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The Structure and Prevalence of Major Risk Factors of Osteoporosis in Uzbek Women over 50

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Abstract

Background: Osteoporosis is a systemic metabolic disease of skeleton, characterized by decrease of bone mass and impaired microarchitecture of bone tissue, leading to increased fragility and fractures. Methods: We screened 1855 postmenopausal female, aged from 50 to 80, the residents of Tashkent, Namangan and Qarshi, three cities with the largest populations in Uzbekistan. The duration of postmenopausal period was ≥1 year. Results: The study revealed unequal prevalence of OP with the least in Qarshi (27.3%) compared to Tashkent (33.5%) and Namangan (51.1%). Conclusions: Osteoporosis is common among women at age 50 and over, who live in the cities with largest population in Uzbekistan (Tashkent, Namangan and Qarshi). The risk factors in the studied cohort of women included decrease of body mass, irregular consumption of dairy products and irregular physical activity, history of fractures, and duration of menopause.

Keywords

Menopause, Risk Factors, Osteopenia, Osteoporosis

1. Introduction

Osteoporosis (OP) is the most common disorder of bone metabolism, characterized by decreased bone strength, which leads to increased fracture risk [1]-[4]. The disease affects all age groups and is diagnosed both in women and men. By the prevalence and severity of the manifestations, osteoporosis takes to one of the first places among chronic noncommunicable diseases and becomes an important indicator of public health, as well as in Uzbekistan.

At the present time, there is large number of described fracture risk factors. Thus, the latest edition of the guidelines of US National Osteoporosis Foundation provides 79

conditions, diseases and medications that are associated with increased risk of osteoporosis and fractures, as well as 25 risk factors for falls, and they differ from each other by quality, by strength of evidence, degree of risk and their dependence or independence from bone mineral density (BMD) [5].

Based on data from the National Health and Nutrition Examination Survey III (NHANES III), National Osteoporosis Foundation has estimated that more than 9.9 million Americans have osteoporosis and an additional 43.1 million have low bone density [6] [7]. About one out of every two Caucasian women will experience an osteoporosis-related fracture at some point in her lifetime, as will approximately one in five men [8].

In the majority of postmenopausal women osteoporosis develops insidiously and without symptoms, and appearance of first symptoms indicates on significant loss of bone mass, where the first sign of the disease is usually a fracture. Prevalence of postmenopausal osteoporosis (PMO) is not same in different regions even within same country. Despite the fact that there are standards for detection and early diagnosis of PMO, its prevalence depends on many factors, such as geographic location, climatic conditions, social factors, age, race, etc.

Uzbekistan is the most populous country in Central Asia and due to the fact that its natural and geographical conditions differ from region to region, it becomes challenging to find exact prevalence of PMO.

According to the U.S. Census Bureau International Database (http://www.census.gov/population/international/data), in 2014 the population of Uzbekistan was 29 million people, 17% (4.2 mln) and 3.4% (971,000) of people being ≥50 and ≥70 years of age, respectively. By 2050 in the face of a general population rise to 35 million people, 40% (14 mln) and 12% (4.2 mln) are expected to be ≥50 and ≥70 years of age, respectively. There were no specially designed epidemiological studies concerning osteoporosis and osteoporotic fractures conducted in Uzbekistan. However, according to the Research Institute of Traumatology and Orthopedics, there are at least 30,000 people with osteoporosis and 150,000 with osteopenia in Uzbekistan. The number of patients with osteoporosis and osteopenia is predicted to increase up to 250,000 men by 2020 [9].

The work was initiated to study prevalence and various risk factors of postmenopausal osteoporosis among female residents of Tashkent, Namangan and Qarshi.

2. Patients & Methods

We screened 1855 postmenopausal female residents of Tashkent, Namangan and Qarshi, three cities with the largest populations in Uzbekistan, aged from 50 to 80. The duration of the postmenopausal period was ≥1 year. The groups were comparable by parameters.

2.1. Inclusion Criteria

Duration of osteoporosis and menopause was ≥1 year.

2.2. Exclusion Criteria

Diseases affect bone metabolism, such as hyperparathyroidism, thyrotoxicosis, Cushing's syndrome and disease, hypogonadism in medical history, rheumatic disorders, malabsorption syndrome, renal insufficiency, hepatic dysfunction, and malignancies, as well as prior treatment with medications affecting calcium metabolism 12 months.

