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RISK FACTORS FOR OSTEOPOROSIS AS MAIN PREDICTOR OF FRACTURE PROGNOSIS

ABSTRACT

In order to determine the most significant risk factors for osteoporosis (OP) in individuals living in the Arctic region, bone mineral density (BMD) was studied using the GE Lunar Achilles ultrasound densitometer and a questionnaire was conducted for men and women of different age groups.

The study revealed a decrease in BMD (below the expected age norm) in the age group up to 50 years, and at the age of 50 and older - osteoporosis and osteopenia in more than half of the subjects. Low-energy fractures were more frequent at the age of 50 years and older, that indicates severe forms of osteoporosis in these individuals. The use of dairy products was a significant risk factor for OP, as patients with fractures used dairy products less frequently than people without fractures (p <0.05). Thus, it was found that inadequate consumption of dairy products, age, early menopause, history of a fracture are the main risk factors for OP, significantly affecting the density of bone tissue and the frequency of low-energy fractures.

Keywords: risk factors, osteoporosis, fractures, mineral density of bone tissue.

INTRODUCTION

Osteoporosis is a multifactor disease accompanied by reduction in bone mineral density and strength, which together increases the risk of fractures [4]. In recent years, interest in the problem of osteoporosis is steadily increasing due to both the ever-growing incidence of this disease, and the high cost of treatment (OP) of osteoporosis and its complications such as bone fractures. According to the Russian epidemiological studies, in the age group over 50 years more than 10 million people are diagnosed with osteoporosis: in 30-33% of women and 22-24% of men [1]. Diagnosis of osteoporosis, especially early, is difficult due to the lack of specific clinical signs of the disease. Fractures occurring against the background of osteoporosis are late clinical manifestations of the disease. X-ray signs of osteoporosis in the form of vertebral deformations also indicate a significant loss of bone mineral density (BMD). Along with this, in the light of modern data X-ray absorptiometry (DXA) cannot be considered the only basic diagnostic method, and the BMD indicator, determined with its help is considered to be only one of the risk factors for fractures.

In this regard, knowledge and consideration of risk factors becomes particularly important for the prevention and diagnosis of the disease. We need targeted identification of patients with risk factors for osteoporosis and fractures for organization of prevention or formation of risk groups for further examination for the diagnosis or ruling out of osteoporosis [5].

Prior fractures and age are predictors of fractures, regardless of bone mineral density [2]. History of prior fracture occurring with minimum trauma is the most significant OP and osteoporotic fractures risk factor, having even greater importance than BMD [2]. Low-trauma fractures are fractures that occurred spontaneously or when falling from one's own height or below, and also in a situation where the patient's roentgenogram has a compression fracture of the vertebra, regardless of whether the symptoms of compression are detected or not. In people with a fracture in any location, risk of subsequent fracture is 2.2 times higher than in those without prior fracture [6]. For the prediction, the number and location of the fractures are important. Thus, previous vertebral fractures increase the risk of subsequent fractures by more than 4 times, and also become predictors of fractures in other locations, including the femoral neck. Along with that forearm fractures can be preceded by vertebral and hip fractures, and previous hip fractures increase the risk of subsequent fractures in this location [6].

BMD decrease begins from 45-50 yrs, but significant increase in risk of OP is associated with the age of 65 years and older [6]. Therefore, ages of 65 years and older should be considered a predictor of bone fracture [1, 8]. It should be noted that even such a factor as low BMD correlates with this age group. For example, with a 75-year-old male with low BMD risk of OP was significantly higher than with a 55-year-old male with the same BMD [8]. Low BMD is one of the most important risk factors of OP [3].

Women have a higher risk of developing OP. This is due to specifics of hormonal state, as well as with smaller bone sizes and smaller total bone mass [1, 6]. In addition, women lose bone mass faster and in greater numbers due to menopause, another thing is greater life expectancy [1]. For example, bone loss in women is 0,86-1,21% per year in different parts of the skeleton, while in males it is only 0,04-0,90% [6]. In this case, female sex can be attributed to risk factors for both OP and bone fractures (proximal femur and distal forearm) due to "worse" geometry of the corresponding sections of the skeleton in women. For example, in men, the neck of the hip is shorter, and the CCD angle is greater. However, OP is a significant problem for both sexes [1].

