Evaluation of Risk Factors for Osteoporosis in Postmenopausal Women

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ORIGINAL PAPER

SUMMARY

Introduction Osteoporosis is a disorder characterized with decreased bone mineral density. Osteoporosis is divided in two groups: primary and secondary. After thirties year of life reduction of bone tissue is inevitable process, and as a consequence of it, there is a change in bone remodeling cycle what can lead to fragility of bones and increase risk of fractures. Risk factors are numerous and there is no single cause of the disorder. **Patients and methods** As a part of the investigational project 1000 female patients were examined at the Clinic for Nuclear medicine of the University Clinical Center of Sarajevo, age 40 to 75 during 12 months. The study was designed as prospective. For each patient we did personal history, and diagnostic procedure, ultrasound of calcaneus as screening procedure and DXA of femur and lumbar spine. We established presence of risk factors for osteoporosis in postmenopausal women. **Results of investigation:** Results of measurement with diagnostic ultrasound method screening of calcaneus T score showed that out of 1000 patients in 92% of patients osteoporosis was diagnosed. Comparation of T score results for all three diagnostic methods (ultrasound of calcaneus, DXA femur and spine), in investigated group of patients highest efficiency was found with screening method of calcaneus ultrasound. Leading three factors for osteoporosis development are: smoking, genetic factors and endocrine conditions. **Conclusion:** ultrasound of calcaneus as screening method demonstrated presence of osteoporosis in 920 out of 1000 patients. Results of measurement with diagnostic ultrasound method demonstrated highest efficiency in osteoporosis diagnostic in postmenopausal women.
Key words : osteoporosis, risk factors, postmenopausal women, ultrasound of calcaneus, DXA femur and DXA lumbar spine.

1. INTRODUCTION

Osteoporosis

Osteoporosis is a disorder of the skeleton in which bone strength is abnormally weak and reduced bone mineral density. After thirties year of life, loss of bone mineral density is inevitable and as a consequence of this there is a change is bone remodeling cycle. With age new bone cells can not replace those destroyed and permanent damage occurs (Figure 1).
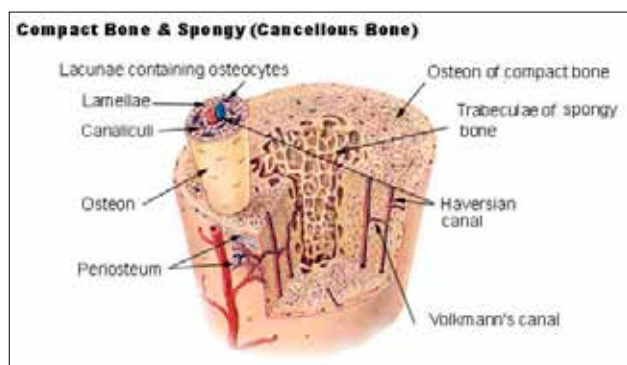

Figure 1. Anatomy of bone

Osteoporosis is divided in two groups: **primary and secondary.** When cause is not fully known, we talk about primary osteoporosis and when osteoporosis appears as a part of some other conditions than it is called secondary.

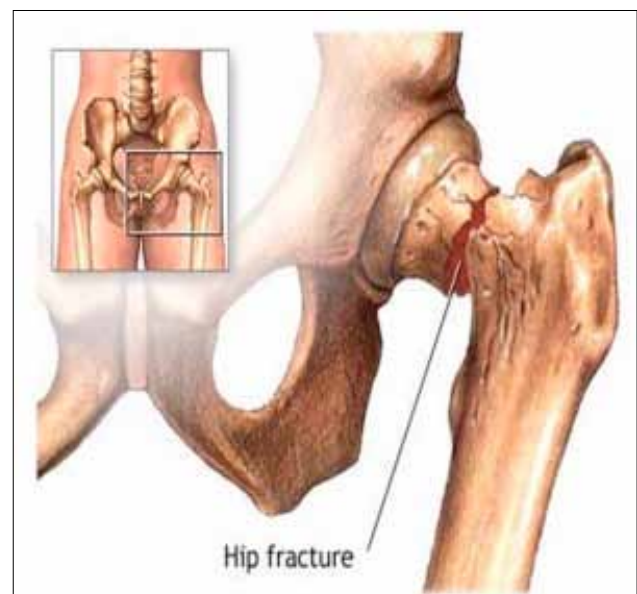Disorder of bone spicules, what can cause fragility of

Figure 2. Hip fracture

bones and increase risk of fractures (1). This leads to an increase in the risk of breaking bones (bone fracture). In the United States, more than 10 million people have osteoporosis of the hip and almost 19 million more have low hip bone density (Figure 2). Between 4 to 6 million postmenopausal white women have osteoporosis, and an additional 13 to 17 million have low hipbone density. One in two white

women will experience a bone fracture due to osteoporosis in her lifetime.

