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Interrelation of risk factors and occurrence of a possible fracture in patients with osteoporosis

Sinziana Calina Silisteanu, Andrei Emanuel Silisteanu

Corresponding author: **Sinziana Silisteanu** E-mail address: sinzi_silisteanu@yahoo.com

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Railway Hospital Iasi - Specialty Ambulatory of Suceava - "Stefan cel Mare" University of Suceava FEFS-DSDU

Abstract

Introduction Osteoporosis is a disease characterized by low bone mass and structural damage to bone tissue, leading to bone fragility and increased susceptibility to fractures. In Romania, menopause was found 10 years earlier than the internationally accepted limit, which increases the risk of osteoporosis. Osteoporosis is the result of bone loss that correlates with age and can begin after the 4th decade of life. Material and method. The study was conducted over a 12-month period in a total of 29 female patients diagnosed with osteoporosis. The study was conducted in an ambulatory regime and respected ethical and deontological principles. The demographic data of the study group consisted of age, lifestyle, professional training, body mass index. Pain (visual analogue scale), lumbar mobility (Schober test), patients' quality of life (QOL scale) were also evaluated. Clinical data correlated with bone mineral density (DEXA test). Patients received drug therapy with bisphosphonates. Results. The patients participating in the study were 62 years old (62 ± 5.51). Depending on the living environment, there was a higher rate of osteoporosis in the rural area with 15 patients (51.72%) than the urban one with 14 patients (48.28%). The values of the t-student test were statistically significant for the spine in the study group ($p = 0.002$) and the control group ($p = 0.0001$) Conclusions. The study was based on the use of diagnostic utility indices such as bone mineral density, the data correlated with the DEXA investigation and the risk of fracture, but also on the evaluation of risk factors influencing the possible production of a fracture in a person with osteoporosis. Applying a physical exercise program can influence the patient's physical and mental condition with osteoporosis, lowering morbidity and increasing the quality of life.

Key words: *osteoporosis, risk of fracture, bone mineral density, physical activity*

Introduction.

Osteoporosis is a disease characterized by low bone mass and structural damage to bone tissue, leading to bone fragility and increased susceptibility to fractures. [1]

This condition can be a major cause of fractures and can cause many complications. [1], [2] The most common fractures occur in the spine or femur [4], but they can also occur at the radius level. Fractures accentuate morbidity and mortality in older people and increase medical costs.

In 1960, there were about 250 million people over 60, and about 1 billion in 2020, indicating a population aging trend, although the woman's average age of menopause will remain 51 years old. Osteoporosis is considered a consequence of menopause, being a major medical and social problem. Among the determinants of the risk of osteoporotic fracture we mention: bone quality, bone micro-architecture, bone mineral density - this being responsible for 4-67% of the reduction of the risk of fracture after anti-resorbants.

Prevention factors are balanced diet in calcium and vitamin D, practicing weight-bearing exercises, healthy lifestyle, no smoking or alcohol, periodic bone mineral density measurement, and appropriate medical treatment. In Romania, menopause was found 10 years earlier than the internationally accepted limit, which increases the risk of osteoporosis. From the studies performed, there was found a high percentage of osteopenia with over 10% of the accepted limits abroad, which shows that during the formation of the bone there was a poor diet. [3] World statistics show that in 1990, 1.7 million people were diagnosed who had a hip fracture. It is assumed that in 2050 the number of people with this diagnostic will reach 6 million. Studies show that hip fracture rate in Taiwan was the highest in the world [4]

Osteoporosis is the result of bone loss that correlates with age and can begin after the 4th decade of life. It is mainly the result of bone destruction by osteoclasts and the decrease of bone formation by osteoblasts. In women, the role in estrogen deficiency (menopause) and bone loss (age-related) are involved, and in males, bone mass is correlated with estrogen levels. Vitamin D deficiency, secondary hyperparathyroidism, reduced physical activity, and decreased production of insulin-like growth factors may occur. The genetic factor with involvement in the decade 3 of life, along with calcium intake, vitamin D, should be mentioned. Even though bone loss has a

major role in the pathogenesis of fractures, consideration should be given to factors correlated with bone fractures and frailty, and namely the risk of falling, energy intake, bone composition, bone material, bone structure.

Osteoporosis, according to the WHO (World Health Organisation), is based on bone mineral density measurement in the spine and femur using dual X-ray absorptiometry (DXA) and the result shall be T≤2.5 standard deviations below normal bone mass.