2.3. Patients Characteristic

The study was conducted in accordance with the ethical principles stated in Declaration of Helsinki of 1964 (revised in Seoul in 2008). The trail is registered on http://www.who.int/bulletin/archives/79(4)373; http://www.wma.net/en/30publications/10policies/b3/. The study was approved by the Center for the Scientific and Clinical Study of Endocrinology Ethics Committee. Written informed consent was obtained from all participants. A special questionnaire chart was developed in the Center and was filled out for each woman. The chart included demographic and anthropometric data (age, height, weight), gynecological and hormonal history (age of menarche, age of menopause, the number of children, reproductive history), private and familial history of fractures, and the present way of life (physical activity, smoking, drinking, and everyday use of dairy products).

Bone mineral density (BMD) was measured by ultrasound osteodensitometry (Omnisense 8000, Sunlight, Israel). According to clinical guidelines, diagnosis of osteoporosis or osteopenia was based on the values of a T-score, the number of standard deviations (SD) from age norm. Thus, osteoporosis was diagnosed with T-score of ≤−2.5 SD, the parameter's range from −1.0 SD to −2.5 SD determined osteopenia, and the value > −1.0 SD was taken as normal. Every patient filled in a card-questionnaire developed at the Center for the Scientific and Clinical Study of Endocrinology, Uzbekistan Public Health Ministry.

2.4. Statistical Analysis

Results were statistically processed using Excel 2010 and the software package STATISTICA 6.0 (Stat Soft, 2001). Logistic regression was used to calculate OR and 95% CI. Quantitative parameters are presented as M ± (SD), as well as Median (Me) and 25th and 75th percentiles as Inter Quartile Range (IQR). We used the Chi-square test to compare observed data. P values of <0.05 were considered statistically significant.

3. Results

An epidemiological study of1855 postmenopausal women aged ≥50 years (mean age 57.8 (±5.9) years, Me 57.0; IQR 53.0 to 61.0) was carried out within the period from 05.01.2010 to 05.01.2015. The study included women with PMO who lived in Tashkent (n = 963), Namangan (n = 415) and Qarshi (n = 477). Among the examinees, 559 (30.1%) women had normal BMD (nBMD), while osteopenia and osteoporosis were diagnosed in 632 (34.4%) and 664 (35.8%) examinees, respectively (Table 1).

Significantly higher number of women with nBMD belonged to age group 50 - 59

(82.8%; $P < 0.0001$). Aging correlated with progressive decline in the number of women with nBMD: 60 - 69 years-15.6%, 70 - 76 years-1.6%. The number of women at age of 50 - 59 was significantly lower in the group of OP (55.9%) compared to group with nBMD (82.8% OR 0.26; 95% CI 0.20 - 0.34; $P < 0.0001$) and group of osteopenia (66.9% OR 0.63; 95% CI 0.50 - 0.78; $P < 0.0001$). Analysis of dependence of BMD on age revealed the following: the average age of all studied women was 57.8 (±5.9) years, with the age of the residents of Tashkent being slightly higher (59.0 ± 6.4) years) than age of women in Namangan (55.5 ± 5.8) years) and Qarshi (58.2 ± 4.1) years) (Table 2).

Likewise, consistent with this trend, were the results of more comprehensive analysis of the dependence of varying degree of BMD disturbance on age. However, despite the fact that the prevalence of OP was higher in Namangan, the women were 2 - 4 years on average younger than women in Tashkent and Qarshi.

The prevalence of OP depending on the region of residence was studied as the next stage of research. Distribution of women by regions of their residence revealed that significantly less women had normal BMD in Namangan (18.1%) than in Tashkent (30.7%; OR 0.50; 95% CI 0.37 - 0.66; $P < 0.0001$) and Qarshi (39.4%; OR 0.34; 95% 0.25 - 0.46; $P < 0.0001$). In Qarshi, OP is registered less frequently (27.3%) than in Tashkent

Table 1. Characteristics of women in Tashkent, Namangan and Qarshi.

Variable	Tashkent, n = 963		Namangan, n = 415		Qarshi, n = 477		Total, n = 1855	
	n	%	n	%	n	%	n	%
nBMD	296	30.7	75	18.1	188	39.4	559	30.1
Osteopenia	345	35.8	128	30.8	159	33.3	632	34.1
Osteoporosis	322	33.5	212	51.1	130	27.3	664	35.8
			Age					
50 - 59 year	555	57.6	327	78.8	375	78.6	1257	67.8
60 - 69 year	330	34.3	68	16.4	82	17.2	480	25.8
≥70 year	78	8.1	20	4.8	20	4.2	118	6.4
Weight < 57 kg	74	7.7	70	16.8	49	10.3	193	10.4
BMI < 20.0 kg/m^2	15	1.6	11	2.7	26	5.5	52	2.8
Daily consumption of dairy products	208	21.6	90	21.7	235	49.3	533	28.7
Regular physical activity (not less than 30 min per day)	631	65.5	150	36.1	273	57.2	1054	56.8
Cigarette smoking	26	2.7	-	-	-	-	26	1.4
Consumption coffee	52	5.4	41	9.9	-	-	93	5.0
Previous fracture	16	1.7	25	6.0	10	2.1	51	2.7

Note: nBMD—normal bone mineral density.

