Prevalence of Osteoporosis in Female Health Personnel as Measured by Quantitative Ultrasound

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Purpose: *To determine the prevalence and risk of osteoporosis as measured by quantitative ultrasound (QUS) in female health personnel aged 41-60 years, compared with the general female population.*
Methods: *A cross sectional study of bone mineral density (BMD) measured in females aged 41-60 years using both health personnel and the general population. T score of BMD derived from QUS was recorded and analyzed.*
Results: *The overall prevalence was higher in the general population than in health personnel (18.08% vs. 13.11%). The prevalence showed little difference between age groups of health personnel (15% vs. 12.19%), but a higher prevalence was demonstrated in health personnel, as compared to the general population in the 41-50 years age group (12.19% vs. 0%).*
Conclusion: *The younger age group of female health personnel had a relatively high prevalence of osteoporosis. Effective education and prevention should be implemented for these high risk female health personnel.*

Keywords: *osteoporosis, female health personnel, quantitative ultrasound*

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Osteoporosis is common in women, especially after menopause. Osteoporosis itself may not cause any appreciable symptoms or disability until the occurrence of an osteoporotic fracture. As the elderly population continues to increase, cases of osteoporosis will increase, leading to important changes in those patients' quality of life, and their survival. Additionally, this increase will impose a huge burden on society from an economic standpoint[1, 2]. Osteoporosis can be prevented, and effectively treated with early detection.

The gold standard for diagnosis of osteoporosis, based on World Health Organization (WHO) guidelines, is a bone mineral density (BMD) T score below -2.5 SD measured by dual energy X-ray absorptiometry (DXA)[3]. While this method of BMD measurement has been shown to be reliable and a valid predictor of fracture risk, its limited availability and high expense restrict its application in community or large population screening settings. Measurement of BMD by quantitative ultrasound (QUS) is acceptable: it offers high sensitivity and modest specificity for fracture prediction (without ionizing radiation), relatively low cost, and portability[4,5,6].

Health personnel who work in hospitals have easier access to information and treatment than the general population. However, the perception of the prevalence of osteoporosis in female health personnel surveyed by questionnaire was low[7]. Health personnel could be a model for self caring and prevention of osteoporosis. Female health personnel should be the first to be educated to appreciate their own risk, and the prevalence of osteoporosis. This cross sectional study was designed to identify the prevalence, and the risk of osteoporosis measured by QUS in female health personnel working in Vachira Phuket hospital aged 41-60 years, compared with the general (female) population in the same age range.

The T score measured by QUS starts to decline after 40 years[8], the average age at menopause of Thai women is about 50 years[9], and since Thai civil servants must retire at 60 years, the study was limited to those aged 41-60 years and divided into 10-years increments.

Purpose

To determine the perception of risk of osteoporosis, and the prevalence and risk of osteoporosis as measured by quantitative ultrasound (QUS) in female health personnel aged 41-60 working in Vachira Phuket Hospital, compared with the general female population.

Material and Method

Independent ambulatory female volunteers aged 41-60 years were recruited by advance

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announcement. Two groups, each with a limit of 100 subjects were recruited: health personnel working in Vachira Phuket Hospital, and the general population. Exclusion criteria were: volunteers with malignant disease, infection, fracture under treatment, and ulcers or chronic wounds on both feet. The left heel of participants was used to measure broadband ultrasound QUS T scores (Cuba Clinical device, McCue, Hampshire, England), and those T scores recorded. The process of measurement was performed with the same device, under the same circumstances, by the same technicians on separate days for each group.

Criteria for diagnosis of osteoporosis proposed by WHO[3, 10] were based on a T score of BMD measured by DXA at spine, hip, and forearm. A threshold value of BMD greater than 2.5 SD below the mean for a young adult population was defined as osteoporosis, a T score between -1.0 and -2.5 SD was defined as osteopenia, and a T score at or above -1.0 was defined as normal. In cases of a T score at or below -2.5 SD with the presence of fragility fractures, severe osteoporosis was diagnosed. However, this scale cannot be used interchangeably with different techniques or site measurements, since the same T score derived from different sites and with different techniques yields different information on fracture risk[11].

