# Postmenopausal Osteoporosis : What is the Real Magnitude of the Problem in the Thai Population?

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**Abstract**

To assess the prevalence of osteoporosis, bone mass measurement was performed on 1,047 women attending a menopause clinic at Chulalongkorn Hospital, Bangkok. The mean age of the population was 50.5±5.7 years. The bone density was measured at lumbar spines (LS) (L1-L4) and the non-dominant femoral neck (FN) site utilizing a Hologic QDR 2000 dual energy X-ray absorptiometer. According to the World Health Organization's (WHO) definition a value of bone mineral density (BMD) that is more than 2.5 standard deviation (SD) below the young adult mean is considered diagnostic of osteoporosis. In this study, Thai and American cut-off values of BMD for osteoporosis were used to compare the prevalence of osteoporosis. Using Thai's cutoff value, the results showed a lower prevalence of osteoporosis of both LS and FN (15.7% and 9.5%, respectively). Considering the subgroups of the studied population, the prevalence of osteoporosis of LS and FN utilizing Thai's cutoff value was significantly higher in postmenopausal than in premenopausal women. (Premenopause *vs* postmenopause, LS : 4.7% *vs* 21.4%; FN : 4.7% *vs* 11.9%, respectively, $P<0.05$) WHO's definition of osteoporosis (the cutoff value of 2.5 SD below the young adult mean) is based on the rationale that this cutoff value identifies approximately 30 per cent of postmenopausal white women as having osteoporosis which is approximately equivalent to the lifetime risk of fracture at the spine, hip and forearm of white women at age 50 years. The prevalence of osteoporosis obtained in this study might not represent the true magnitude of the problem in Thailand. Until we have our own lifetime fracture risk which will enable us to have an appropriate cutoff value to diagnose osteoporosis, this prevalence might be used as an approximate figure or initial information for further research in this field.

It has been predicted that by the year 2010, the number of patients suffering from osteoporosis will be even greater. Not only because the number of elderly people rises, but there will also be relatively greater increase in the prevalence of disease in Southeast Asia and the Pacific Rim[1]. The clinical significance of osteoporosis lies in the fractures that occur. This fracture risk increases

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when bone density is reduced[2]. For instance, fracture risk increases 1.5 - to 3 - fold or more for each standard deviation (SD) decreases in bone mineral density[3]. The ability of bone mass measurement to assess fracture risk has a high specificity[4] and permits the development of appropriate cutoff values for bone mineral so that intervention can be directed to individuals at high risk before fracture occurs[3]. At present, several approaches have been taken to define osteoporosis on the basis of bone mass measurement[5]. In adult women, the cutoff value of 2.5 SD below the average of the healthy young adult reference range is appropriate[6]. Since, such a cutoff value identifies approximately 30 per cent of postmenopausal women as having osteoporosis using measurements made at the spine, hip or forearm. This is approximately equivalent to the lifetime risk of fracture at these sites[3].

Thailand is one of the Southeast Asian countries that is predicted to have an increasing prevalence of osteoporosis. Hence, the aim of this study was to assess the prevalence of osteoporosis in women attending the menopause clinic, Chulalongkorn Hospital, Bangkok, using Thai's cutoff values.

## MATERIAL AND METHOD

One thousand and forty seven women attending the menopause clinic at Chulalongkorn University Hospital from January 1992 to December 1995 were recruited for the study. Bone mass measurement was performed in these women utilizing dual energy X-ray absorptiometer, Hologic QDR 2000. Long term precision is 1.5 per cent. A standard region of measurement, including anterior lumbar spines (LS : L1-4) was scanned. Patients with severe osteoarthritic changes or compression of vertebrae were excluded from the study. Bone mineral density of the hip was measured at the nondominant side. Results are expressed in grams of ashed bone per unit area of bone scanned. (gram per square centimeter, $g/cm^2$)