Table 2. Demographic characteristics of women in Tashkent, Namangan and Qarshi.

Variable	Tashkent, n = 963	Namangan, n = 415	Qarshi, n = 477	Total, n = 1855
Age (year)	59.0 (±6.4)	55.5 (±5.8)	58.2 (±4.9)	58.0 (±6.1)
Me: *IQR*	58.0	54.0	57.0	57.0
	54.0: 63.0	50.0: 59.0	55.0: 59.0	53.0: 61.0
Weight (kg)	75.3 (±13.8)	70.0 (±13.7)	68.0 (±11.3)	72.2 (±13.6)
	74.0	69.0	65.0	70.0
Me: *IQR*	65.4: 84.8	60.0: 78.0	60.0: 75.0	63.0: 80.0
BMI(kg/m^2)	29.7 (±5.3)	28.9 (±5.5)	26.6 (±4.9)	28.7 (±5.4)
Me: *IQR*	29.3	28.3	25.8	28.1
	26.1: 32.9	25.3: 32.3	23.4: 29.1	25.0: 31.9
T-score	−1.86 (±1.5)	−2.34 (±1.5)	−1.52 (±1.9)	−1.83 (±1.7)
Me: *IQR*	−1.89	−2.60	−1.30	−1.89
	−2.91: −0.78	−3.60: −1.20	−2.72: −0.10	−3.0: −0.6
Duration menopause (year)	10.8 (±8.2)	9.5 (±7.2)	9.6 (±6.8)	10.0 (±7.5)
Me: *IQR*	10.0	8.0	7.0;	9.0
	4.0: 16.0	4.0: 14.0	4.0: 12.0	4.0: 14.0

Note: Data presented as mean (±SD); Me—Median; IQR—Inter Quartile Range. -25th and.

(33.4%; OR 0.75; 95% CI 0.59 - 0.95; $P < 0.0001$) and Namangan (51.1%; OR 0.36; 95% CI 0.27 - 0.47; $P < 0.0001$).With age, there is logical growth of women with OP in all regions.

It is known that one of the factors contributing to the development of the OP is a low body weight (less than 57 kg). We have studied the dependence of OP development on critical body weight (<57 kg) and BMI (<20.0 kg/m^2). The number of women with body weight less than 57 kg was higher in the group of OP (14.2%) than in the group of nBMD (11.1%; OR 1.32; 95% CI 0.94 - 1.86; $P = 0.13$), and in the group of osteopenia (5.9%; OR 2.65; 95% CI 1.78 - 3.95; $P < 0.0001$). The share of women with BMI < 20.0 kg/m^2 in the groups with nBMD, osteopenia and OP were comparable and had no significant difference (2.7%, 3.3% and 2.4% correspondingly). A comparative analysis of values by regions of residence has revealed that larger number of women with critical weight resided in Namangan (16.8%) compared to Tashkent (7.7% OR 2.44; 95% CI 1.72 - 3.46; $P = 0.005$) and Qarshi (10.3% OR 1.77; 95% CI 1.20 - 2.62; $P = 0.005$). Among Qarshi residents the BMI < 20.0 kg/m^2 (5.5%) was more frequent than in Tashkent (1.6% OR 3.64; 95% CI 1.91 - 6.95; $P < 0.0001$) and Namangan (2.7% OR 2.12; 95% CI 1.03 - 4.34; $P = 0.05$).

Daily intake of dairy products was another aspect to consider. According to the results of our studies a little over a quarter of the surveyed (28.7%) had constantly in-

cluded in their diet dairy products. It was found that the share of women who consume dairy products on a daily basis was much lower in the group of OP (25.5%) than in the group with nBMD (31.8% OR 0.73; 95% CI 0.57 - 0.94; $P = 0.02$) and with osteopenia (29.4% OR 0.82; 95% CI 0.64 - 1.05; $P = 0.12$). Considering consumption of dairy products in the regional aspect, it should be noted that dairy products were significantly more often consumed in Qarshi (49.3%) than in Tashkent (21.6%; OR 3.52; 95% CI 2.78 - 4.46; $P = 0.0000$) and Namangan (21.7%; OR 3.51; 95% CI 2.61 - 4.71, $P = 0.0000$). Perhaps this explains the lower rate of OP in Qarshi.