The diagnosis of osteoporosis in this study used Frost's criteria[8]. Thus a QUS T score cutoff threshold less than or equal to -1.8 SD is comparable to a DXA T score of -2.5 SD as defined by WHO. Subjects with a T score less than or equal to -1.0 SD were categorized as having a risk of osteoporosis, based on National Osteoporosis Foundation (NOF) guidelines[12], with additional DXA examination required.

Each participant's age, body weight, and height were recorded. Body mass index (BMI) was calculated and categorized as per WHO guidelines [13].

The perception of their own possible osteoporosis by health personnel was evaluated by comparing the number of volunteers participating in the study, and the number of participants in the general population. The number of volunteers in each group was recorded and evaluated for perception or awareness of osteoporosis. Prevalence of osteoporosis ($T \leq -1.8$) and risk of osteoporosis ($T \leq -1.0$) in relation to age group and subject group were analyzed and compared. The data were statistically analyzed by two-tailed Fisher exact and risk ratio (RR), with a 95% confidence interval (95%CI).

Results

Table 1 Subjects enrolled in the study, categorized by age group

Age group (years)	Health personnel (persons)	General population (persons)
41-50	41 (67.21%)	31 (32.98%)
51-60	20 (32.79%)	63 (67.02%)
Total (persons)	61	94

Table 2 Body mass index, categorized by age group and sample group

BMI (Bone mass index)	Health personnel (persons)	General population (persons)	Osteoporosis (T score≤ -1.8)
Thin < 18.5	3	4	2
Normal 18.5-24.9	47	62	18
Overweight 25.0-29.9	8	23	4
Obese ≥ 30.0	3	5	1
Total (persons)	61	94	25

There were 155 volunteers in this study, 61 health personnel (mostly nurses) and 94 from the general population (Table 1). Of the 61 health personnel, 41 were aged 41-50 years, and 20 were 51-60 years. The average age was 48.16 ± 4.52 years. The average BMI was 22.73 ± 3.14 kg/m² (Table 2). In the general population group, 31 were aged 41-50 years, whereas 63 were 51-60 years. The average age was 52.80 ± 4.11 years and the average BMI was 23.47 ± 3.44 kg/m².

Table 3 Prevalence of osteoporosis, using T score cutoff -1.8

Age group (years)		T score		Total (persons)
		≤ -1.8	> -1.8	
Health personnel	41-50	5	36	41
	51-60	3	17	20
General population	41-50	0	31	31
	51-60	17	46	63
Total (persons)		25	130	155

Table 4 Risk of osteoporosis, using T score cutoff -1.0

Age group (years)		T score ≤ -1.0	T score > -1.0	Total (persons)
Health personnel	41-50	20	21	41
	51-60	9	11	20
General population	41-50	9	22	31
	51-60	43	20	63
Total (persons)		81	74	155

Given the cutoff T score at -1.8, subjects with a T score at or less than -1.8 were diagnosed as having osteoporosis. The prevalence of osteoporosis in subjects aged 51-60 years was 24.10% (20 of 83) and 6.94% (5 of 72) in subjects aged 41-50 years (Table 3). The prevalence in subjects aged 51-60 years was 3.47 times higher than in subjects aged 41-50 years. (p 0.006046, RR 3.47 (95% CI 1.372, 8.774)). The prevalence was 13.11% (8 of 61) in health personnel and 18.08% (17 of 94) in the general population. Prevalence was 1.38 times higher in the general population than in health personnel (p 0.5551, RR 1.379 (95% CI 0.6346, 2.996)).

Among the health personnel, the prevalence was a little higher in age group 51-60 years, compared to age group 41-50 years (15% vs. 12.19%, p > 0.9999, RR 1.23 (95% CI 0.3261, 4.64)). In the general population, the prevalence was 26.98% in age group 51-60 years, whereas there was no osteoporosis in age group 41-50 years (p 0.00096).