Almost every fourth women older than age of 60 suffers from osteoporosis which in early stages does not give any symptoms and therefore we talk about „silent stealer of calcium". Its frequency increases with age, it advances unnoticeably, clinical symptoms appear only with fractures, risk factors are numerous and there is no single cause of the disease (2,3).

Risk for development of osteoporosis and appearance of fractures depends on health of bones (hardness, density and mass). Total health of skeleton depends on good bone modeling during childhood and adolescence and sport activities.

Factors that will increase the risk of developing osteoporosis are:

- **Female gender,** Caucasian or Asian race, thin and small body frames, and a family history of osteoporosis.
- **Cigarette smoking,** excessive alcohol and caffeine consumption, lack of exercise, and a diet low in calcium.
- **Poor nutrition** and poor general health.
- **Malabsorption** (nutrients are not properly absorbed from GI tract)
- Low estrogen levels
- **Chronic diseases** (Thyreoid, Chemotherapy, Breast cancer)
- Immobility
- Vitamin D deficiency
- **Certain medications** can cause osteoporosis (heparin, phenobarbital, and long term use of corticosteroids).
- Family history of this disease. (4).
- Therapy of osteoporosis is divided to: pharmacological and physical therapy (5,6,7).

2. PATIENTS AND METHODS

As a part of the investigation 1000 of postmenopausal women with risk factors were examined at the Clinics for Nuclear medicine of University Clinical Center of Sarajevo in four year period from year 2006 to year 2010.

Bone density was performed with two methods:

- Quantitative ultrasound of calcaneus
- *Osteodensitometry* – DXA:
- DXA femur and
- DXA lumbar spine.

3. RESULTS OF INVESTIGATION

Obtained results are shown in tables, graphs and are statistically analyzed for measured values established via T-TEST. This investigation that was done at the Clinic for Nuclear Medicine Clinical Centre University of the Sarajevo, inlcuded 1000 of female patients, age 40 to 75 years (postmenopausal period), in time frame of years 2006 to 2010. Analysis of age structure of patients demonstrate that age interval for patients was between 40 and 75 years with arithmetic median value of 61,01 years.

Total number of patients in menopausis was 890. The highest number of them have been in menopauses over 5 years and we had 820 (92,13%) patients, in time frame of 13 months to 5 years 50 (5,62%) and 1-12 month 20 (2,25%).
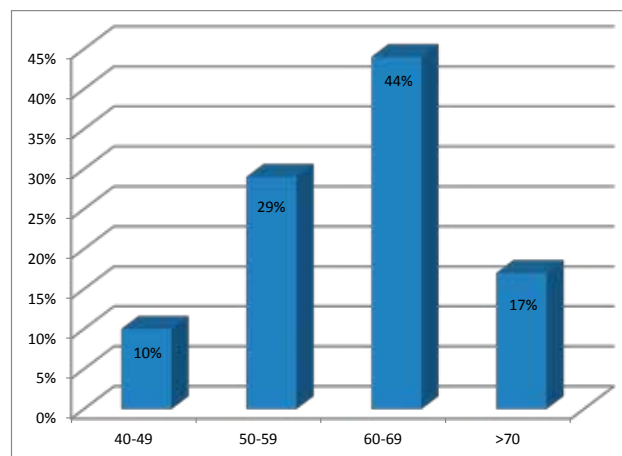

Graph 1. Age distribution of patients

As a part of evaluation for development of osteoporosis for genetic factors it was not present in 78% of participants, while 22% of patients had genetic factor for osteoporosis.
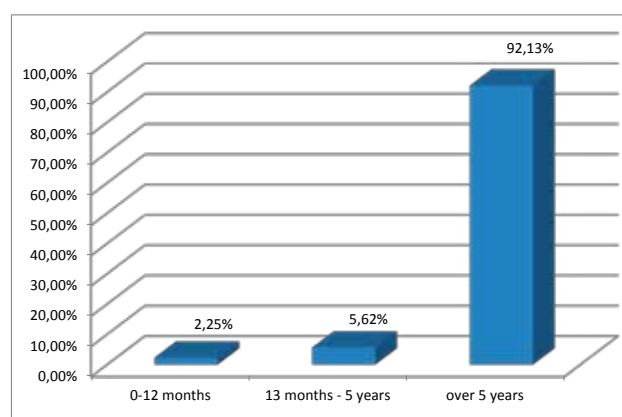

