CHAPTER V

DISCUSSION, RECOMMENDATION AND CONCLUSION

DISCUSSION

BONE MINERAL DENSITY (BMD) AND HIP FRACTURE

No significant difference in bone mass between age-matched cases and controls does not mean that we accept the hypothesis, or there is no difference of bone mass between them, because the number of subjects selected (total 35) has not satisfied with the designed sample size (total 56). Maybe insufficient subjects caused the failure to show the true difference between age-matched cases and controls. A matched case-control study in postmenopausal women found that there was a significantly reduced mean of bone mineral content in nontraumatic hip fracture group comparing with non-fractured group (8) and suggested that reduced bone mass is an important risk factor for hip fracture. While between all cases and controls, age-unmatched groups, bone mass was different as well as age. It told us that among female elderly patients with accidental falling, the patients with hip fracture were more osteoporotic in hip than those without hip fracture, but probably because of different age.

RELATIONSHIP BETWEEN BONE MASS AND AGE, WEIGHT

It was known that both age and low body build are risk

factors for bone mass loss. Bone formation and bone resorption occur at anatomically discrete foccicalled bone remodeling units. After peaking in young adulthood, bone mass begins to decline with advancing age. During age-related bone loss, there is a remodeling imbalance with a relative or absolute increase in resorption over formation. Because of this imbalance at each bone remodeling unit, an increase in bone turnover (i.e., an increase in the number of bone remodeling units) leads to increased bone loss (9). Bone loss is proportionately greater in women than men (10), in part because a period of accelerated bone loss accompanying menopause is superimposed upon the underlying age-related loss in women. Besides, women who are thin have less bone mass than those who have higher weight (11, 12, 13). This study also suggested that bone mass decreases as age increases and as weight declines in all controls, but there was no significant positive relationship between bone mass and weight in all cases. It might be because of insufficient sample size or might be that low body build is not a risk factor for low bone mass in all cases, while the relationship between bone mass and age in all cases is similar to that in all controls. From this, it shows that the result of significant positive relationship between bone mass and weight in all subjects is affected by the controls.

Obesity may protect against bone loss in women after menopause by increasing the amount of biologically available estrogen. After menopause, most estrogen is formed from the conversion of androstenedione to estrone (14). Since much of this conversion takes place in adipose cells, obese women produce more

estrone than thin women (15, 16). In addition to protecting against postmenopausal bone loss, greater body weight might be associated with greater peak bone mass achieved in early adulthood. It is also possible that hips well padded with fat tissue might be less likely to fracture during a fall. Also, higher weight-bearing is more beneficial to bone mass than the lower.

RISK FACTORS FOR HIP FRACTURE

A threshold of hip fracture for the minimal trauma, falling to the floor was selected from the evaluation of ROC curve. Less than or equal to 0.6 g/cm² of BMD was estimated as the threshold with sensitivity 90% and specificity 68% which can be used to predict the likelihood of hip fracture when the elderly female fall down.

Without matching age, less than or equal to 0.6 g/cm² of BMD in hip was found to be a high risk, 19 times higher than that with over 0.6 g/cm² of BMD, for hip fracture. This result supports the result in comparison of BMD mean between all cases and all controls. One study in Minnesota showed that the incidence of cervical femur fracture was estimated at 8.3 per 1,000 person-years among women with cervical BMD < 0.6 g/cm², while the estimated incidence of intertrochanteric femur fracture reached 16.6 per 1,000 person-years among those with intertrochanteric BMD < 0.6 g/cm² (17). Both incidence was much higher than that in women with higher BMD level. Another population-

based cohort study suggested that hip fracture have an increased incidence in elderly women with low bone mass as well (18).

Smoking, alcohol drinking, low milk drinking and low body mass index seemed not to be the risk factors for hip fracture in this study. Maybe the results were invalid because most subjects did not have those characters and the sample size was small. The percentile of subjects' number who had the characters of smoking, alcohol drinking, low milk drinking and low body mass were only 5.7% (2 out of 35), 8.6% (3 out of 35), 11.4% (4 out of 35) and 14.3% (5 out of 35) respectively. Besides, the result implied that low physical activity and age have no direct relation with the risk of hip fracture.

RISK FACTORS FOR LOW BMD (< or = 0.6 g/cm^2)

In the analysis of possible risk factors for low BMD, aging is a risk factor for low BMD, approximately 1 time increase in risk to reach low BMD level for each year's increase in age after 45 years old.

Smoking, alcohol drinking, milk drinking, low body mass seemed not to be the risk factors for low BMD. As mentioned above, maybe because few subjects smoked, drank alcohol, did not drink milk and has low body mass index in this study, and the sample size was not big enough, these items showed no association or no significant association with low BMD. The result indicated that low level of physical activity has no association with the risk of low BMD as well.

SMOKING, ALCOHOL DRINKING, MILK INTAKE AND PHYSICAL ACTIVITY

It is still uncertain that whether smoking affects hip fracture and bone loss. In Kiel' study (19), current smoking did not appear to increase hip fracture risk, but in Paganini-Hill's study (20), current smoking had a significantly increased risk for hip fracture. Both were population-based cohort studies among elderly women. The effect of cigarette smoking on bone mass could be mediated by several factors. On average, female cigarette smokers are thinner than nonsmokers. Women who smoke have lower serum concentration of endogenous estrogens (21) and lower concentration of estrogens during estrogen therapy than women who do not smoke. Women who smoke also undergo menopause at an earlier age than women who do not smoke (22), which might also reduce postmenopausal bone mass. Even so, it is still hard to establish with certainty that cigarette smoking causes bone loss and osteoporotic fracture.