Considering the risk of osteoporosis (T ≤ -1.0) (Table 4), participants aged 51-60 years (62.65%, 52 of 83) had a risk 1.5 times higher than those aged 41-50 years (40.28%, 29 of 72) (p 0.0086, RR 1.55 (95%CI 1,122, 2.156)). Health personnel had nearly 50% overall risk for both age groups (p 0.9977, RR 1.084, (95% CI 0.6087, 1.931)). The risk for both age groups showed little difference (48.78% vs. 45%). The overall risk in the general population was 55.32%. There was a 2.35 times higher risk of osteoporosis in the general population aged 51-60 years, compared to those in the age group 41-50 years (p 0.00068, RR 2.351, (95% CI 1.322, 4.18)). The risk of osteoporosis in the older age general population group (51-60 years) was 2.73 times higher than in the age group 41-50 years (68% vs. 29%) (p 0.0086, RR 1.555, (95% CI 1.122, 2.156)).

The prevalence and risk of osteoporosis categorized by profession (aged matched) was considered. For the two 51-60 years groups, the general population had a 1.79 times higher prevalence, compared to the health personnel (p 0.4359, RR 1.799, (95% CI 0.5873, 5.511) and 1.5 times higher risk (p 0.1104, RR 1.517, (95% CI 0.9082, 2.533)). For the 41-50 years groups, the prevalence in health personnel was 12.19% (5 of 41), whereas no cases of osteoporosis were found in the general population group (p 0.1071). There was a 1.68 times higher risk in health personnel compared to the general population (p 0.146, RR 1.68, (95% CI 0.8918, 3.166)).

BMI and prevalence of osteoporosis

The health personnel and the general population groups demonstrated very similar proportions of thin subjects (BMI < 18.5) (4.92% vs. 4.26%), while the general population had a 1.6 times higher proportion of overweight individuals (29.79% vs. 18.03%). The prevalence of osteoporosis in thin subjects was 2.17 times higher than in non thin subjects (28.57% vs. 15.54%, p 0.6295, RR 1.839 (95% CI 0.5374, 6.29)).

Discussion

The perception of osteoporosis risk in health personnel as evaluated by questionnaire was low in a previous study [7]. In this study, the number of enrolled volunteers was interpreted as the intention to do self surveillance for osteoporotic risk. There was a 1.5 times proportion of participants, general population to health personnel (94:61). The smaller population of health personnel in hospital, when compared to the larger numbers of the general population, may be the explanation for this relatively low participation by health personnel. General population aged 51-60 years was the highest group enrolled the BMD measurement (63 of 155) while health personnel aged 51-60 years was the lowest group (20 of 155) especially subgroup 56-60 years (3 of 155). The proportion of the general population in older age (51-60 years) participating was two times than the younger age (41-50 years) (63: 31). This ratio was reversed in health personnel participants. The number of younger aged individuals was twice that of the older age group (41: 20). The enrolled health personnel in the older age group were expected to be higher than in the younger age group. The older age health personnel appeared less interested in receiving this osteoporotic surveillance, or perhaps they had previous examination(s). This hypothesis may not be valid, since the lower perception of osteoporosis risk in health personnel, may be due to the advance recruitment of volunteers, thus raising the suspicion that the easier access to resources for health personnel would only be beneficial if this opportunity were seized.

Age is accepted as an important risk factor for osteoporotic fracture, as BMD decreases

exponentially with increasing age[11]. Prevalence increases with age in the general population (0% vs. 26.98%), as would be expected. However, the prevalence showed little difference in the two age groups of health personnel (12.19% vs. 15%). This trend was the same for risk of osteoporosis (T≤ -1.0) in health personnel (48.78% vs. 45%). This finding requires further investigation to determine which factors have more influence than increasing age on BMD in health personnel.

The overall prevalence and risk of osteoporosis in the general population was higher than in health personnel. The result was reversed when participants aged 41-50 years were considered: there was a higher prevalence and risk of osteoporosis in health personnel than in the general population, even without statistical significance. There was not a single case of osteoporosis in the general population group (0 of 31), whereas 5 out of 41 health personnel were diagnosed with osteoporosis (12.19%). This indicated that there may be other contributing factor(s) to a higher osteoporotic risk in health personnel aged 41-50 years.

The prevalence of osteoporosis in thin subjects was 28.57% (2 of 7) compared with 15.54% (23 of 148) in non thin subjects, but with no statistical significance. BMI is a good predictor for osteoporotic fracture risk [14], but body weight instead of BMI is cited as the predictor of BMD[15].

Benefits and limitations of this study

The process of QUS measurement was controlled to reduce the error. All subjects were measured using the left heel, with the same device, and by the same technicians under the same conditions.