Graph 2. Menstrual cycle of patients

Analysis of smoking as a potential risk factor for osteoporosis established that highest number of patients do not smoke or 670 of them (67%), and group of smoker consisted of 330 patients (33%).
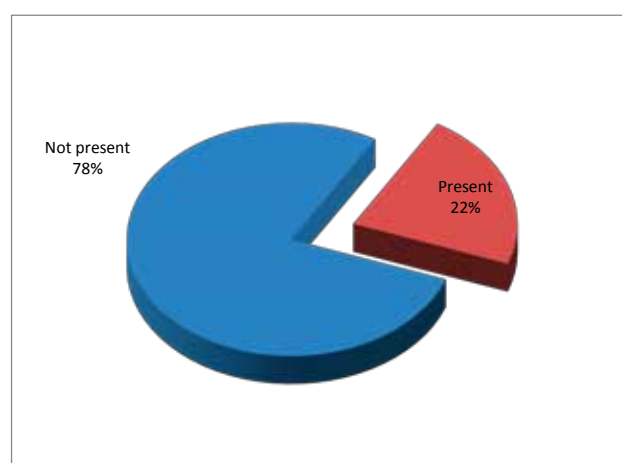

Graph 3. Genetics as risk factor in patients

Evaluation of physical activity demonstrated that the highest number of participants in weakly active or 580 of them (58%), 310 of them (31%) are not active while 110 (11%) is moderately active.

Out of total number of patients with osteoporoses, 440
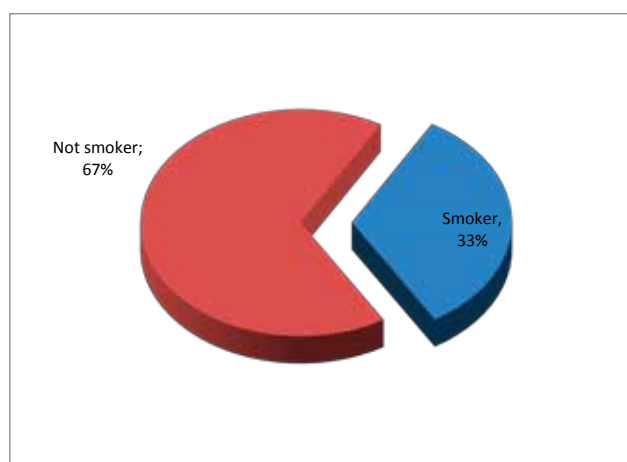
Graph 4. Smoking as a risk factor in patients

participants had (44,1%) endocrine conditions (thyroid gland disease), 354 patients (35.5%) had malignancies and 206 patents (20,6%) had immobilization.
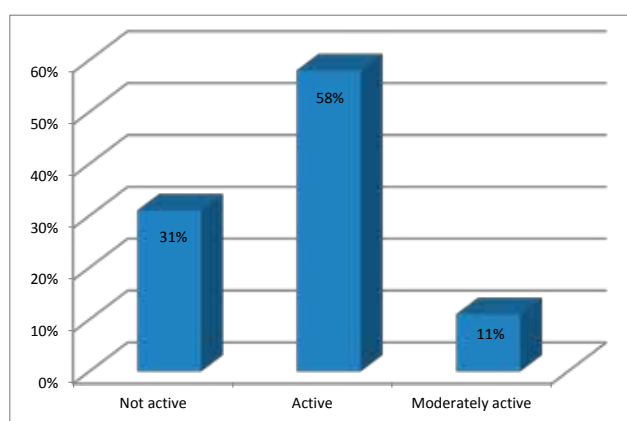
Graph 5. Physical activity of patients

Results of T score measurement with ultrasound of calcaneus show that out of total 1000 patients in 920 (92%) patients osteoporosis was diagnosed. Interval T score in investigated group of patients varies -2,0 to -4,8.

