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THE INCIDENCE AND LEVEL OF
OSTEOPOROTIC VERTEBRAL FRACTURES
IN RELATION TO AGE

UČESTALOST I NIVO VERTEBRALNIH
OSTEOPOROTIČNIH PRELOMA U ODNOSU
NA STAROSNU DOB

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Key words

osteoporosis, vertebral fractures, age

Ključne reči

osteoporoza, vertebralni prelomi,
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Abstract

INTRODUCTION: Vertebral fractures are the most common type of osteoporotic fractures and often remain unrecognized. They most frequently occur without major or visible trauma. Each vertebral fracture represents an increased risk of subsequent fracture, either vertebral or non-vertebral. It is considered that only one third of accidental vertebral fractures get to be described on radiography, so these fractures must be actively sought.

AIM: To examine the incidence and level of vertebral osteoporotic fractures in relation to age.

MATERIALS AND METHODS: Prospective study which included 1028 participants, out of 2457 examined in DXA Center during first six months 2011, who complied with treatment initiation criteria, either based on osteodensitometric findings or present of risk factors. All patients were done DXA scan of the hip and lumbar spine. Vertebral fractures were detected by examining the accompanying radiographs or with lateral scan (VFA) in patients who had indications. Also, all participants were examined for the presence of risk factors. For statistical analysis is used the "Bonlink" data processing program.

RESULTS: Average age of 98,97% women and 1,77% men was 64,13±8,32 years. The largest number of participants was in the age group 61-70 years (36.28%). All participants had low bone mineral density. Presence of previous low energetic fracture was the most common risk factor. Vertebral fracture was detected among 27,6% participants. Most frequent was existance of one vertebral fracture (68%) and those participants are 64,2 years old in average, existance of two vertebral fractures had 24% participants 70,9 years old in average and three or more fractures had 8% participants average age 79,5 years. In the older age groups, number of fractures increases, and among older than 80 years was the greatest number of participants with fractures (61.54%). The highest frequency of vertebral fractures was detected in the thoracolumbar transition and mid-lower thoracic spine.

CONCLUSION: The incidence of vertebral fractures increases with age and is higher in elderly patients. Age should be considered as an important invariant risk factor for osteoporotic vertebral fractures and it is necessary to influence other risk factors that are potentially variable to reduce the number of future fractures.

INTRODUCTION

Osteoporosis is a diffuse-skeletal metabolic disease of a chronic character, and is widely spread all over the world and in all races. Osteoporosis is characterized by reduced bone mass and impaired bone microarchitecture, which leads to bone fragility and increased risk of susceptibility to fractures (1). It is considered that 10% of population suffers from osteoporosis and that, by year 2020, the number of people suffering from this disease will increase for 30%, due to prolonged population life-span and ever growing negative, risk factors influence on bone quality. When considering the concept of osteoporosis, we first think of the consequences – and these are bone fractures. Fractures represent the main osteoporosis qualifier and, therefore, diagnostic and therapeutic measures are directed towards prevention of first fracture occurrence (2). Hip (3) and limbs (4) fractures, most frequently happen during a fall in the same level, causing severe pain and forcing the person to seek medical help. Vertebral fractures, most commonly occur without visible trauma (5) and they often do not cause the pain of such intensity, which would cause the person experiencing it, to start worrying (6). Vertebral fractures are the most frequent type of small trauma fracture (7,8). It is considered that 5% of women older than 50 and 25% older than 80 years have at least one spine fracture. Only one third of vertebral fractures get to be described on radiography, and it is more often in men (42%) than in women (22%) (9). Spine fractures are associated with lungs function impairment (10, 11, 12), chronic back pain (13, 14), body height loss (13), impaired posture (15), loss of self-confidence (6), abdomen disorders (6), disability (16), loss of independence (16) and mortality (17). Every fifth woman and every eight man who are older than 50 are at bone fracture risk. Mortality rate - 5 years after suffered vertebral fracture is almost 20% higher than the expected one (18) and it is higher in men than in women (19). Mortality rate increases with the number of vertebral fractures (20). Vertebral fracture presence, 4,4 times increases relative risk for a new vertebral fracture occurrence and increases the risk of non-vertebral fractures (21). Vertebral fracture presence represents a risk factor for a new fracture, independently from BMD value (22).

