Original article

EFFECT OF HEMODIALYSIS DURATION, AGE AND GENDER ON EMERGENCE OF RENAL OSTEODYSTROPHY SYMPTOMS

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The study comprised 185 patients at the hemodialysis (HD) in the hemodialytic center of the Clinic of Nephrology of the Clinical Center Nis. The factors analyzed in the hemodialytic patients were: duration of hemodialysis according to which the patients were divided into two groups (shorter and longer than 5 years), age on the basis of which the patients were divided into three groups (younger than 30, subjects of 30 to 60 years of age, and older than 60, and gender. In all 185 hemodialytic patients the most frequent symptoms of renal osteodystrophy were investigated on the basis of visualization and the use of verbal symptoms score (VSS). For the statistical processing, the student t-test and the Mantzel Haencel tests were used, while the differences at the levels $p < 0.01$ and $p<0.05$ were taken as statistically significant and were shown in diagrams and tables. The results of the research showed that of a significantly higher frequency and intensity of pain in the bones, muscles and joints as well as the emergence of spontaneous fractures and/or skeletal deformations in the group which is on HD for more than 5 years, while the emergence of itching, fatigue and wearisome walking were insignificant with respect to the group which was on the HD for less than 5 years. The impact of gender upon the emergence of subjective symptoms of renal osteodystrophy did not show any significance, while the influence of old age showed statistical significance for the emergence of pain in the bones, muscles and joints in addition to spontaneous fractures and/or skeletal deformations in the group of examinees of 30 to 60 years of age and older than 60. *Acta Medica Medianae 2008;47(4):19-24.*

Key words: symptoms, renal osteodystrophy,hemodyalisis,age, gender

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Introduction

The patients suffering from chronic renal insufficiency (CRI) are subjected to hemodialysis during which the blood of the uremic patient is "cleansed" of detrimental substances while passing through semipermeable membrane on the other side of which the liquid (dialysate) is flowing. During the chronic dialysis, a great number of patients are experiencing the so-called chronic complications which are most often manifested in the emergence of renal osteodystrophy, anemia, polyneuropathy, hypertension and hypotension states (1,2).

Renal osteodystrophy is an early complication of the kidney weakness which is developed even in the early stages of the CRI. Renal osteodystrophy is characterized by clinic signs and symptoms, biochemical abnormalities (especially Ca, P, PTH – parathyroid hormones) and changes of the vitamin D concentration and its metabolites along with structural and functional changes of the bone tissue, such as: pain in the bones, pain in the joints, anxiety, forgetfulness, itching, sense of weakness, headaches, and the like, while the objective symptoms include periarthritis, fractures and bone deformities, bone cysts, osteopathy, myopathy, extraskeletal calcifications, ruptures of tendon and the like (2,3).

On the basis of the histological characteristics, renal osteodystrophy can be divided into four groups:

1. brain uremic osteodystrophy–comprising moderate to mean manifested hyperparathyroid disease of bones and defect mineralization,
2. aluminum-induced bone diseases – can be seen to a different degree in all the groups of renal osteodystrophy,
3. renal osteodystrophy of slowed-down passing – comprising two entities: a) adynamic bone disease and, b) osteomalacia, and
4. renal osteodystrophy of accelerated passing or secondary hyperthyreoidism (2HPT) (4,5,6).

Aims

The aim of the research was to determine whether there was any influence of some factors such as the duration of hemodialysis, gender and age of hemodialytic patients on the emergence of the symptoms of renal osteodystrophy, which thus implied their impact upon the quality of life of hemodialytic patients.

Material and methods

The research comprised all 185 patients who were at the chronic hemodialysis program in the Dialytic Center of the Clinic of Nephrology of the

Clinical Center Nis. In this study, the hemodialytic patients were divided into respective groups depending on the factor being examined. Regarding the duration of the HD, the hemodialytic patients were divided into two groups, namely, the first one comprised those patients who were on HD in the period less than 5 years, while the second one was made up of the patients who were on HD for more than 5 years. Regarding the age, the hemodialytic patients were divided into three age groups: the first group was made up of the examinees up to 30 years of age, the second comprised those of 30 to 60 years of age, and the third included patients over 60. In all the cases we had at our disposal all the facts regarding the duration of hemodialysis, patients' age, gender and the basic renal disease of each one of them.