It is advisable to actively identify risk factors for osteoporosis and fractures due to their cumulative effect with increasing number and combination in one patient. The use of a set of validated factors associated with an increase in the probability of fractures allows the physician to form risk groups and take diagnostic and prophylactic measures, with possible correction of the modifiable conditions, as well as to estimate the threshold levels of drug intervention based on clinical judgment even when X-ray densitometry is not available.

Objective: to identify the most important risk factors for osteoporosis, taking into account gender differences and past medical history of fractures, in people living in the Arctic region.

MATERIALS AND METHODS

We conducted a survey to identify possible risk factors for disorders of bone remodeling in patients living in the RS (Ya). The research involved 430 people, including 319 women and 111 men aged 16 to 83 years. The ratio of men to women was 1:2.8. The patients were

divided into two groups; Group I – ages 50 and younger, Group II – ages 50 and older.

All survey members completed a questionnaire of the "National Program for Identification of the Main Risk Factors of OP and Bone Fractures in the Russian Population", which takes into account age, preceding low-energy fractures, heredity (low-energy fractures in first-degree relatives), systemic administration of glucocorticoids (5mg or more of prednisolone for more than 3 months), hypogonadism in men and women (the latter experiencing early menopause before the age of 45), smoking, insufficient intake of calcium, excessive alcohol consumption (more than 36 ml in terms of pure ethanol), the presence of secondary causes for OP development (rheumatoid arthritis, type 1 diabetes, hyperthyroidism, chronic liver disease). Study of bone mineral density was performed using peripheral ultrasonic densitometer GE Lunar Achilles (Table 1).

In order to interpret the results, the densitometry classification of WHO was used in estimating the BMD values in postmenopausal women and in men aged 50 and over. According to the recommendations of WHO (1994), the results of densitometry were evaluated as: "normal" with T-test value of +2.5 SD to -0.9 SD from peak bone mass; "osteopenia" with T-test value of -1.0 SD to -2.4 SD; "Osteoporosis" with T-test value of -2.5 SD and less. "Severe OD" was classified as values of T-test of -2.5 SD and lower with past history of one or more fractures.

The results were processed using Microsoft's programs Office Excel and statistical data processing programs.

RESULTS AND DISCUSSION

The conducted survey revealed that of the women surveyed early menopause (up to 45 yrs.) was found in 13.1% of cases (n -42), that is higher than data of a number of authors, thus marking an increase in the number of women with early menopause.

Smoking and excessive alcohol consumption (no more than 3 daily intakes according to WHO criteria) were detected in 4.4% (n -19) surveyed, only in 10% of cases with women (n-2) and in 90% (n-17) of cases with men.

Rheumatic diseases and history of diabetes as a risk factor for osteoporosis occurs in 10.6% and 6.9% of subjects, respectively. Thyroid disease was found in 3.0% of the subjects. A person gets 70-80% of calcium from dairy products that contain other components, such as phosphorous and magnesium, positively influence the bone remodeling process [5, 7], the basic milk proteins [10], phosphoproteins from casein and estrogens [9].

The use of dairy products as a source of nutritional intake of dietary calcium was 98.1%, of them 10.9% consume dairy products once a week, 50% - 2-3 times a week, and 39.0% - 4-5 times a week. Among the surveyed 15.3% (n -66) already had a low-energy fracture (Tabl.2), and 74% of cases (n-49) of the fractures were observed in the age group of 50 years and older, indicating possible severe forms of osteoporosis, which has to be treated to prevent repeat fractures.

In Group I we examined 142 people including 38 men and 104 women, 23.3% of the cases showed decrease in bone mineral density below the age indicators. In women, the decrease in the detected changes in bone density was at 19.7%, while for men it was 3.5% (p <0.05). Risk factors for men – dairy products consumption of 2 times a week or more in 100% of cases, with women in 89.4% (10.6% of women do not consume dairy products). 11 (28.9%) men had a history of fractures in different locations, as well as 6 women (5.7%). Thyroid disease was identified in 31 (29.8%) women and 3 men (10%). Early menopause before the age of 45 was detected in 14 (13.4%) women of this age group.

