

Calcaneal Ultrasound As An Important Parameter For Pre-Screening Osteoporosis

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Abstract

Introduction: Osteoporosis is progressive metabolic bone disease characterized by bone loss, and damages in architecture of bone tissue what et the end results in increased bone fragility and bone fractures. Ultrasound densitometry is a simple, fast and cheap method for measurement performed on the calcaneus and can be used as a screening method, especially as a method for assessing the risk of fractures. The aim is to examine the prevalence of osteopenia and osteoporosis in women of different age groups and to identify risk factors for them.

Participants and methods: In this study were included 60 patients who were admitted to the Department for Physical Medicine and Rehabilitation of the University Clinical Centre Tuzla, as well as patients in Health Centres of Tuzla Canton for physical treatment during time period of three months. BMD measurements are expressed in a form of the T-score. Osteoporosis is defined as T score value over -2.5SD

Results: Out of 60 patients, 53 (88.3%) were women and 7 (11.7%) were man. The average age of the patients was 52.6 years. osteoporosis was represented by 10.6% of patient in age group 51-70 years and 36% of patients over 70 years old. Among women who reached menarche before the age of 15 is a lower percentage of osteoporosis (8.8%) compared to women who had their menarche later 15 years (13.5%). Among the patients in whom menopause lasted 1-10 years 11.1% had osteoporosis. In patients in whom menopause lasted over 30 years, 60% of them had osteoporosis. if the patient's BMI is below 19 kg/m², the percentage of osteoporosis was 20.6%, while in a female patient with a BMI above 19 kg/m², the percentage of osteoporosis was 7.2%. Osteoporosis was present in 6.4% patients who were not had chronic diseases; 10.3% patients with one chronic disease had osteoporosis while 12.2% female patients who had two or more chronic diseases had osteoporosis too.

Conclusion: The frequency of osteoporosis increases with age, and it is higher in people with a longer duration of menopause, a lower BMI, and with chronic diseases.

Keywords—osteoporosis, calcaneal ultrasound, risk factors

Introduction

Osteoporosis is progressive, systemic, metabolic bone disease characterized by bone loss, damaged microarchitecture of bone tissue, increased in bone fragility, and at the end it results in an increased risk from fracture formation [1]. Osteoporosis is the most common metabolic bone disease. Approximately 75 million people in the world are suffering from osteoporosis.

Women older than 45 age being hospitalized more for complications of osteoporosis than for many other diseases including breasts carcinoma, diabetes and myocardial infarction, and they die more from complications of osteoporosis the of the three most common carcinomas in women (breast, uterine and ovarian carcinomas). Because of all the above, early detection,

prevention and rational treatment are not only important for the individual person, it has more and more getting the social dimension [2].

Radiological techniques are used to diagnose and monitor osteoporosis. Dual Energy X-ray Absorptiometry (DEXA), a diagnostic method that quantitatively assesses bone density, is considered the gold standard for the diagnosis of osteoporosis. Bone density (BMD) measured by these techniques is expressed in g/cm² and as a T and Z score. The T score implies the deviation (number of standard deviations) of the bone density of the examined person in relation to the mean bone density of healthy persons of the same sex between the ages of 20 and 40. BMD \leq -2.5 SD defines osteoporosis, while a range of -1 to -2.5 SD defines osteopenia. Z score represents the difference between the measured BMD and the BMD of a healthy person of the same age [2, 3]. Ultrasound densitometry is a simple, fast and cheap method for measurement performed on the calcaneus. This method can be used as a screening method, especially as a method for assessing the risk of fractures, whether its reliability and precision as well as the correlation with the findings obtained by the DEXA method are low. The aim is to examine the prevalence of osteopenia and osteoporosis in women of different age groups and to identify risk factors for them.

Methods

The study was conducted prospectively from a period of three months (1st January 2019 – 1st April 2019). In this study were included 60 patients who were admitted to the Department for Physical Medicine and Rehabilitation of the University Clinical Centre Tuzla, as well as patients in Health Centres of Tuzla Canton for physical treatment. For the ultrasound densitometry of the heel bones we used an ultrasonic densitometer, Ultrasonometra Ge Lunar 1. The examination was performed using the direct method. We used the questionnaire for patients with osteoporosis, which contains information about gender, age, and body type height and weight, menarche and menopause, presence of clinical symptoms and chronic diseases (diabetes mellitus, rheumatoid arthritis, hysterectomy, ovariectomy). Body mass index (BMI) values are calculated according to the classic formula, but 19 kg/m² is taken as a limit value according to the applicable ones. Ultrasound densitometry of the calcaneus bone is used because it is generally accepted as screening method for early detection of osteoporosis. Also, it enables the examination of a large the number of patients in a short period of time with small expenses. BMD measurements are expressed in a form of the T-score. Osteoporosis is defined as T score value over -2.5SD [2.4].