During our research, the polling of patients was performed individually. The patients were asked previously-prepared questions and their replies were recorded. The total of the prepared questions was 24 divided into 2 groups. The first group comprised the questions related to general data about the patient and the disease. The second group comprised those related to the most typical symptoms emerging in renal osteodystrophy and there were 9 including 6 of those offering answers linked to the intensity of the subjective symptoms' manifestations (pain in the bones, pain in the muscles, a sense of fatigue and weakness, pain in the joints, difficulties with walking, itching); 2 questions referring to the objective symptoms (calciphylaxis and skeleton deformities) while 1 question referred to the frequency of the emergence of pain in the bones and muscles. The intensity of the symptoms' manifestations was determined in all the patients on the basis of visualization of the objective symptoms while for the subjective ones the system of the verbal symptom score or VSS was used (0-no symptoms, 1-weak symptom manifestation, 2–moderate symptom manifestation (bearable), 3 – strong symptom manifestation and 4 – very strong symptom manifestation). The symptoms which were regarded as aftermaths of other pathological processes and traumas were not taken into consideration. Visualization enabled the determination of whether an objective symptom was present or not.

In addition to the symptom investigation, the age and gender structure of all the hemodialytic patients was presented.

Each answer was carefully and precisely recorded, while those that were beyond the scope of the offered ones were recorded as additional ones that were also included in the analysis.

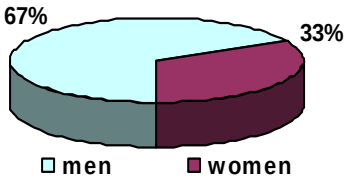
The patients were treated by hemodialysis from one to three times a week for 4 hours by capillary dyalisators with polysulfone in 90% and hemophane membrane in 10% of the cases.

All the patients were on the bicarbonate hemodialysis.

For determination of the level of the statistical significance regarding the presence of the above-mentioned symptoms of renal osteodystrophy, the Student t-test and the Mantzel Haencel test were used while the differences at the level $p < 0.01$ and $p<0.05$ were taken as statistically significant. This and other data were processed by PC using the commercial Microsoft Excel 2003 program.

Results

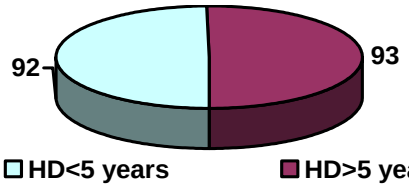
The overall number of patients included 124 men (67.2%) and 61 women (32,9%) (Graph 1). The average age of the patients was 58.66± 12.13 years. The greatest number of the patients ranged between 30 and 60 years of age, 99 of them (Table 1). The average age of the patients in the first group regarding the HD duration was 59.25±12.83 years, while in the second group regarding the HD duration it was 58.09±11.44 years. The number of patients increased with increasing age in both groups regarding the HD duration so that the number of patients was considerably larger in the second age group with respect to the first one and somewhat greater with respect to the third age group (Table 1). Regarding the HD duration, the first group comprised 92 examinees while the second group comprised 93 examinees (Graph 2).



Graph 1. Gender structure of the patients

Table 1. Age structure of the patients at the Hemodialysis depending HD duration

Years of age	<5 years n (%)	>5 years n (%)	Total n (%)
<30 years.	3 (1.62)	2 (1.08)	5 (2.70)
30–60 years.	47 (25.40)	52 (28.11)	99 (53.51)
>60 years.	42 (22.71)	39 (21.08)	81 (43.78)
Σ	92 (49.73)	93 (50.27)	185 (100)



Graph 2. Number of patients regarding the HD duration

Subjective symptoms

Regarding the subjective symptoms with respect to the HD duration, pains in the bones, joints and muscles as well as their frequency of emergence were statistically significant between the first and the second group of the examinees, while for the feeling of fatigue and weakness, as well as itching and walking difficulties, the emergence was statistically insignificant.

As for the presence and intensity of the subjective symptoms' manifestation with respect to the gender of the hemodialytic patients, the statistical significance became prominent only with the emergence of itching where itching was more present in men than in women ($p<0.05$, $\chi^2=5.73$).

