis, widespread use of antiresorptive agents and the development of new medication, thorough countermeasures for fall prevention, and proper nutrient intake might contribute to the decline of hip fracture incidence in the coming years.

Our study has several limitations. First, we used the mailing method because we do not have a nationwide computer-based register system of hip fractures. At present, this is the best way to obtain information on hip fractures as

a nationwide survey. In order to receive as many responses as possible, we asked for it four times. Moreover, we dealt with any questions from institutions on the phone. Second, although we asked institutions not to include patients that underwent surgery for hip fracture at other institutions or patients for rehabilitation, it was not possible to check them. Third, since we collected data for all hip fracture patients together, it was not possible to distinguish between fractures caused by primary osteoporosis and secondary osteoporosis. It was also impossible to analyze data by types of hip fractures.

In conclusion, despite the increasing number of new patients, the incidence of hip fracture in some age groups for both men and women showed the possibility of decline. The exact reasons for this are unknown, but drug therapy for osteoporosis and fall prevention programs might have contributed to the results. Moreover, some nutrient intakes might explain the regional differences not only in Japan but also in some countries. Additional studies are necessary to identify factors that contribute to regional differences throughout the world.

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