Osteoporosis is defined as the value of BMD which is more than 2.5 standard deviation below the young adult mean[4]. In this study, we compared the prevalence of osteoporosis using two different cutoff values. The first cutoff value was from the bone mineral density databases for American Men and Women[7]. With this reference database, the young adult mean of BMD of anterior lumbar spines (L1-L4) and femoral neck are 1.047 and 0.895 $g/cm^2$ respectively. Hence, the cutoff value for osteoporosis (-2.5 SD) is 0.772 $g/cm^2$ for anterior lumbar spines (LS) and 0.645 $g/cm^2$ for femoral neck (FN). The second cutoff value is from the bone mineral density database for Thai men and women[8]. With this reference database, the young adult mean of BMD of anterior lumbar spines (L1-L4) and femoral neck are 0.987 and 0.810 $g/cm^2$, respectively. Hence the cutoff value for Thai women (-2.5 SD) is 0.765 $g/cm^2$ and 0.593 $g/cm^2$ for anterior lumbar spines and femoral neck respectively[8].

Descriptive statistics were used where it was appropriate. Unpaired *t*-test was used to compare quantitative data. P value of less than 0.05 is considered statistically significant.

## RESULTS

Of all the 1,047 women who participated in this study, 34.4 per cent were premenopausal and 65.6 per cent were postmenopausal. Postmenopause was defined as having no vaginal bleeding during the last 6 months and measurements of serum gonadotropin and estradiol level were in the menopausal range. In the latter group, the mean time since menopause was 4.78±4.16 years. Demographic characteristics of the studied population are shown in Table 1. The age range of the studied population was 92.7 per cent between 41-60 years, 4.8 per cent above 60 and 2.5 per cent < 40 years old.

**Table 1. Population characteristics (N=1,047).**

| Characters | Mean±SD/Percentage |
|---|---|
| 1. Age (year) | 50.51±5.70 |
| 2. BMI ($kg/m^2$) | 23.78±3.35 |
| 3. Parity | 1.94±1.64 |
| 4. Educational background | |
| Above University/college level | 4.8% |
| University/college | 45.9% |
| Below University/college level | 49.3% |
| 5. Income (Baht/month) | |
| <20,000 | 47.3% |
| 20,000-50,000 | 38.6% |
| >50,000 | 14.1% |

BMI = Body mass index

**Table 2. Comparison the prevalence of osteoporosis in Thai women using Thai's and American's cutoff values (N=1,047).**

| Measurement sites | Cutoff values | | | |
|---|---|---|---|---|
| | Thai* | | American# | |
| | No. | % | No. | % |
| 1. Anterior lumbar spines (L1-L4) (LS) | 164 | 15.7 | 173 | 16.5 |
| 2. Femoral neck (FN) | 99 | 9.5 | 228 | 21.8 |

WHO's definition of osteoporosis : BMD of less than -2.5 standard deviation
*Thai's cutoff value : LS < 0.765 g/cm$^2$, FN <0.593 g/cm$^2$
#American's cutoff value : LS < 0.772 g/cm$^2$, FN <0.645 g/cm$^2$

Regarding the prevalence of osteoporosis in Thai women, the results were different according to the cutoff values used as shown in Table 2. When considering the prevalence of osteoporosis in premenopausal and postmenopausal women, there was statistically significant difference between the two groups (P<0.05) either utilizing Thai's or American's cutoff values, as shown in Table 3.

## DISCUSSION

It has long been accepted that there are geographical differences in fracture rates[9]. The reasons for these differences are unknown. Racial variation in bone mass has been described[9]. However, Asian women have a peak bone mass that is 5-10 per cent lower than their white counterparts,[10] yet have hip fracture rates one-third to one-half as great[9]. This discrepancy may relate, in part, to inadequacies in the normalization of bone density measurements for differences in body size[9].

In this study, dual energy X-ray absorptiometer, Hologic QDR 2000 was used to measure bone mineral density. The reference database of the American population installed in the software of this machine contains nearly 1,000 lumbar spine measurements plus over 1,400 hip measurements. This primary source of data derived from measurements of volunteers at the University of California, San Diego, of which all the subjects were Caucasians[7]. Poshyachinda et al[8] developed a range of bone density from normal healthy Thais which serves as normal reference for our clinical services. With this reference, the author has set a cutoff value to diagnose osteoporosis using WHO's definition as mentioned earlier.