Table 2. Values of manifestation of subjective symptoms in the examined groups regarding HD duration

HD duration (in years))	Pain in the bones	Pain in the muscles	Pain in the joints	Feeling of fatigue and weakness	Walking difficulties	Itching
	(X ± SD)	(X ± SD)	(X ± SD)	(X ± SD)	(X ± SD)	(X ± SD)
0-5	1.21 ± 1.41	1.87 ± 1.29	1.37 ± 1.44	2.03 ± 1.14	1.90 ± 1.44	1.96 ± 1.37
>5	2.16 ± 1.45	3.00 ± 2.11	2.34 ± 1.54	2.03 ± 1.14	1.87 ± 1.46	1.90 ± 1.46
	p<0.001	p<0.001	p<0.001	p=NS	p=NS	p=NS

Table 3. Presence of subjective symptoms regarding the gender of the hemodialytic patients

Gender structure	Total in the group	Pain in the bones	Pain in the muscles	Pain in the joints	Feeling of fatigue and weakness	Walking difficulties	Itching
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Men	124 (100)	71 (57.26)	91(73.39)	73(58.87)	101(81.45)	85(68.55)	94(75.81)
Women	61 (100)	39 (63.93)	46(75.41)	39(63.93)	49(80.33)	41(67.21)	35(57.38)
		p=NS	p=NS	p=NS	p=NS	p=NS	p<0.05 χ^2 = 5.73

Table 4. Presence of subjective symptoms in regard to age of the hemodialytic patients

Years of age	Total in the group	Pain in the bones	Pain in the muscles	Pain in the joints	Years of age	Total in the group	Pain in the bones
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
10-30	5 (2.70)	0 (0.00)	0 (0.00)	0 (0.00)	3 (1.62)	0 (0.00)	1 (0.54)
31-60	99 (53.51)	56 (30.27)	65 (35.14)	78 (42.16)	80 (43.24)	59 (31.89)	66 (35.68)
>60	81 (43.78)	53 (28.65)	69 (37.30)	55 (29.73)	70 (37.84)	66 (35.68)	60 (32.43)
Σ	185 (100)	109 (58.92)	138 (74.59)	133 (71.89)	153 (82.70)	125 (67.57)	127 (68.65)
p1-2		p<0.05 χ^2 = 4.06	p=NS	p<0.001 χ^2 = 11.83	p=NS	p<0.05 χ^2 = 4.67	p=NS
p2-3		p=NS	p<0.01 χ^2 = 7.93	p=NS	p=NS	p<0.01 χ^2 = 9.05	p=NS
p1-3		p<0.05 χ^2 = 5.98	p<0.01 χ^2 = 9.26	p<0.01 χ^2 = 6.70	p=NS	p<0.001 χ^2 = 13.25	p<0.05 χ^2 = 4.31

As for the impact of the years of age upon the emergence and intensity of the subjective symptoms, there was no pain in the bones in the first age group while in the second group the greatest number of examinees reported this symptom; it was somewhat smaller in the third group so that statistical significance of this factor was present in the inter-comparison of the first group with the second and third one (p<0.05). Pain in the muscles was statistically significant compared to the second and the third ones, and especially when the first and the third age groups of examinees were compared (p<0.01, χ^2 =9.26). Of special importance was the emergence of pain in the joints of the hemodialytic examinees aged between 30 and 60 years, which reduced the quality of their lives to a great extent with respect to the younger population of examinees (p<0.001,χ^2 =11.83), and to a smaller degree with respect to the older population of examinees. The feeling of fatigue and weakness showed no statistical significance for all the three age groups.

Walking difficulties were not found in the first age group, but almost the same large number of examinees had this complaint in the second and third age group, which was statistically confirmed and which pointed to the fact that age of examinees was influental when it came to the emergence of these symptoms. Itching, comparing to healthy people, emerged significantly when the youngest and the oldest groups were compared (p<0.05, χ^2 =4.31).

Calciphylaxis and skeletal deformities

In the first group of examinees, that is, the group which was up to 5 years of HD duration, of the total number of 92 examinees, 90 denied while the examination of two examinees confirmed the existence of changes on the skin, which pointed to calciphylaxis, while in the second group (total of 93 patients) 88 had no changes unlike 5 of them who had caliphaxis-indicative skin changes. In this situation, there was no statistical significance for the emergence of caliphaxis regarding the duration of the hemodialysis for both groups, P=NS.

Table 5. Presence of calciphylaxis and skeletal deformities with respect to hemodialysis duration

HD duration (in years)	Caliphaxis/skin changes		Skeletal deformities/spontaneous fractures	
	No (%)	Yes (%)	No (%)	Yes (%)
0-5	90 (48.64)	2 (1.08)	87 (52.41)	5 (26.31)
>5	88 (47.50)	5 (2.71)	79 (47.59)	14 (73.69)
p	P=NS	P=NS (χ^2=0.57)	P=NS	p<0.01 (χ =8.73)

Regarding the presence of acquired skeletal deformities and/or spontaneous bone fractures: in the first group 77 examinees had not any, while

15 had skeletal deformities; in the second group 59 patients had not any, while 34 of them had or had had skeletal deformities, that is, spontaneous bone fractures. There was a marked increase in the number of examines of the second group when compared to the first group regarding skeletal deformities, which statistically pointed to significance of $p<0.01$ ($\chi^2 = 8.73$).