The golden standard for bone mineral density (BMD) evaluation is dual energy x-ray absorptiometry (DXA). Bone mineral density (BMD) testing represents a key factor in diagnosing osteoporosis, before occurrence of the fracture. World Health Organization (WHO) officially announced DXA as the best technique for BMD assessments in postmenopausal women and it based osteopenia and osteoporosis definitions on achieved results and interpreted it based on T score (the number of standard deviations-SD of patient's BMD above or below average BMD observed in young, healthy, adult person, a reference population member (23). A good health evaluation depends on both: the quality and DXA validity report, according to which, further decision on patient's treatment will be based (24).

In addition to osteodensitometry finding, risk factors for osteoporosis occurrence are very important. The National Osteoporosis Foundation, classified them in two groups:

unchangeable (previous small trauma fracture, old age, female sex, race, early menopause and fracture in first - line relative) and potentially changeable (low body mass, smoking, alcohol consumption, insufficient potassium intake, bad eyesight, frequent falls and inadequate physical activity) (25).

Bone density measuring, osteoporotic fracture risk identification and decision on the person to be treated represent optimal goals in evaluation of patients suffering from osteoporosis. Osteoporotic fractures prevention is primary goal in osteoporosis treatment (26).

THE AIM

To examine the incidence and level of vertebral osteoporotic fractures in relation to age.

MATERIALS AND METHODS

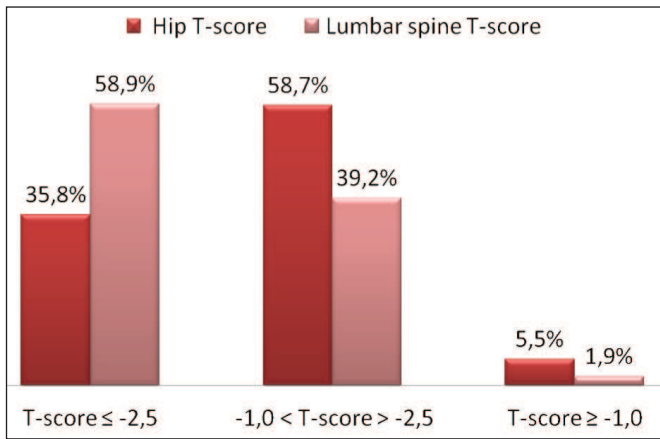
A prospective study included 2.457 patients, who were referred to Railway Healthcare Center, Belgrade, during the first six months of year 2011, for the purpose of osteodensitometry examination. Bone mineral density was measured on lumbar spine and on hip and Hologic Discovery C device was used. The results are expressed in absolute values g/cm² for bone mineral density values and in standard deviations (SD) i.e. in T-score and they are interpreted according to valid osteoporosis definition. According to ISCD recommendations, a lateral scan was done (IVA-Instant Vertebral Assessment) in the purpose of vertebral fractures detection. Also, IVA was done even in cases of suspicion that obtained result could influence the decision on further treatment of therapy change. The semiquantitative Grant's method on vertebral deformities analysis was used. Grades II and III of vertebral decreases were included in the analyses. Grade I was not included into analysis due to low specificity and sensitivity.

In participants who already done thoracic and lumbar spine RTG, lateral scan (IVA) wasn't done. Following data on risk factors existence was, as well taken into consideration: existence of previous small trauma fracture, positive family anamnesis in respect to fractures, early menopause, smoking, low body mass index (BMI), corticosteroid therapy, rheumatoid arthritis, presence of autoimmune disease, alcohol consumption (more than 3 units/day), frequent falls (more than 3 annually). Out of 2.457 examined patients, 1.028 patient complied with treatment initiation criteria, either based on osteodensitometry finding or present risk factors, and they were further analyzed in the study. In the statistical analysis, a „Bonlink” data processing program was used.

RESULTS

The sample included 1.028 subjects, as follows: 98,33% (1001/1028) were postmenopausal women and 1,77% (17/1028) were men, older than 50 years.

