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ORIGINAL PAPER

Osteoporosis – Comparative Study Between Quantitative Ultrasound of Calcaneus and DXA

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Introduction: Osteoporosis is bone disease characterized by reduced bone mass and reduction of bone tissue. Main complications of osteoporosis and major cause of morbidity and mortality in elderly population are fractures. Early diagnosis and detection of osteoporosis can prevent complications of osteoporosis in terms of fractures. **Objectives:** Diagnostic assessment of osteoporosis is mostly being done threw two commonly used methods: ultrasound of calcaneus and osteodensitometry (DXA).The results were compared through a prospective study involving two groups of patients with osteoporosis. **Patients and methods:** The study included 100 female patients with average age 54. In I phase every patient had some protocol. That protocol included: age, body, mass index (BMI), employment , marrital status, risk factors (smoking, coffee, physical activity), endocrine causes of osteoporosis and osteoporotic fractures.In II phase for every patient we were using two methods in diagnostics of osteoporosis: ultrasound of calcaneus and DXA. In both methods,we analyzed T score and Z score. **Results:** 21% patients had 21,12 BMI (low BMI), 58% patients were in menopauses, triad of risk factors (smoking, consumption of coffee, low physical activity) had 32%, 28% of patients had osteoporotic fractures. Quality of life patients with osteoporosis was weak.T score is main score for diagnostics. Results of T score with UZ and DXA had statisticly significant differents. **Conclusion:** Tscore (UZ) and maximum T score (DXA) (lumbal spine and hip) has statisticly similar value with potential possibility to predict osteoporosis fractures. Key words: Osteoporosis, diagnostics methods, rehabilitation.

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1. INTRODUCTION

Osteoporosis is a disease characterized by reduced bone mass, disorder of the bone material , which can cause brittle bones and increase the risk of fractures (1-6).

The disease is characterized by a reduce of the mass per unit of the volume, disorder of the mineralisation of the bone, which corresponds to body size, age, gender and racial affiliation (7-14). It causes musculoskeletal problems in adults, then causes a compression fracture of the vertebrae, and fractures of proximal femur (thigh bone), humerus (upper arm), and distal radius (forearm).

2. OBJECTIVE

Within this prospective clinical study there was performed measuring the density of bone matrix via two methods : quantitative ultrasound (QUS–Quantitative ultrasound) and densitometry (DXA)

Quantitative ultrasound (QUS–Quantitative ultrasound) is often referred to as the device for the heel , because it measures the density of calcaneus. Instead of X-ray, this device transmits ultrasonic waves through the calcaneus. Bone density is being measured on the base of discovering rejected ultrasonic waves from the bones. The higher bone density, ultrasound waves are being sooner bounced off of the bone.

Bone density test or densitometry (DXA) shows the current state of bone mineral content. The test result can :determine whether we have reduced the density of certain bones, regardless of whether we had a fracture or not, determine whether you suffer from osteoporosis. If testing is being carried out for several consecutive years, results can be compared and determine : changes in bone density over time, the effectiveness of therapy and measures to prevent the deterioration of the health status of the skeleton. This test is simple, running fast and completely painless. Test uses X-rays to measure how many grams of calcium and other minerals is being contained in one cm^2 bones. The greater the bone density, the bones are stronger and the risk of fractures is lower. Bone density test or densitometry is being performed on the bones where most fractures due to osteoporosis appears.

3. MATERIALS AND METHODS

Within the scientific research project, we treated 100 women ages 40-70,where we performed measuring of bone density (BMD) using two methods: quantitative ultrasound of calcaneus (brand GE Medical Systems Lunar) and central osteodensitometria–DXA (this device uses X-rays generated in the X-ray tube at a voltage of 70 to

140kVA and amperage of 3mA of , the length of exposure to coxofemoral joint is 4 minutes, and to the L / S part is 5 minutes, dimatera of aperture of tutor armor was 2mm and diameter of detector was 6mm). The study was prospective and prior to diagnostic procedures for osteoporosis (1, 3).

Each respondent was interviewed by the protocol, which included–age, profession, individual risks–smoking, drinking coffee, physical activity / inactivity, endocrine disorders, menopause, surgery, fractures.

Within the diagnostic evaluation of BMD measurements with two comparative methods,there was a comparison :

- T score of UZ of calcaneus compaired to T score of lumbal spine
- T score of UZ calcaneus compaired to T score of femur
- Z score of UZ calcaneus compaired to T scores of lumbal spine
- Z score of UZ calcaneus compaired to T score of the femur
- T scores of UZ calcaneus compaired to the maximum (minimum) value of T score of lumbal spine
- T scores of UZ calcaneus compaired to the maximum (minimum) value of T score of the femur.