The results revealed lower prevalence of osteoporosis both of lumbar spines and femoral neck when using Thai's cutoff value than that of the American's. Using the American's cutoff value, the prevalence of osteoporosis of femoral neck in the studied population was higher than that of the lumbar spines. However, when using Thai's cutoff value, the prevalence of osteoporosis of the lumbar spines was higher than that of the femoral neck.

**Table 3. Comparison the prevalence of osteoporosis in premenopausal and postmenopausal Thai women using Thai's and American's cutoff values (N=1,047).**

| Measurement sites | | Cutoff values | | | | P-value |
|---|---|---|---|---|---|---|
| | | Thai* | | American# | | |
| | | No. | % | No. | % | |
| 1. Anterior lumbar spines (L1-L4) (LS) | Pre. | 17 | 4.7 | 19 | 5.3 | <0.05 |
| | Post. | 147 | 21.4 | 154 | 22.4 | |
| 2. Femoral neck (FN) | Pre. | 17 | 4.7 | 46 | 12.8 | <0.05 |
| | Post. | 82 | 11.9 | 182 | 26.6 | |

WHO's definition of osteoporosis : BMD of less than -2.5 standard deviation
*Thai's cutoff value : LS < 0.765 g/cm$^2$, FN <0.593 g/cm$^2$
#American's cutoff value : LS < 0.772 g/cm$^2$, FN <0.645 g/cm$^2$
Pre. = Premenopause
Post. = Postmenopause

In women, using vertebra which contains more proportion of trabecular bone as indicator, the fracture incidence increases during the age of the fifth decade of life[11,12]. However, the hip which contains more cortical bone has a rising incidence of fracture after the age of 70[11,12]. In this study, more than 92 per cent of the women were in the fourth and fifth decade. Hence, the prevalence of osteoporosis of the lumbar spines in this studied population are higher than that of the femoral neck. Therefore, it may be more appropriate to use Thai's cutoff value to identify those who have significant low bone mass in our population.

The prevalence of osteoporosis of femoral neck using Thai's cutoff value was 9.5 per cent in this study. This is much lower than the prevalence reported in England and Wales (age range of the studied population from 50 to >85 years, N=1,986) which was as high as 22.5 per cent[3]. Nevertheless, this may be partly due to the difference in age range of the studied population.

When considering subgroups of the studied population, we found significantly higher prevalence of osteoporosis both of lumbar spines and femoral neck in postmenopausal than in premenopausal women. This is because after menopause, bone loss occurs at a more rapid rate[13]. Loss of bone mass in the first five years after menopause may be as much as 3-5 per cent per year in cancellous bone and 1-3 per cent in cortical bone[14].

In setting an appropriate cutoff value for BMD, account must be taken of the prevalence of the clinical fracture incidence[3]. For example, setting a cutoff at -4 SD would make the disorder a rarity. Conversely setting a cutoff at -1 SD, 20 per cent of the young healthy population would be deemed to have osteoporosis[3]. As mentioned earlier, the cutoff value of 2.5 SD below the average of the healthy adult reference range is appropriate to identify 30 per cent of postmenopausal white women as having osteoporosis using measurements at the spine, hip or forearm[3]. This is approximately equivalent to the lifetime risk of fracture at these sites (39.7%)[15] of white women at age 50 years. In Thailand, up until the time of this report, there has been no reliable data concerning fracture incidence at each age interval ranging from 50 to 94 years. This can be used for calculation of lifetime risk as the method described by Cummings SR, et al[16]. With the lifetime risk of fractures, this will enable us to find the appropriate cutoff value which might be more or less than -2.5 SD that can identify postmenopausal Thai women who have osteoporosis and have the most likely risk of osteoporotic fractures. In conclusion, eventhough the result of this study can not represent the real magnitude of osteoporosis in Thailand, however, it might be used as an approximate figure or initial information for further research in this field.