An important factor that has an effect on the development of OP is physical inactivity. We have found that the share of physically active women among examinees in the group with OP was much rarer than in the group with normal values of BMD (53.8% vs 60.8%; OR 0.75; 95% CI 0.60 - 0.94; $P = 0.02$). If we consider this factor in the regional aspect, the number of physically active women, among those with OP, in Namangan was significantly lower (26.4%) than in Tashkent (62.4%; OR 0.22; 95% CI 0.15 - 0.32; $P = 0.0000$) and Qarshi (54.6%; OR 0.30; 95% CI 0.19 - 0.47; $P < 0.0001$). In addition, in Namangan, the proportion of physically active women in the OP group is significantly lower compared to the groups with nBMD (49.3%; 95% CI 0.21 - 0.64; $P < 0.0001$) and osteopenia (44.5%; 95% CI: 0.28 - 0.71; $P < 0.0001$)—the difference, which is not observed in other regions.

The share of non-smoking women, among those surveyed, in Namangan and Qarshi comprised 100%, the value which was not high in Tashkent either (2.7%). According to the survey, none of the surveyed Qarshi residents consumed coffee. No significant difference in the occurrence of this factor was seen in Tashkent and Namangan.

In the general cohort of examined women the proportion of those who had previous fractures comprised 2.7%. Low-energy fractures were significantly more often in the history of women with OP (2.9%), compared to women with nBMD 2.5%; OR 1.15; 95% CI 0.57 - 2.31; $P = 0.84$). A separate analysis was carried out regarding previous fractures, as one of the most significant predictors of subsequent fractures, depending on the regions of residence. It was found that women living in Namangan had significantly more frequent fractures in history (6.0%) than women in Tashkent (1.7%; OR 3.79; 95% CI 2.0 - 7.18; $P = 0.0000$) and Qarshi (2.1%; OR 2.99; 95% CI 1.42 - 6.31, $P = 0.005$).

We studied the prevalence of OP dependence on the duration of menopause. Osteoporosis occurs in a far greater proportion of women with menopause that lasts up to 5 years, living in Namangan (31.1%) compared with those of Tashkent (15.3%; OR 2.50; 95% CI 1.49 - 4.19; $P = 0.0007$) and Qarshi (15.8%; OR 2.41; 95% CI 1.33 - 4.36; $P = 0.005$).

There was significantly greater number of women with menopausal duration exceeding 15 years in Tashkent (25.1%) compared with Namangan (18.1% of OR, 1.52; 95% CI 1.14 - 2.03, $P = 0.005$) and Qarshi (13.8% OR 2.09; 95% CI 1.55 - 2.82; $P < 0.00001$). Increase of duration of menopause was associated with progressive decrease of BMD in all regions.

4. Discussion

As is known, female sex and age are the main non-modifiable risk factors of OP in terms of low BMD and fractures. The prevalence of osteoporosis in the female population depends primarily on the age of patients, and may also vary depending on the region of residence. We studied the prevalence of OP risk factors in postmenopausal women, considered in the aspect of their place of residence.

It was found that the average age of women in the study had no statistically significant difference. Nevertheless, despite the fact that the prevalence of OP is higher among women in Namangan, on average, they were 2 - 4 years younger than women of Tashkent and Qarshi. The number of women with OP predictably grows with advanced age, in all studied regions

The reduction of BMD begins at age 45 - 50 years; however, a significant increase in the risk of OP is associated with age 65 and over. Therefore, the age over 65 should be considered a predictor of bone fracture [10].