Results

A total number of 60 patients were examined from a period of 1st January to 31st March 2022, in the University Clinical Centre Tuzla, Department for Physical Medicine and Rehabilitation. Out of 60 patients, 53 (88.3%) were women and 7 (11.7%) were man. The average age of the patients was 52.6 years. Examination of the incidence of osteoporosis estimated with the T-score depending on the age of the patients showed that with the increase in the number of years the percentage of osteoporosis is also increasing (Table 1). Data shown in Table 1 also show that the later onset of menarche increases the risk of osteoporosis, and that the percentage increases with the length of menopause with osteoporosis. Analyzing the relationship between BMI and the frequency of osteoporosis, it was observed that low BMI values condition lower T-score values, i.e. lower frequency osteoporosis. Higher prevalence of osteoporosis was detected in patients who had 2 or more chronic diseases.

Table 1. The frequency of osteoporosis depending on the age of the patient, age of menarche, duration of menopause, body mass index (BMI) and chronic disease

Risk factor	Percentage of patients with osteoporosis	
Age	18-50 year	4,3
	51-70 year	10,6
	Over 70 year	36,0
Menarche	Before 15 years	8,8
	After 15 years	13,5
Menopause	Before 1-10 years	11,1
	Before 11-20 years	12,2
	Before 21-30 years	16,5
	Before over 30 years	60,0
BMI	<19 kg/m ²	20,6
	>19 kg/m ²	7,2
Chronic disease	Without chronic disease	6,4
	With one chronic disease	10,3
	With 2 or more chronic disease	12,2

Discussion

Calcaneal ultrasound is a safe, simple, cheap, easily portable and can be applied to large number of patients. Disadvantages of calcaneal ultrasound is that this method is not sensitive and precise enough and not to be used for measuring changes in the central skeleton nor for evaluation of the results of osteoporosis treatment [4]. Pfister et al. [5] found in their tests that calcaneal ultrasound sensitivity is 58% and specificity 80% in detection of osteopenia and osteoporosis of the hip. In the analysis of the relationship between risk factor and frequency of osteoporosis, there are some factors that cannot be influenced such as age, time of menarche, length of menopause. It is shown that the decrease in BMD is also a consequence the risk of osteoporosis increases with age. Avdić et al. [6] report an increase prevalence of osteoporosis with each decade after the age of sixty. It is also showed in United National Health and Nutrition Survey (NHANES) III Study of Postmenopausal Women that the prevalence of osteoporosis in white American women was 27% in the age group 50-59 years, and as many as 41% in the group of women over 70 years of age [7]. The obtained results of our research show that osteoporosis was represented by 10.6% of patient in age group 51-70 years and 36% of patients over 70 years old. Late onset of menarche and early onset of menopause are significant factors for reduction of BMD. The results show that among women who reached menarche before the age of 15 is a lower percentage of osteoporosis (8.8%) compared to women who had their menarche later 15 years (13.5%). Among the patients in whom menopause lasted 1-10 years 11.1% had osteoporosis. In patients in whom menopause lasted over 30 years, 60% of them had osteoporosis. Kapetanović et al. [8] states in his work that the loss of function ovary in menopause is the most important factor for the development of osteoporosis. Bone loss mass after menopause is caused by a decline estrogen, which is supported by the fact that correction of estrogen deficiency prevents loss bone mass. Weight loss is also low BMI is an indicator of lower BMD. Low BMI and code women and men drastically increase the risk for osteoporosis, the risk of falls as well as the risk of fracture [9,10]. In our research, it was shown that if the patient's BMI is below 19 kg/m², the percentage of osteoporosis was 20.6%, while in a female patient with a BMI above 19 kg/m², the percentage of osteoporosis was 7.2%. According to Hodgson [11], certain physical disorders and chronic diseases can increase the risk of the onset of osteoporosis. Most often, we are talking about endocrine disorders, stomach disorders, intestines and liver, rheumatoid arthritis, surgical procedures, long-term immobilization. Research of the World health organizations from March 2004 show that the risk of developing osteoporosis is increased by the existence of one or more chronic diseases [12]. Our results show that osteoporosis is present in 6.4% patients who were not had chronic diseases; 10.3% patients

with one chronic disease had osteoporosis while 12.2% female patients who had two or more chronic diseases had osteoporosis too.

Conclusion

The frequency of osteoporosis increases with age, and it is higher in people with a longer duration of menopause, a lower BMI, and with chronic diseases. Calcaneal ultrasound could be a useful screening method for osteoporosis and with the analysis of the risk factor could make possible to take preventive measures for osteoporosis and its complications.

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