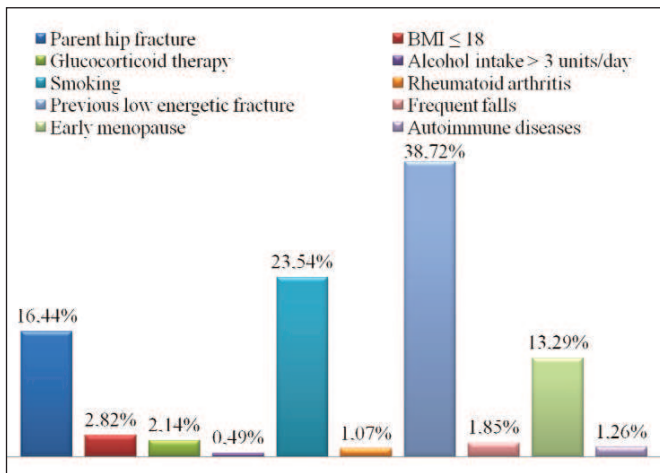
Average bone mineral density in subjects on L-spine was 0.818±0.23 g/cm³ and on hip, it was 0.719±0.140 g/cm³ (graph 1).



Graph 1. Values of T-score on hip and lumbar spine

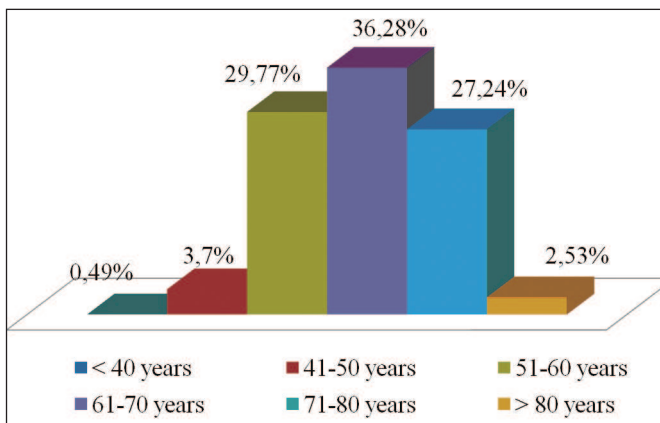
All subjects had decreased BMD values on spine and/or on hip.

Data on the risk factors incidence in respect to susceptibility to osteoporosis and, therefore, fractures, are shown in graph 2.



Graph 2. Distribution of risk factors

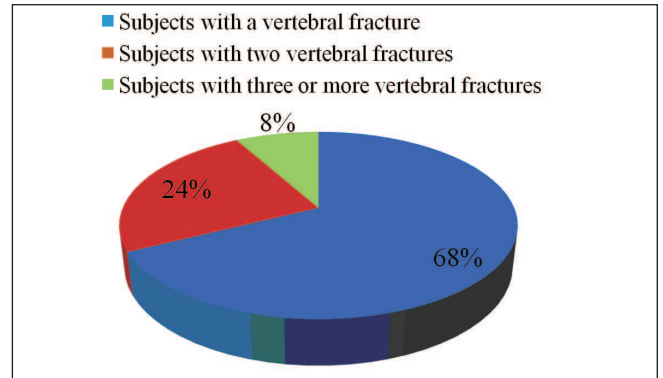
The most common of all risk factors are as follows: existence of previous small trauma fracture, smoking, hip fracture presence in the family and early menopause in women. Next are the risk factors with low incidence: low BMI, glucocorticoid therapy, propensity to falls, presence of autoimmune diseases, rheumatoid arthritis and alcohol consumption.



Graph 3. Distribution of subjects according to age groups.

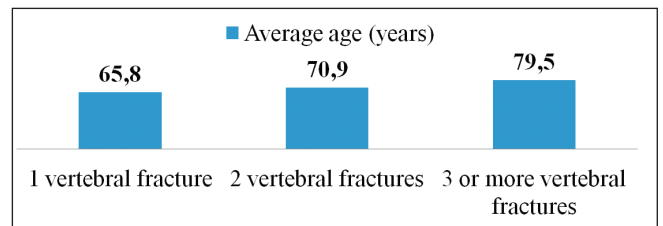
The average age of subjects was 64,13±8,32 years. Distribution of subjects according to age groups has shown that the most subjects are of the age between 60 and 70 (graph 3).