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# โรคกระดูกพรุนในสตรีวัยหมดระดู : ในสตรีไทยมีปัญหาเท่าใด

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ได้ศึกษาหาความชุกของโรคกระดูกพรุนในสตรีที่มารับบริการที่คลินิกสตรีวัยหมดระดู โรงพยาบาลจุฬาลงกรณ์ จำนวน 1,047 ราย ซึ่งได้รับการตรวจวัดความหนาแน่นของกระดูก กลุ่มประชากรที่ศึกษามีอายุเฉลี่ย 50.50±5.70 ปี ได้รับการวัดความหนาแน่นของกระดูกบริเวณกระดูกสันหลังส่วนเอวและกระดูกคอสะโพกด้านที่ไม่ถนัด โดยใช้เครื่อง Hologic QDR 2000 ชนิด Dual energy X-ray absorptiometer ในการศึกษาครั้งนี้ได้วินิจฉัยโรคกระดูกพรุน ตามคำนิยามขององค์การอนามัยโลก ซึ่งกำหนดไว้ว่า คือ ค่าความหนาแน่นของกระดูกที่ต่ำกว่าค่าเฉลี่ยในสตรีวัยสาวเกินกว่า 2.5 ส่วนเบี่ยงเบนมาตรฐาน โดยได้เปรียบเทียบค่าจุดตัดที่ใช้วินิจฉัยโรคกระดูกพรุน โดยใช้ค่าของคนอเมริกัน และค่าของคนไทย เมื่อใช้ค่าจุดตัดของคนไทย พบว่า มีความชุกของโรคกระดูกพรุนต่ำกว่า การใช้ค่าจุดตัดของคนอเมริกัน (ใช้ค่าจุดตัดของคนไทย พบความชุกของกระดูกสันหลังส่วนเอวและกระดูกคอสะโพก เท่ากับ 15.7% และ 9.5% ตามลำดับ) เมื่อพิจารณาลงไปในกลุ่มย่อยของประชากรที่ศึกษา โดยใช้ค่าจุดตัดของคนไทย พบว่า ความชุกของโรคกระดูกพรุนของกระดูกสันหลังส่วนเอว และกระดูกคอสะโพก ในสตรีที่หมดระดูแล้วสูงกว่า ในสตรีวัยก่อนหมดระดูอย่างมีนัยสำคัญทางสถิติ (วัยก่อนหมดระดู : วัยหมดระดู ; กระดูกสันหลังส่วนเอว : 4.7% และ 21.4% ; กระดูกคอสะโพก 4.7% และ 11.9% ตามลำดับ, $P<0.05$) ตามคำนิยามขององค์การอนามัยโลก ซึ่งกำหนดค่าจุดตัดความหนาแน่นของกระดูกที่ต่ำกว่าค่าเฉลี่ยในสตรีวัยสาวเกิน 2.5 ส่วนเบี่ยงเบนมาตรฐาน มาจากหลักการที่ว่า ค่าจุดตัดนี้จะช่วยให้วินิจฉัยสตรีผิวขาวที่เข้าสู่วัยหมดระดูแล้ว และมีภาวะกระดูกพรุนได้ร้อยละ 30 ซึ่งจะได้ตัวเลขใกล้เคียงกับความเสี่ยงของกระดูกหักจากภาวะกระดูกพรุนในบริเวณกระดูกสันหลัง, กระดูกสะโพกและกระดูกข้อมือ ในสตรีผิวขาวตั้งแต่อายุ 50 ปี จนสิ้นอายุขัย อย่างไรก็ตามถึงแม้ว่า ผลการศึกษาในครั้งนี้ จะไม่สามารถใช้เป็นค่าตัวแทนของคนไทยทั้งประเทศ แต่ก็สามารถเป็นตัวเลขที่แสดงถึงขนาดของปัญหาโดยประมาณ หรือใช้เป็นข้อมูลเบื้องต้นสำหรับทำการศึกษาวิจัยในปัญหาดังกล่าวต่อไป ต่อเมื่อเรามีข้อมูลมากพอที่จะคำนวนหาความเสี่ยงของกระดูกหักจากโรคกระดูกพรุน ในสตรีวัยหมดระดูของไทยได้แล้ว เราจึงจะสามารถหาค่าจุดตัดที่เหมาะสมสำหรับคนไทย เพื่อนำไปใช้ในการวินิจฉัยโรคกระดูกพรุน เพื่อประเมินปัญหาของภาวะดังกล่าวในคนไทยได้อย่างถูกต้องมากยิ่งขึ้น

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