Hernandex-Avila M et al found that alcohol intake was independently associated with increased risk of both hip and forearm fractures and with a dose-response relation (23). Alcoholic men have lower bone mass and lose bone more rapidly than nonalcoholics, but whether moderate consumption of alcohol causes significant loss of bone is uncertain (3). the association between alcoholism and osteoporosis could result from a direct toxic effect of alcohol or could be a consequence of poor nutrition, reduced body weight, cigarette smoking, reduced physical activity, liver disease, chronic illness, or other factors. Regular use of alcohol may also contribute to an

increased risk of fractures by predisposing to falls (24).

An osteoporotic bone has lost both calcium and protein and so it is not unreasonable to think that a diet low in calcium and protein might accelerate the osteoporotic process. There is no evidence to support this view (25, 26). Osteoporosis is not more common in those parts of Asia and Africa where diets are low in these nutrients than in the well fed countries of Europe and North America. Indeed in the USA osteoporosis is probably more common in the white than in the negro population, who in general eat poorer diets. This difference might be due to a genetic factor or more probably to differences in physical activity.

Bone is composed mainly of calcium and phosphate deposited on a matrix of protein called osteoid. Because that about 99% of the calcium in the body is contained in the bone, osteoporosis must be accompanied by loss of calcium from the skeleton. Zero calcium balance is therefore necessary for maintaining total skeletal mass. Calcium balance depends on the dietary intake of calcium, but the role of dietary calcium intake in the etiology of osteoporosis in humans is controversial. Although milk contains rich calcium, phosphate and protein, other foods in daily diet can be instead of milk. So it is difficult to measure the relationship between diet (including low milk intake) and osteoporosis.

It has long been recognized that prolonged immobility results in osteoporosis (27, 28). Patients confined to bed and astronauts under weightless condition lose as much as 1 per cent

of their trabecular bone per week (29, 30). Cortical bone may be lost at a somewhat slower rate (29). Resumption of normal weight-bearing activity gradually restores both type of bone (29, 30). It seems that weight-bearing and physical activity both act as mechanical stimuli for bone growth and remodeling (31). Exercise is an attractive method for attempting to prevent osteoporotic fractures because regular exercise may have other beneficial effects on health. It is also possible, but untested, that regular exercise might prevent falls or help protect against injury during falls by improving neuromuscular function (3). There is evidence that regular exercise can effectively reduce the risk of osteoporotic fractures in both sexes (20).

SINGH INDEX AND DEXA

Singh Index (32) was developed and has been applying in the clinic for more than twenty years. But some investigators argued its reliability. Leichter et al found that Singh Index is of no clinical value (33), because no correlation was found between the breaking stress and Singh Index, and that the bone density is the best indicator for the compressive bone strength was suggested. While Horsman et al reported that singh grade provides the best discrimination between fracture and non-fracture groups, fracture risk must be predominantly determined by the trabecular structure and integrity in the femoral neck (34). Cooper et al also reported that Singh Index is a useful epidemiological tool for the measurement of bone mass in the proximal femur (35). The concordance of Singh Index and DEXA was assessed in this study. If less than or equal to 0.6 g/cm^2 of BMD

in proximal femur measured with DEXA is estimated as osteoporosis, Singh gradings has sensitivity 46% and specificity 93%. We believe that Singh Index still is a simple and useful method for the measurement of bone mass in hip.

RECOMMENDATION FOR FUTURE STUDY

In order to reveal BMD difference in hip between the elderly female patients with and without hip fracture resulted from falling, another study with a sufficient sample size is recommended. Besides, a population-based cross-sectional study is suggested to identify the possible risk factors for osteoporotic fractures.

CONCLUSION

Thirty five Thai elderly female patients with and without hip fracture resulted from falling were collected. Among them, only 7 cases with hip fracture and 14 controls without hip fracture were eligible matched within 3 years of age. BMD in the proximal femur, age, height and weight were compared between 7 cases and 14 controls in age-matched groups, and between all 10 cases and all 25 controls in age-unmatched groups. No significant difference in BMD mean between age-matched groups was found, probably because the sample size has not been satisfied. While in age-unmatched groups, very significant differences in BMD mean and age mean implied that among the elderly female with a history of a fall, those with hip fracture might be more osteoporotic than those without hip fracture, but probably because their age

has not been matched. A future case-control study with sufficient samples should be made in order to reveal the truth.

Independently, advancing age is strongly related with the risk of bone mass loss, while higher body build has a inverse relationship with the risk of osteoporosis. This multiple regression equation may be utilized for the prediction of bone mass in the proximal femur in Thai elderly female population.

Less than or equal to 0.6 g/cm^2 of BMD in the proximal femur may be estimated as the threshold of hip fracture when one elderly Thai woman experiences a fall. In elderly Thai women who aged 45 years old or over, that bone mass is below the threshold is of high risk for hip fracture. While aging is still of a main risk for reaching the threshold of hip fracture, less than or equal to 0.6 g/cm^2 of BMD in hip.

Singh Index still is of clinical value especially in epidemiological study and in developing countries where the quantitative equipment for the measurement of bone mass in the proximal femur are not popular.

Cigarette smoking and alcohol drinking seem not to be main risks of hip fracture and bone mass loss in Thai women because few of them have these characteristics. Strategies for controlling the main risk factors of hip fracture and low bone mass should be taken into consideration as the public health issue since the elderly population in Thailand is rapidly growing up.