Out of total subject's number, 49% (505/1028) have previously suffered from a small trauma fracture, as the risk factor. Out of them, 60,4% (305/505) have suffered a non-vertebral fracture (forearm, hip, upper arm, shank, ribs, hand, foot), while 56,2% (284/505) of subjects have suffered from a vertebral fracture. Vertebral fractures prevalence, within examined group, was 27,62% (284/1028); 13% of subjects (67/505) had vertebral and non-vertebral fracture presence. The number of fractures incidence in subjects with vertebral fracture is shown in graph 4.



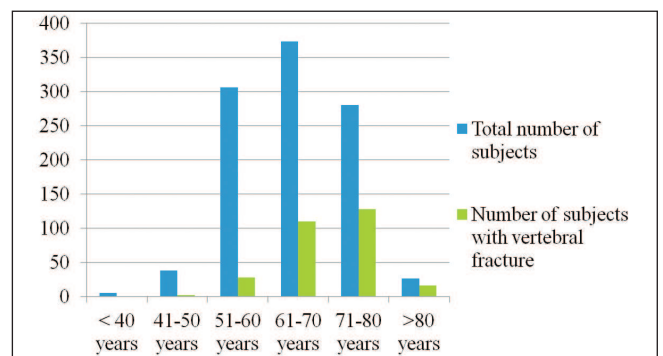
Graph 4. Incidence of number of vertebral fractures.

Subjects with higher number of fractures are also of older age, as it is shown in the graph 5.



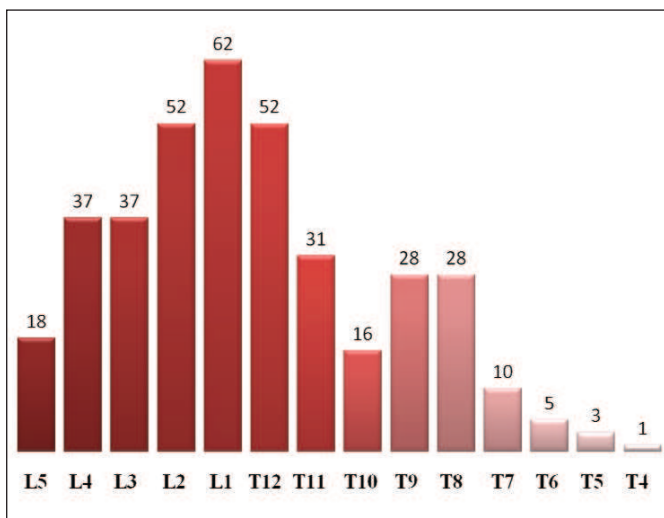
Graph 5. Number of vertebral fractures in relation of age.

The incidence of vertebral fractures increases with subject's age. Therefore, in subjects younger than 40, there were no vertebral fractures. Within age group between 41 and 50 years old, only 5,26% of subjects had a vertebral fracture, within the age group 51- 60 the result is 9,15% ; age group 61-70 the result is 29,49%; age group 71-80: 45,71% and the highest result is detected in age group older than 80: 61,54% subjects (graph 6).



Graph 6. Vertebral Fracture Incidence in relation of age.

If we observe the level of fractures on spine, the most frequent vertebral fractures are detected on thoracolumbar passage and middle-lower thoracic part (graph 7).