DXA spine we see in 850 (85%) patients osteoporosis was diagnosed. Interval T score in investigated group of patients varies from -1,3 to -4,8.
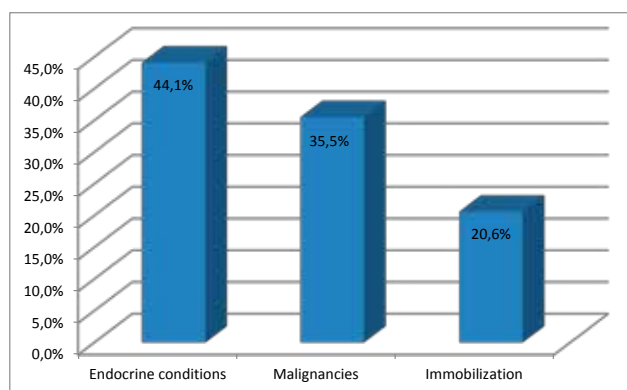

Graph 6. Previous conditions of patients with osteoporosis

DXA femur show 560 of them (56%) were diagnosed with osteoporosis. Interval T score in investigated group of patients varies from -0,8 to -4,8.

Comparison of results for T score measurement in

investigated group of patients with methods ultrasound of calcaneus and DXA spine there was found 7% higher efficiency of ultrasound of calcaneus what presented in number of patients whose condition was diagnosed with method of ultrasound of calcaneus and number of patients whose condition was diagnosed with method of DXA spine
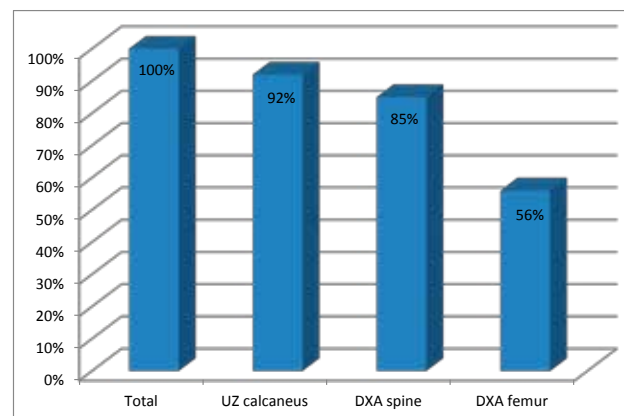
Graph 7. Summary of measurement for T score values with different diagnostic procedures

4. DISCUSSION

The World Health Organization (WHO) declared decade 2000-2010 for decade of osteoporosis (decade of bones and joints) due to high risk of all possible complication caused by osteoporosis.

With the aging the number of people with osteoporosis related fractures will increase exponentially. The pain, suffering, and economic costs will be enormous.

Conducted investigation for development of osteoporosis and two diagnostic procedures (ultrasound of calcaneus and densitometry -DXA) included 1000 participants.

Age interval of participants was 40 to 70 years, with mean value of 61 year. Most of the participants were in age group 60-69 years. A menopause in women presents one of the risks for development of osteoporosis (8,9).

It is estimated that in the USA, where health educations is high, more than 20 million of inhabitants suffers from osteoporosis, i.e. 30% of postmenopausal women in population, with over 1.6 million of fractures caused by osteoporosis. Investigation of Mayo clinic experts demonstrated similar data on dominancy of osteoporosis in age group of women 60 to 65 years.

Women who enter menopauses before age of 50 have 8% higher lost of bone mass compared to women with regular menstrual cycle (10,11). Frequency of osteoporosis increase with age, it is especially sensitive and risky period of life for onset of osteoporosis and psychic disorders on the other hand. Obtained results demonstrate that total number of women in menopauses in our investigation is 890 out of 1000 women who participated the study.

Smoking is a risk factor for development of osteoporosis. A series of scientific studies demonstrate direct link between smoking and osteoporosis onset. The results of the investigation demonstrate that 33% of participants smokes, what presents high risk for onset of osteoporosis with all its consequences and complications it carries.

Investigation of nutritionist Darija Vranešić-Bender, PhD

in year 2009 on coffee and osteoporosis demonstrated that excessive consummation of coffee causes lost of calcium but amount of two to three cups of coffee is not dangerous for bones, especially if it is drink with milk.

Genetic factor as a risk for development of osteoporosis in our investigation was present in 22% participants. Series of investigation done on twins and members of close family provided firm demonstrators that genetic factors help in determination of bone hardness. In one of these investigations a gene that affects metabolism of vitamin D and increases risk for osteoporosis four times was discovered (12).