Risk factors for osteoporosis are partially independent, but also dependent on bone mineral density. Of the independent we mention: age over 45 years, fractures by fragility (in a history of even maternal antecedents of hip fracture), oral glucocorticoid therapy, active smoking, alcohol consumption, body mass index ≤ 19, obesity, falling, other diseases (rheumatoid arthritis). [2], [5], [6] Alcohol and smoking negatively influence bone density and may favor a bone fracture. [2], [7] Factors dependent on bone mineral density are family history, ethnic-white race, malabsorption, some endocrine disorders, chronic liver, kidney or lung disease, immobilization or some medications. There is research that has shown that there are factors associated with osteoporosis, including older age, female sex, lack of education, social factors. There are also few early prevention and screening programs for osteoporosis in women and especially in the elderly [1], [8]

Calcium and vitamin D intake should also be taken into account, as they increase bone loss and reduce bone loss. Studies [9], [10] show that practicing exercise, especially with resistance and moderate weight gain, allow the development of bone mass and reduce the risk of falling, especially in the elderly. Also, daily exposure to the sun for 5-15 minutes, two to three times a week influences the synthesis of vitamin D. [11], [12] Recent research [9], [13] shows that maintaining adequate bone mass, but also keeping a proper muscle tone can prevent osteoporosis. [2], [14]

A balanced diet accompanied by exercise may have a prophylactic effect on osteoporosis. [15], [16] Calcium intake (food, medication) can have a positive effect on bone mass, reducing the risk of falling and producing a fracture . [17], [18]

A case-control study in Taiwan tracked 200 women diagnosed with osteoporosis, of whom 100 had hip fracture. Initially, the quality of life was assessed even every 4 months by the SF-36 questionnaire, the risk factors, the physical examination, the height, weight, body mass index, bone mineral density in the spine and at femoral level were assessed (using X-ray absorptiometry with dual DXA energy). It was found that patients diagnosed with osteoporosis who performed a controlled and individualized exercise program had significant outcomes compared to those who, although following pharmacological treatment did not have a physical exercise program, the level of education was low and did not followed by comorbidity control guidelines. The aversge age of the patients was 77.9 years. [19]

Another study, which looked at the risk-fracture link for hip fracture - the quality of life in people with osteoporosis, was based on 200 women with an average age of 78 years of which 99 had a hip fracture. The assessment was performed initially every 4 months on the basis of the SF-36 quality of life questionnaire, bone mineral density assessment using X-ray absorptiometry. All patients received controlled drug treatment for osteoporosis. Patients who had a hip fracture showed deterioration health conditions and implicitly decreased quality of life, have used walking aid and medication for pain. Individuals who performed regular and individualized exercises with mental support from family members and society had statistically significant results compared to those who did not benefit from physical therapy and mental support, which favored fracture and deteriorated health. [20]

The emergence of another study brings attention to the consequences of vertebral fractures on the quality of life of patients with osteoporosis. It is known that vertebral fractures are associated with increased mobility, pain, reduced daily activities, decreased quality of life. Applying exercise for a period of 4 or more weeks has benefited from all aspects of patients diagnosed with osteoporosis who have had a vertebral fracture. Pain, balance, mobility, muscle balance, quality of life and bone mineral density were assessed by X-ray absorptiometry (DXA) in the spine and femur. The results of the studies conducted between 2005-2011 and published in 2013 (Cochran) showed that in 488 patients diagnosed with osteoporosis, exercise reduced pain, increased walking speed, increased joint and muscular balance, regaining balance and static and dynamic posture (highlighted by the "rise and walk" test), the increase in quality of life. While studies have shown benefits in terms of

pain, balance, walk, posture, activity, they have found results especially for female patients, and for the male patients collected data are rarer. [21]

Other researchers followed in another study the immediate and long-term effects (of at least 4 months) of the exercise program on 75 people diagnosed with osteoporosis who also had vertebral fractures compared to the 75-people control group with the same diagnosis, but without applying the exercises. Rate of walking, balance, posture, quality of life was assessed. The results were favorable to individuals who have developed an individualized exercise program. [22]

In 2011, a study was published evaluating the effect of physical exercise over a period of 3 months on mobility, balance and quality of life in people diagnosed with osteoporosis and a history of vertebral fracture. The study included 89 patients (study group and control group) with the "rise and walk" test, the QUALEFF-41 questionnaire and the health assessment questionnaire (GHQ-20). [23] The results were statistically significant for balance, pain, mental and physical function in patients who had physical activity.

In 2016, another study was published that was conducted over a 12-month period that assessed the effect of physical exercise on patients with osteoporotic vertebral fracture. Pain, balance (using the "rise and walk" test), functional mobility, quality of life (using the QUALIFFO-41 quality of life questionnaire) were evaluated. The study included 40 people who followed a physical exercise program and 38 people in the control group, the average age being 69.2 years. The exercise program was performed twice a week for 12 months, with a daily duration of 40 minutes. Patients were initially evaluated every 12 months. The results were statistically significantly better in the study group (44.2 ± 7.5) compared to the control group (56.6 ± 9.4), p <0.0001. Pain reduction, improvement in physical, social, mobility, and health status has been identified. [24]

Objectives. The study sought to highlight the interrelationship between the risk factors and the occurrence of a possible fracture in people diagnosed with osteoporosis.