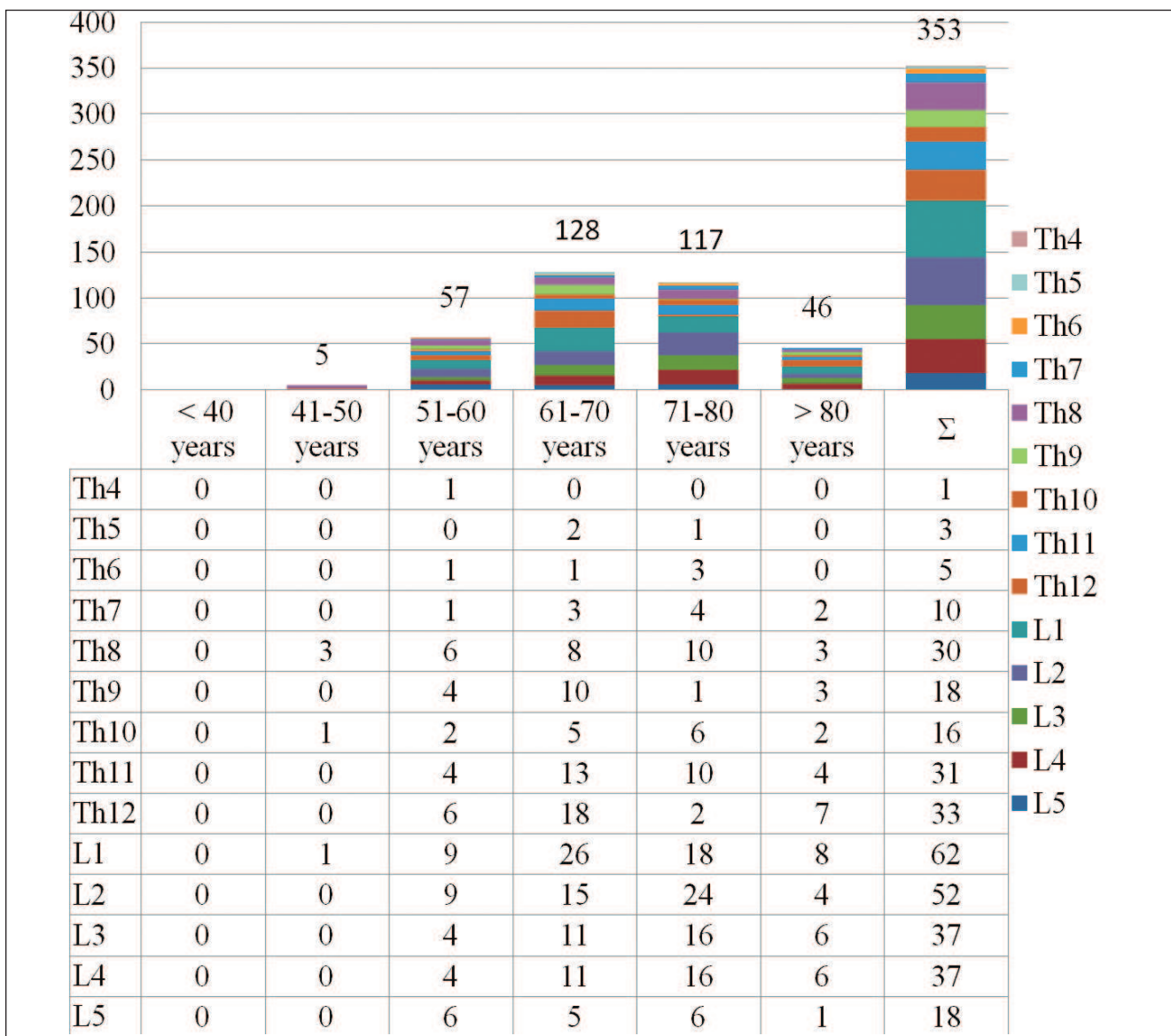
Graph 7. Fracture incidence of particular vertebral bodies.

The largest number of fractures in subjects with age 41-50, was on Th8 vertebral body level, in subjects with age from 51-60 it was on L1 and L2 vertebra, in age group 61-70 years on L1, in age group 71-80 on L2 and in older than 80, on L1 vertebra (graph 8).

DISCUSSION

Diagnosis of osteoporosis is not simple, because it's development is without symptoms and signs until complications, in the form of fractures, occur. There are no precise methods, for now, that could be widely applied for early detection purpose. Due to the fact that osteoporosis development is asymptomatic, more than 50% of women suffering from osteoporosis are not diagnosed.