Besides the measurement of perception for osteoporosis by questionnaire (past history of any BMD measurement)[7], the perception can be evaluated by other means. Since the date of measurement was scheduled prior to the announcement of the study, that the volunteers enrolled for the test was interpreted as their having real intention and/or awareness of screening their own risk.

The study included all female health personnel working in hospital, and the subjects were not subdivided by profession. Therefore the risk for individual professions could not be identified. The implementation of this study result should be carefully adjusted if applied to any population of female health personnel. Most of the participants in this study were nurses, working in a hospital. Further study to identify the specific risk among nurses is needed to clarify the picture, with the results guiding the application of the data.

This was a comparative, volunteer-based study. Hence the imbalance of sample size was unavoidable.

Different QUS cutoff thresholds give different false positive and false negative results in predicting osteoporosis[16, 17]. Moreover, each QUS device is programmed with its own specific normal range[16]. Normative values for each area population also differ[18]. To improve the accuracy and reliability of further study, it would be preferable to have T scores derived from a device that was based on Thai reference data. If normal reference data can be collected from each area community, the diagnosis of osteoporosis (using WHO criteria) would be reasonable[19].

The lack of a definitive diagnosis of osteoporosis by DXA measurement, raises the suspicion of accuracy of QUS measurement. If the prevalence of osteoporosis in Thai women (based on the measurement of DXA in this study) is compared to the prevalence in Caucasian women (study by Limpaphayom et al)[20], we found the following: the ratio of prevalence of osteoporosis (age adjusted) measured by DXA and by QUS did not differ greatly. It ranged from 1.18 to 1.92 within matching age groups. However, the diagnosis of osteoporosis made by QUS in this study was not definitive; it was used as a surveillance tool, thus requiring further measurement by DXA to make a more precise diagnosis.

Finally, the prediction of osteoporotic fracture is not solely based on the diagnosis of osteoporosis or BMD measurement, but requires the assessment of all clinical risk factors. This will assure much greater accuracy[11].

Conclusions

While the risk of osteoporosis measured by QUS for female health personnel aged 41-60 years was nearly 50%, the perception of the risk of osteoporosis was relatively low, especially in the older age group. We did not expect to discover that the younger age health personnel (41-50 years) displayed a tendency to a higher risk and prevalence of osteoporosis, when compared to the general population (same age group). This requires further study to confirm that conclusion, and to search for any contributing factors affecting a high risk in this specific professional group. Effective prevention and education should be implemented for this high risk group of female health personnel.

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ความชุกของกระดูกพรุนในบุคลากรการแพทย์เพศหญิงช่วงอายุ 41-60 ปี

ยงยส จีระธัญญาสกุล, พบ.

วัตถุประสงค์ : *เพื่อศึกษาความชุกและความเสี่ยงต่อการเกิดกระดูกพรุนจากการวัดด้วยเครื่อง Quantitative ultrasound (QUS) ในบุคลากรการแพทย์เพศหญิงช่วงอายุ 41-60 ปี*

วัสดุและวิธีการ : *เป็นการศึกษาแบบตัดขวาง โดยวัดความหนาแน่นของมวลกระดูกด้วยเครื่อง QUS ในบุคลากรเพศหญิงช่วงอายุ 41-60 ปี เปรียบเทียบกับประชากรทั่วไปในช่วงอายุเดียวกัน บันทึกค่า T score เพื่อทำการศึกษาเปรียบเทียบความชุกและความเสี่ยงต่อการเกิดกระดูกพรุน*

ผลการศึกษา : *ความชุกของกระดูกพรุนในบุคลากรการแพทย์แต่ละช่วงอายุมีค่าต่างกันไม่มาก แต่ไม่พบกระดูกพรุนในประชากรทั่วไปอายุ 41-50 ปี*

สรุป : *บุคลากรการแพทย์หญิงช่วงอายุ 41-50 ปี มีแนวโน้มที่จะมีความเสี่ยงและความชุกของกระดูกพรุนสูงกว่าประชากรทั่วไปในช่วงอายุเดียวกัน ควรมีมาตรการป้องกันและส่งเสริมการเรียนรู้ภาวะกระดูกพรุนสำหรับกลุ่มเสี่ยง*