In Group II we examined 288 people, including 73 men and 215 women. Risk factors for men - consumption of dairy products 2 times a week or more in 79.4%, and 89.4 in women (19.1% of men and 8.8% of women use dairy products once a week or less). In men, the bone mineral density within the age norm was found in 49 people, which was 67.1%, while for women this ratio was only 84 (39%). Osteopenia in men was observed in 19 (26%) men, in women – 97 (45.1%). Osteoporosis in 5 (6.8%) men and in 35 (16.2%) women. 17 (23.2%) men had a history of fractures in different locations, from fractures in women's history occurred in 32 (14.8%). Thyroid disease was found in 71 (33%) women and 5 men (6.8%). Early menopause before the age of 45 was found in 75 (34.8%) women in this age group.

CONCLUSION

Thus, age, decreased bone mineral density, early menopause, past history of fractures and inadequate consumption of dairy products are currently the major risk factors for osteoporosis and fractures.

Mineral density of bone tissue depending on gender differences and age group

Age	Gender	Norm	Osteo-penia	Osteo-porosis	Total
up to 50 years	Men	33	5	0	38
	Women	76	26	2	104
Subtotal		109	31	2	142
50 years and older	Men	49	19	5	73
	Women	83	97	35	215
Subtotal		132	116	40	288
Total		242	147	42	430

Low-energy fractures in older age groups suggest severe osteoporosis and the need for therapeutic and preventive measures for the prevention of future fractures.

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Low-energy fractures

Age	Gender	Total	Fractures
up to 50 years	Men	38	11
	Women	104	6
Subtotal		142	17
50 years and older	Men	73	17
	Women	215	32
Subtotal		288	49
Total		430	66

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THE IMPACT OF ONE-TIME EXPOSURE TO COMBINED STRESS ON THE NEURONAL PARAMETERS OF NEOCORTEX AND HIPPOCAMPUS OF OLD RATS

ABSTRACT

The purpose of this study is to assess morphological and morphometric parameters of the neocortex and hippocampus neurons of old rats exposed to one-time combined stress. Experimental rats were divided into 2 groups: male old intact and male old rats. The last group exposed to the one-time combined attack of noise, light and immobilization for 1 hour. Experimental materials were taken by decapitation, on the 7th day in the morning hours. We figured out that the influence of combined stress enhances significantly the process of neuronal death in the neocortex of the aging animals' brain. Morphological changes are manifested by increasing number of hyperchromic neurons, vacuolization and increasing cell cytoplasm's area. In the hippocampal neurons of the CA1 area morphological changes were not detected.

Keywords: neurons, morphometry, stress, neocortex, hippocampus, ageing.

INTRODUCTION

For centuries, scientists from various fields pay their attention on the problem of ageing. There are several theories about the development of aging, but now the most widely accepted is the free radical theory. According to this theory, a change in the balance between the intensity of free radical formation and antioxidant protection is the main universal mechanism of aging and damage to living systems [1,5]. It is also known that during the process of age involution resistance to stress factors naturally decreases [1,4]. There are data that stress-induced effects lead to intensification of lipid peroxidation and development of oxidative stress in the brain [2,3]. It leads to damages and death of neurons through apoptosis or necrosis. At the present time, the role of stress factors in the formation of age-related changes in the morphology and metabolism of neurons are not well known, therefore this is of significant interest.

The purpose of this research is to study the morphological and morphometric parameters of neocortex and hippocampus neurons of old male rats exposed to one-time combined stress.

MATERIALS AND METHODS OF THE RESEARCH

In the research we used old (20-24 months) male white rats, weighing 350 – 400 g (n = 10). Animals were divided into 2 groups: 1 group – old intact (n = 5), 2 group – old rats, stressed one-time by combined exposure of noise, light and immobilization for 1 hour (n = 5).

The combined stress was modeled by placing the animals in a narrow plastic box with simultaneous exposure to white noise and 100W light at a distance of 50 cm. The experiment was carried out under the conditions of a vivarium; the animals were kept in ad libitum conditions.

All procedures and manipulations on animals were carried out in accordance with the requirements of the European Convention for the Protection of Vertebrate Animals and the principles of the World Medical Association Declaration of Helsinki. Experimental materials were taken by decapitation on the 7th day in the morning hours.

The materials were fixed in a Carnoy's fluid. Sectioning tissues was made by standard paraffin method. The morphological study was carried out on sections (7 μm) of the parietal lobe, stained by methylene blue and hematoxylin-eosin. The program PhotoM1.21 was used for morphometric research. Statistical analysis of the