Statistically, no direct correlation of gender with the emergence of calciphylaxis and skeletal deformities of bones in hemodialytic patients was proved.

Table 6 Effect of gender upon the emergence of calciphylaxis and skeletal deformities

Gender structure	Caliphaxis/skin changes		Skeletal deformities/ spontaneous fractures	
	absent (%)	present (%)	absent (%)	present (%)
Men	119(64.32)	5(2.70)	109(58.92)	15(8.11)
Women	59(31.89)	2(1.08)	57(30.81)	4(2.16)
p	P=NS	P=NS	P=NS	P=NS

As for calciphaxus and years of age, there was no statistical significance in any of the three age groups nor when they were mutually compared. When it came to the presence of skeletal deformities and/or skeletal bone fracture, the only significant difference that could be noticed was between the second and the third age groups of examinees for the probability of even 95% ($p<0.05$, $\chi^2=5.83$).

Table 7. Emergence of caliphaxys and skeletal deformities with respect to the age of hemodialytic patients

Age	Caliphaxys/ skin changes		Skeletal changes/ spontaneous fractures	
	absent (%)	present (%)	absent (%)	present (%)
10-30	5 (2.70)	0 (0.00)	5 (2.70)	0 (0.00)
31-60	97 (52.43)	2 (1.08)	94 (50.81)	5 (2.70)
>60	76 (41.08)	5 (2.70)	67 (36.22)	14(7.57)
p1-2	P=NS	P=NS	P=NS	P=NS
p2-3	P=NS	P=NS	P=NS	$p<0.05$ ($\chi^2=5.83$)
p1-3	P=NS	P=NS	P=NS	P=NS

Discussion

The subjective symptoms of renal osteodystrophy can, to a large degree, reduce the quality of life of the hemodialytic patients in the sense of the prevention of normal functioning as well as performing the basic life needs, so that it is of great importance to note every symptom and sign of renal osteodystrophy, their monitoring and curing.

The subjective symptoms in renal osteodystrophy emerge due to defect mineralization of the bones by depositing aluminum in the bones and the emergence of hypercalcemia that makes it easier and faster to discharge calcium and phosphorus into soft tissues, thus causing calcifications.

Duration of hemodialysis

One of the more important problems posed in this study was whether the duration of the HD affected the emergence and development of pain in the bones, muscles and joints. Numerous studies done by Janice et al. (7), Buargub et al. (8), Schwarz et al. (9) as well as our study show that there is an important influence as pointed out by statistical significance between these two groups of examinees concerning the emergence of the given symptoms, and that even despite the regular symptomatic therapy the development of renal oseodystrophy still goes on.

The feeling of fatigue and walking difficulties in our study have no statistical significance for the reason that a great and approximately the same number of the examinees of both groups have these symptoms, as has been found in the study by Buargub et al. (8) in which out of 103 examinees, even 95 of them have these symptoms, so that it can be concluded that in the early phase of renal osteodystrophy these symptoms appear also as a consequence of other metabolic processes related to renal insufficiency regardless of renal osteodystrophy as also pointed out by Janice et al. (7), Schwarz et al. (9).

Calciphylaxis emerges within hypercalcemia that makes it easier and faster to discharge calcium and phosphorus into the soft tissues; thus, it worsens the degree of vascular calcification. Calciphylaxis is characterized by peripheral ischemic necrosis and wide calcification in the medium of median and small arteries, especially located in the subcutaneous tissues (1,2,6). In our study, the duration of hemodialysis does not represent any important factor for the emergence of calciphylaxis since the increase of the presence of calcification is noted only for 3 percent, that is about 1,6%, which is statistically proved.

The study done by John et al. (10) comprised 200 hemodialytic patients of both groups of examinees regarding the HD duration, which showed an increase of the emergence of calciphylaxis by 4% in the second group with respect to the first-control group which showed statistical insignificance, that is there is no significant increase of the number of patients with calciphylaxis. Chandran et al. (11) in their study done on 135 patients show that the emergence of calciphylaxis in the control group is 9%, while in the second group it is even 42%, which leads to important statistical significance. However, Chandran et al. (11) note every non-specific skin change that could point to calciphylaxis even when it is not calciphylaxis. The emergence of calciphylaxis is present in the patients who have been on hemodialysis for long, usually for more than 15 years, as well as in those who do not take or who irregularly take drugs. This number of patients is very small so that the emergence of caliphaxis is expected in a very small number (10,11).