4. RESULTS

The age interval of the patients (100) ranged from 40-75 years with an avarage arithmetic value of 54 and the best represented group with avarage age 50-59 years. Assessment of bone density index (BMI) was determined as the avarage value of 21.13 in the group with avarage body weight, while 21% of respondents had a BMI from 16 to 18.5 which is the stage of malnutrition and it represent a risk for osteoporosis. Among respondents , 50% of them were employed, which increases the importance of the need for education and prevention in terms of prevention of osteoporosis and prevention of osteoporotic fractures that results with absenteeism and possible disability. Assessment of marital status of respondents shows that the largest percentage of respondents (69%) are married. Menopause , as one of the known risks for osteoporosis is present in 58% of subjects,

Triad of factors of risk	Very high risk	High risk	Moderate risk	Absence of risk
Content of triad	Physical activity once per week; smoking >20 cigatettes, consumption of the coffee >5 cups per day	Physical activity twice per week; smoking 10-20 cigatettes per day, consumption of the coffee 2-5 cups per day	Physical activity> twice per week; smoking 0-10 cigatettes per day , consumption of the coffe 1-2 cups per day	Physical activity several times per week , no smoking, no consumption of the cofee
N	8	17	7	68
%	8	17	7	68

Table 1.Triad of factors of risk for development of osteoporosis

where the most patients has been in menopause for 1-5 years and this is percentage of 65.5 % .Individual risk for osteoporosis represent also consumation of the coffee. Our results show that 62% of the women consumed coffee. Consumation of cigarettes, as first identified risk of osteoporosis, is being repesented with high percentage (47%) within the group of subjects enrolled in the study. Physical inactivity as individual risk of osteoporosis was present in 28% of subjects. Triad of individual risk factors (smoking, coffee consumption, physical inactivity) are represented in a very high percentage (32%) within the patients of our study. Osteoporotic fractures as the most severe and most common complications are represented by a large number of respondents (28%) of which two-thirds of the fracture accounted for forearm fractures, and the rest of the lumbar spine fractures, fractures of the hip, thigh.

Fractures	Fractures of the forearm	Fratures of the hip	Fractures of vertebrae	Absence of the fractures
N	18	3	7	72
%	18	3	7	72

Table 2. Fractures within the respondents (n=100)

T score	Uz screening of T score of calcaneus	DXA screening of T score of lumbar spine
Interval	-2.8,—3.9	-2.0,—3.6
N	100	100
X	-2.782	-2.436
S	0.845	0.383
Sx	0.0845	0.0383
Medijana	-2.8	-2.4
Mann-Whitney Rank Sum test	P<0.001	P<0.001

Table 3. Comparative evaluation of the value of T-score with UZ calcaneus and DXA lumbar spine within the respondents with osteoporosis (n=100)

T score	Uz screening of T score of calcaneus	DXA screening of T score of femur
Interval	-2.8,—3.9	-1.8,—4.0
N	100	100
X	-2.782	-2.415
S	0.845	0.402
Sx	0.0845	0.0402
Medijana	-2.8	-2.4
Mann-Whitney Rank Sum test	P<0.001	P<0.001

Table 4. Comparative evaluation of the value of T-score with UZ calcaneus and DXA femur within the respondents with osteoporosis (n=100)

T score	Uz screening of T score of calcaneus	DXA screening of maximum T score of femur
Interval	-2.8,—3.9	-1.2,—4.2
N	100	100
X	-2.782	-2.816
S	0.845	0.424
Sx	0.0845	0.0424
Medijana	-2.8	-2.8
Mann-Whitney Rank Sum test	P<0.001	P<0.001

Table 5. Comparative evaluation of the value of T-score with UZ calcaneus in relation to maximum value of T score (DXA femur) within the respondents with osteoporosis (n=100)

Evaluation of T score (score ordering diagnostic assessment BMD) based on comparative studies (UZ calcaneus and DXA femur) showed a statistically significant difference and didnt show a distinct diagnostic sensitivity and specificity. Evaluation of T score (score ordering diagnostic assessment BMD) based on comparative studies (UZ calcaneus and lumbar spine DXA) showed a statistically significant difference and didnt show a distinct diagnostic sensitivity and specificity. Evalutation of the Z score (BMI value for a person

of the same sex and age) on the basis of data obtained by the comparative methods (ultrasound and DXA femur) showed the closeness and possibility of fast assessment of Z with ultrasound screening methods. Evaluation of the Z score (BMI value for a person of the same sex and age) on the basis of data obtained by the comparative method (ultrasound and DXA lumbar spine) shows a statistical closeness and possibility of fast assessment of Z score with ultrasound screening methods. Assessment of quality of life in patients with osteoporosis (physical function, pain, vitality, social life, emotional life, mental health and general health in general) shows a lower value in relation to the expected value for the group without osteoporosis. Evaluation of T scores on the basis of comparative studies (UZ calcaneus) and the lowest value of T scores (DXA lumbar spine and DXA femur) shows statisticly approximate values with the ability to predict the potential risk of osteoporotic fractures.

T score	Uz screening of T score of calcaneus	DXA screening of maximum T score of lumbar spine
Interval	-2.8,—3.9	-2.8,—3.9
N	100	100
X	-2.782	-2.872
S	0.845	0.912
Sx	0.0845	0.0912
Medijana	-2.8	-2.8
Mann-Whitney Rank Sum test	P=0.819	P=0.819

Table 6. Comparative evaluation of the value of T-score with UZ calcaneus in relation to maximum value of T score (DXA lumbar spine) within the respondents with osteoporosis (n=100)

5. CONCLUSION

Ultrasonic method of measuring BMD of calcaneus showed benefit of clinical use with the ability to predict the risk of osteoporotic fractures for patients with generalized osteoporosis with remarks on the importance of measurement conditions and the possibility of the influence of seasonal variations and variations of the temperature of the feet. All patients with the value of T score -2,5 and more,are necessary to refer to osteodensitometry, and after that, evaluation of the results and possible prescription of medications and supportive therapy.

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