Material and method. The study was conducted over a 12-month period in a total of 29 female patients diagnosed with osteoporosis. The study was conducted in an ambulatory regime and respected ethical and deontological principles. The criteria for inclusion in the study were: female patients diagnosed with osteoporosis by the DEXA test, the patients' agreement to participate in the study, the age of patients over 51 years, no neurological disorders or chronic decompensated disease. The exclusion criteria were: non-cooperating or non- willing to participate in the study, under 51, patients who had chronic decompensated affections or neurological affections. The demographic data of the study group consisted of age, lifestyle, professional training, body mass index. Pain (visual analogue scale), lumbar mobility (Schober test), patients' quality of life (QOL scale) were also evaluated. Clinical data correlated with bone mineral density (DEXA test). Patients received drug therapy with bisphosphonates. Of the 29 patients, 14 received physical exercise (active/passive, active, mild/medium active, with light / medium weights mobilisation) 3 times a week and 35 minutes per session. For the data obtained, statistical analysis was applied, calculating the median, the standard deviation and the t-student test, p being less than 0.05.

Results and discussions. The patients participating in the study were 62 years old (62 ± 5.51). Depending on the living environment, there was a higher rate of osteoporosis in the rural area with 15 patients (51.72%) than the urban one with 14 patients (48.28%). The average weight of the patients in the study group was initially 75.4285 kg and the final of 68.6 kg, and the initial control group was 82.7857 kg and the final weight was 75.66 kg. The average height was in the study group of 165.14 cm and 1.72.67 cm in the control group. The body mass index had an initial average value in the study lot of 27.5413 and an average final value of 26.9053, and in the control group of 27.5914 initially and 27.0571 respectively.

Fig. 1 Distribution of patients by age

Years old	51-60	61-70	71-80	>81
Study group	5	4	3	2
Control group	4	4	4	3

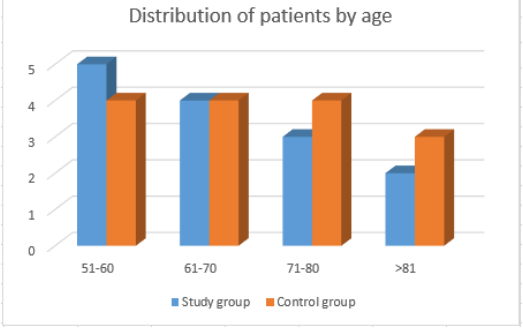

Fig. 2 Distribution of patients by age

The bone mineral density at the initial moment of the lumbar spine and femoral area expressed by the T test allowed the following data to be obtained:

- In study group

- for the lumbar spine, T had for 7 patients (50%) values in the range -2.5 ÷ -3, for 3 patients (21.42%) in the range -3 ÷ -3.5, for 3 patients (21.42%) between -3.5 ÷ -4 and 1 patient (7.1%) over -4
- for hip, T had values for 10 persons (71.42%) below -2.5, and for 4 persons (28.58%) values in the range -2.5 ÷ 3.

- In control group

- for the lumbar spine, T had for 6 patients (40%) values in the range -2.5 ÷ -3, for 4 patients (26.66%) in the range -3 ÷ -3.5, for 3 patients (20 %) between -3.5 ÷ -4 and 2 patients (13.34%) over -4
- for the hip, T had values for 8 persons (53.34%) below -2.5 and for 7 persons (46.66%) values in the range -2.5 ÷ 3.

The average T-score at the lumbar spine was at the study group -2.87 initially and -2.63 finally, and in the control group -2.84 initially and 2.79 finally.
The average T-score at the hip was at the study group of -1.5 initially and -1.1 finally, and in the control group was -1.9 initially and -1.7 finally.

Group/ Moment	**Study group**		**Control group**	
	initial	**final**	**initial**	**final**
Median and standard deviation	**-2.87 ±0.120**	**-2.5 ±0.143**	**-2.8 ±0.112**	**-2.7 ± 0.124**

The values of the t-student test were statistically significant for the spine in the study group (p = 0.002) and the control group (p = 0.0001)

Conclusions

- The study was based on the use of diagnostic utility indices such as bone mineral density, the data correlated with the DEXA investigation and the risk of fracture, but also on the evaluation of risk factors influencing the possible production of a fracture in a person with osteoporosis
- It is found that there are risk factors for osteoporosis such as age, patient's height and body mass index
- Applying a physical exercise program can influence the patient's physical and mental condition with osteoporosis, lowering morbidity and increasing the quality of life

Osteoporosis is a public health problem both in our country and in Europe, requires early diagnosis for the optimization of therapeutic strategies and the application of prevention programs

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