According to current, contemporary positions, it is necessary to actively search for persons who have clinical risk factors for fractures, because, sometimes they are even more important than data obtained by dual x-ray absorptiometry (DXA) method in bone mineral density testing. Reduction in bone mineral density is a certain and independent fracture risk factor. Bone density reduction for 1SD (approximately 10% of bone mass) increases the fracture risk for 1,4-2,6



Graph 8. Fracture incidence of particular vertebral bodies in respect to age.

times (27). We found, in our study, that almost 60% of subjects suffered from osteoporosis on lumbar spine or on hip. Out of all localizations, BMD measuring on femur and vertebral column are the best to predict fracture susceptibility on stated localizations (26). However, osteodensitometry finding is not sufficient for diagnosis setting, except in cases when, according to WHO recommendation, a T-score is $\leq -2,5$ SD and worse (28,29), due to the fact that such BMD reduction is a certain fracture risk factor. One study, that was conducted in USA and included 200.000 women, showed that the largest number of female subjects with fracture had T-score $-1,8$ SD, and/or the finding corresponding to osteopenia (28). This means that, in addition to reduced BMD, other factors are also important for diagnosing purposes and they are: genetic and acquired, changeable and unchangeable. Our study has shown that the most frequent risk factor has been previous small trauma fracture, then smoking, presence of hip fractures in the family and early menopause in women. The study which included 1246 patients in our country and which surveyed vertebral fracture frequency, as the result obtained the following most frequent risk factors in subjects with vertebral fracture: low BMI (93,5%), previous small trauma fracture (69,6%), early menopause in women (19,6%) and glucocorticoid therapy (15,2%) (30). The study which included men and which surveyed predictive factors in reference with osteoporosis occurrence, had distinguished low BMD, previous fractures, rheumatoid arthritis and low BMI, while the number of risk factors had not shown significant importance (31).

Vertebral fractures are the most common fracture localizations in patients with osteoporosis. The importance of early vertebral fracture diagnosis is great; because 3/4 of them are without any clinical symptoms and remain unrecognized (32). It is known that 40% of women and 13% of men, during their life-span, get a fracture due to osteoporosis (33). In prospective multicentre IMPACT study, it is indicated that vertebral fracture diagnosing problem existed all over the world and that in 1/3 of patients they remain undiagnosed (34). The results of European study on vertebral fracture prevalence from year 1996, indicate that, according to standard radiographic finding, in women and men who are older than 50, vertebral fractures can be found in 24% and 10% of subjects, respectively and that their prevalence increases for 5% to 50% between the age of 50 and 95, and that they can be found in elderly population, even up to 74% (35).

The age represents unchanged risk factor for susceptibility to osteoporosis and osteoporotic fractures. The results of our study show that the age is certain predictor of vertebral fractures with presence less than 10% in subjects younger than 60 and higher than 25% in subjects with age between 61 and 70; higher than 45% in older than 70 years and higher than 60% in older than 80 years, who have therapy initiation criteria, at the moment of diagnosing. Total, vertebral fractures presence is 27,62%. Similar data are also obtained during examination conducted in Spain, where it was found as follows: vertebral fracture prevalence of 7,2% within age group 55-59 years and 46,3% in the group of older than 75 years (total prevalence 21,4%) (36). In the study, which was conducted in Vietnam, the total vertebral fracture prevalence was 23%, and it was 17,1% in younger than 60 years and

39,2% in older than 70 (37). The research, which has been conducted in our country, shows the highest incidence of osteoporotic vertebral fractures in age group 61-70 years (20, 38, 39).

Our study has shown that average subject's age increases with number of vertebral fractures. So, the subjects with one vertebral fracture are 65,8 years old in average, population members with two detected vertebral fractures are 70,9 years old in average and population members with three and more fractures have average age of 79,5 years. The risk of future vertebral fracture increases with the number of vertebral fractures, which can explain the fact that subjects with larger number of fractures are elderly population members (32).

In respect to presence of vertebral fracture levels, we obtained similar results as other researchers from Serbia (38, 40). The largest number of fractures occurred on thoracolumbar passing (Th12, L1, and L2) and medium-lower thoracic region (Th8, Th9). These are mechanically the most burdened vertebral column parts. Kyphosis is expressed the most in thoracic region while burden during flexion is enhanced and in thoracic-lumbar junction, a relatively rigid thoracic spine continues itself to more freely mobile lumbar segment. In other studies, it is stated that the largest fracture numbers occur in the medium part of thoracic spine (Th5-Th9) and thoracolumbar passing (41, 42). In respect to age groups, frequency of fracture levels was rather uniform in older than 50 years. In these subjects, the most frequent were fractures on Th11, Th12 L1 and L2, then, for almost one half less, on L3 and L4 and somewhat lesser on Th8 and Th9 vertebral bodies.