Increased physical activity slows down development of osteoporosis. However, professional sport in women, due to lower dose of estrogen, can lead to earlier loss of bone mass. Importance of influence of everyday physical activity like walking, limited exercise with resistance, stretching, aerobic and dance are recommended by many experts. (6). Physical inactivity as a risk factor for osteoporosis was present in investigated group in 31% patients what is relatively high risk predisposing factor in this study.

Endocrine diseases are firmly linked to appearance and development of osteoporosis. As a part of the study out of total number of participants, endocrine diseases (thyroid gland) were present in 41,1% patients (4).

Malignant diseases together with cardiovascular disease are world's leading cause of death. Analysis of data demonstrates presence of neoplasm in 35,5% patients.

Results of investigation for frequency of immobilization is present in 20,6% patients.

Comparation to published studies and investigation speak on exquisite medical importance of fractures that present socio-economic, medical issue and indicate creating stronger resources by the society in order to prevent falls and injuries, patients education and lowering incidence fracture.

Osteoporosis fractures are the most important and the most severe complication of osteoporosis and therefore they are the subject of investigation in many studies.(13).

Method used in the investigation is quantitative ultrasound. Advantages of ultrasound are: lack of radiation, portable equipment, can be used for fast and massive screening. Disadvantages are: only calcaneus bone density is measured and can not be used for precise monitoring of therapy results (14,15).

As a part of the investigation T score value was estimated which is by the WHO indicator of BMD condition and demonstrator of bone mass density. Results of investigation diagnosed osteoporosis based on T score screening, ultrasound of calcaneus in 92% participants. Densitometry (DXA) is the only recognized method by the WHO which can diagnose osteoporosis, monitor its development and success of therapy (12,13).

DXA advantages are: high precision, low radiation dose, performed at more than one location on skeleton, painless, short time period (10 minutes).(9,11,16,17,18). Bisphosphonates therapy and calcium supplement may be useful in the elderly with vitamin D (19,20).

Diagnosis of osteoporosis was established in 85% participants with diagnostic method of densitometry (DXA) of spine and in 56% of patients with DXA of femur. Comparation of results for measurement of T score, in investigated

group of patients, methods of ultrasound of calcaneus, DXA of spine and femur, we established highest efficiency of ultrasound of calcaneus as a diagnostic method, i.e. out of total 1000 patients in highest number of them 920 or (92%) osteoporosis is diagnosed with this method.

5. CONCLUSIONS

Investigation was conducted at the Clinics for Nuclear medicine of the University Clinical Center of Sarajevo in 1000 of participants during four year period. Investigation diagnosed osteoporosis by evaluation of risk factors in postmenopausal women with two diagnostic methods-quantitative ultrasound (QUC) and densitometry (DXA).

Age interval of participants was 40 to 70 years with median arithmetic value of 61 years and the most common age group of 60 to 69 years among investigated women.

Evaluation of bone density index (BMI) established median value of 25, 4 what belong the value of normal body mass index.

Menopauses as one of the risks for osteoporosis was present in 890 participants, out of which number most of women entered menopauses five years ago, what presents percent of 92,13%. Genetic factor as individual risk for development of osteoporosis was present in 22% participants. Smoking as a risk factor was present in 33% of participants.

Physical inactivity was an individual risk for development of osteoporosis was present in 31% of participants. Previous conditions as a risk for development of osteoporosis in participants are present as: endocrine conditions (thyroid conditions) in 44% participants, neoplasm in 35, 5% participants and immobilization in 20,6% participants. Ultrasound method of BMD calcaneus in 92% of participants established diagnosis of osteoporosis.

Diagnosis of osteoporosis was established in 85% participants with diagnostic procedure of densitometry (DXA) of spine. Diagnosis of osteoporosis was established in 56% participants with DXA of femur.

Comparison of results of T score measurement in investigated group of patients, with methods: ultrasound of calcaneus, DXA spine and DXA femur demonstrated the highest efficiency was found for ultrasound of calcaneus, i.e. out of total 1000 patients in highest number (920 or 92%) osteoporosis was found with ultrasound of calcaneus.

By evaluation of risk factors for development of osteoporosis in postmenopausal women, we concluded that there are three leading risk factors: smoking, genetic factor and endocrine conditions of the thyroid gland. Based on obtained results of the clinical investigation a diagnosis of osteoporosis was made in a short time period, followed with start of bisphosphonates therapy,calcium supplement with D vitamin and monitoring of its results.

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