A recent study on the epidemiology of osteoporosis in the United States found a prevalence of 15.4% among women older than 50 years and a prevalence of 34.9% among women older than 80 years [8]. The prevalence of osteoporosis in Brazil amounted to 8% in women aged 45 - 54 years, 19.2% in women aged 55 - 64 years, and 32.7% in women >65 years of age [11] [12]. The epidemiological studies conducted in Russia demonstrated that osteoporosis affects more than 10 million people in Russia– 30.5% - 33.1% of women and 22.8% - 24.1% of men at age 50 and older, which is consistent with the criteria of the WHO [13]. In the study, conducted in Russia, within the scope of European Study of Vertebral Osteoporosis (EVOS) and European Prospective Osteoporosis Study (EPOS) the frequency of osteoporosis and osteopenia in women, measured in lumbar spine and femoral neck, comprised 34% and 43% correspondingly (by WHO criteria). Analysis of the prevalence of osteoporosis in different age groups demonstrated a distinct trend to its growth in the older age groups of women. During the 5-year prospective follow-up of the sample, the frequency of osteoporosis increased among women up to 40%, which was mainly due to "aging of" sample.The loss of bone mineral density during follow-up, accounted for about 1% per year in both areas of measurement. The most significant losses of bone mineral density of the lumbar spine (3.7%) was observed in the age group 55 - 59 years, of femoral neck (2%) in the group of women, older than 75 years [14].

Weight loss or low body mass index (BMI) are indicators of low bone mineral density (BMI is considered low if <20 kg/m^2, or a body weight less than 57 kg). It also matters if weight loss by more than 10% occurs at age over 25 [10]. According to De Laet, S. *et al.* [15] the negative role of low BMI in fracture risk becomes more obvious if compare it with the associations between osteoporosis and above average BMI. For example, compared with a BMI of 25 kg/m^2, a BMI of 20 kg/m^2 was associated with a nearly two-fold increase in risk ratio (RR = 1.95; 95% CI 1.71 - 2.22) for hip fracture. In contrast, a BMI of 30 kg/m^2, when compared with a BMI of 25 kg/m^2, was associated with only a 17% reduction in hip fracture risk (RR = 0.83; 95% CI 0.69 - 0.99). Authors con-

clude that low BMI confers a risk of substantial importance for all fractures that are largely independent of age and sex, but dependent on BMD. The significance of BMI as a risk factor varies according to the level of BMI. Its validation on international basis permits the use of this risk factor in case-finding strategies.

In our study the numbers of women with body weight less than 57 kg and BMI <20.0 kg/m^2 in the groups with nBMD, osteopenia and OP were comparable and had no significant difference. With regard to regional peculiarities, women with a critical body weight and BMI < 20.0 kg/m^2 are more common among residents of Qarshi.

Physical activity can improve and maintain optimal physiological state of the musculoskeletal system throughout life and slow down the process of age related degradation, observed in people leading sedentary lifestyle [16] [17]. Physically active elderly maintain muscle strength and flexibility, which enables them to cope better with daily household chores. Moreover, regular physical activity reduces the risk of falls and hip fractures in elderly [18]-[20]. Sedentary life-style and immobilization result in rapid bone mass loss associated with accelerated bone resorption and slow bone formation [21]. According to our data, less than half of women in the group with OP lead an active life, with significantly smaller proportion of physically active women in Namangan.

A history of fractures that occur due to minimal injuries-is the most significant risk predictor for subsequent fractures and major clinical diagnostic criteria of OP. Along with this, the primary and main endpoint of any antiosteoporosis therapy is to prevent occurrence of new fractures. In the research, carried out by Saneeva GA *et al.* [22], 45.3% of the patients had a history of low energy fractures of various localizations. In 8.1% of cases fractures occurred repeatedly or had multiple localizations. Atypical for OP fractures of the lower leg or ribs that occurred with minimal impact were registered as "of other localization". The frequency of previous fractures in our cohort of women was low. Concerning regional aspects fractures were more frequent in the history of women, living in Namangan, a history of fractures occur much more frequently than in other regions.

Risk factors for osteoporotic fracture should not be considered to be independent of one another; they are additive and must be considered in the context of baseline age and sex-related risk of fracture. For example, a 55 year old with low BMD is at significantly less risk than a 75 year old with the same low BMD. A person with low BMD and a prior fragility fracture is at considerably more risk than another person with the same low BMD and no fracture [10].

Menopause, as it is and its duration are the most significant risk factor of OP. The onset of menopause is associated with bone mass loss approximating to 2% - 3% a year up till the age of 65 - 70, after which the rate subsequently reduces and equals to 0.3% - 0.5% a year [23].

5. Conclusion

According to acquired results, osteoporosis is quite common among Uzbek women older than 50 years of age (35.8%). Estimation of the prevalence of the disorders of

bone mineral density, depending on the region of residence showed that osteoporosis is significantly more often registered with the residents of Namangan, compared with other regions. Moreover, women affected by osteoporosis in this region are 2 - 4 years younger than their counterparts in Tashkent and Qarshi. Low weight and irregular physical activity, fracture history and duration of menopause are risk factors in the studied groups of women.

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All the authors contributed equally to the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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