Within age group 61-70 years, the largest number of fractures was found on Th12, L1 and L2, within age group 71-80 years on L1 and L2, and in older than 80 years on Th12, L1, L3 and L4. In subjects, who are younger than 50 years, there was a small number with vertebral fracture, mostly on Th8. A lateral scan (VFA) has been used in fracture diagnostics; it possesses 92% sensitivity and 96% specificity in detection of II and III grade fractures. It is a very simple method, with small amount of radiation and it can be done immediately after DXA scan. This method offers significant data on the existence of vertebral fractures. In addition, there is a significant congruence in VFA and radiography visual evaluation and, therefore, this method should be used whenever there are indications.

CONCLUSION

Vertebral fractures incidence increases with age and it is higher in elderly patients. The age of the patient should be observed as an important, unchangeable risk factor for osteoporotic fractures occurrence and it is necessary to influence other risk factors, which are potentially changeable, in order to reduce future fractures. Vertebral fracture presence is a powerful future fractures risk factor, either for the new ones on vertebral column, hip or on other places. The largest number of these fractures occurs on mechanically most burdened parts, on thoracolumbar passing and medial-lower part of thoracic spine. Vertebral fractures should be actively searched for, due to the fact that they, sometimes, get diagnosed late and their presence is of importance to us, for the purpose of treatment initiation, as well as, for the therapy selection.

Sažetak

UVOD: Vertebralni prelomi su najčešći tip osteoporotičnog preloma i često ostaju neprepoznati. Najčešće se javljaju bez veće ili vidljive traume. Svaki vertebralni prelom predstavlja povećani rizik za naredni prelom, vertebralni i/ili nevertebralni. Smatra se da samo trećina akcidentalnih vertebralnih preloma se detektuje radiografski te ih treba aktivno tražiti.

CILJ: Ispitati učestalost i nivo vertebralnih osteoporotičnih preloma u odnosu na starosnu dob ispitanika.

MATERIJAL I METODE: Prospektivna studija koja je od 2457 pregledanih, tokom prvih šest meseci 2011. g., u DXA centru uključila 1028 ispitanika koji su ispunjavali kriterijume za lečenje bilo na osnovu DXA nalaza i/ili prisutnih faktora rizika. Svim ispitanicima je rađen DXA sken na kuku i kičmi. Vertebralne frakture su detektovane uvidom u priložene radiografske nalaze ili je rađen lateralni scan (VFA) kod pacijenata koji su imali indikacije. Takođe, svi su ispitivani su na prisustvo faktora rizika. U statističkoj analizi korišćen je „Bonlink“ program za obradu podataka.

REZULTATI: Prosečna starosna dob 98,97% žena i 1,77% muškaraca je bila 64,13±8,32 godina. Najveći broj ispitanika je bio u starosnoj grupi 61-70 godina (36,28%). Svi ispitanici su imali sniženu mineralnu koštanu gustinu. Od prisutnih faktora rizika najzastupljeniji je bio postojanje prethodnog preloma na malu traumu. Vertebralni prelom je bio prisutan kod 27,6% ispitanika, od kojih je najveći broj imao prisustvo jednog vertebralnog preloma (68%) sa prosečnom starošću 64,2 godine, sa 2 vertebralna preloma 24% prosečne starosti 70,9 god. i 3 i više 8% ispitanika prosečne starosti 79,5 god. Po starosnim dobnim grupama raste i broj preloma te ih je najviše kod starijih od 80 godina (61,54%).

ZAKLJUČAK: Učestalost vertebralnih preloma raste sa godinama i veća je kod pacijenata starije životne dobi. Starosnu dob pacijenata treba posmatrati kao važan nepromenljivi faktor rizika za nastanak vertebralnih osteoporotičnih preloma i neophodno je uticati na druge faktore rizika koji su potencijalno promenljivi kako bi se smanjio broj budućih preloma.

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