Skeletal deformities

In chronic renal insufficiency, parathyroid glands are stimulated to release PTH-parathormone as a consequence of the low level of circulating calcium (3). Parathormone increases osteoblastic and osteoclastic activity; the formation and resorption of the bones are quickened and the image of osteitis fibrosa is formed which can be manifested in skeletal deformities or pathological bone fractures which emerge only in 2% of patients, as noted by Chandran et al. (11) up to

45% of patients as in the study of John et al. (10), while the study by John et al. (10) has even 38% of patients with a serious form of secondary hyperparathyroidism. In our research, this percentage moves from approximately 5.5% with respect to those who do not have it - for the first group - to even 15% for those who do not have it - for the second group - in which 22% examines have serious hyperparathyroidism. Our research has shown that there is important statistical significance, that is, that there is an important increase of patients with spontaneous bone fractures and/or skeletal deformities in the second group with respect to the first one $p<0.01$ ($\chi^2=8.73$). On the basis of the aforementioned, it can be seen that the presence of skeletal deformities and spontaneous bone fractures is directly dependent on the level of the development of secondary hyperparathyroidism (10, 11).

Gender structure

As for gender and the emergence of the symptoms of renal osteodystrophy, our study showed that gender had no important influence upon the emergence of subjective symptoms except when it came to itching which was almost two and a half times more frequent in men (12). Tomanoski et al. (13) state that gender is of smaller importance as a factor in the development of the symptoms of renal osteodystrophy, while smaller differences conditioned by the hormone disbalance of some patients are also possible. Stolic et al. (12) state that the persistently high levels of phosphorus are the main factor for the symptom's manifestation in advanced secondary hyperparathyroidism and probably a high dose of PTH-parathyroid hormone regardless of the gender of the patient.

Gender plays no role for the emergence of calciphilaxis in hemodialytic patients, which our study proved to be statistically insignificant. John et al. (10) and Tomanoski et al. (13) in their studies come to the same conclusion exactly because the number of patients with calciphylaxis with respect to the overall number of hemodialytic patients for each of the given groups is very small.

Our study did not show that gender played any importance when it came to the emergence of skeletal deformities and/or spontaneous bone fractures as is the case in the research study done by John et al. (10) and Chandran et al. (11).

Age

Our study showed that there was an important difference in the emergence of pain in the bones between the first and the second group ($p<0.05$, $\chi^2=4.06$), as well as a difference between the first age and the third group ($p<0.05$, ($\chi^2=5.98$). This points out that age in respect to the first group – in our case, the group with no symptoms – affects the emergence of pain in the bones as the symptoms of renal osteodystrophy. The pain in the muscles in the second and in the third groups emerges in approximately the same number of patients but, while comparing with the first group which has no symptoms, there is significance in the relationship between the second and the third groups ($p<0.01$ ($\chi^2=7.93$), especially with respect to the first and third age groups ($p<0.01$ ($\chi^2=9.26$). This points out that age of hemodialytic patients represents an important factor for the development of renal osteodystrophy.

No pain in the joints emerged in any of the examines up to 30 years of age unlike even 78 of the examinees of 30 to 60 years of age in addition to 55 examinees of over 60 years of age. This shows that even the physical efforts that are the most present in the second age group are joined by the development of the renal osteodystrophy symptoms as also shown by Tomanoski (13) as well as Janice et al. (7) stating that middle-aged patients have the most prominent complaints with the joints.

The feeling of fatigue and weakness is not directly associated with years of age in hemodialytic patients in our study, as pointed by Tomanoski (13); only Buargub et al. (8) in their paper on 103 examinees remark that, with small probability, there is correlation between fatigue and age when hemodialytic patients are compared to healthy subjects, while it is not in direct correlation with the hemodialytic process.

Walking difficulties in our study are shown to be a symptom that is considerably more frequent in older subjects on hemodialysis with respect to the first age group of examinees, which means that age represents a strong factor for the emergence of this symptom in renal osteodystrophy with respect to healthy population, as also pointed out in the studies done by Petrovic et al. (4), Tomanoski (13) where the differences between the examinees were more divergent, even by 15%.

Itching does not seem to exert any great influence with respect to age, except in comparison between the youngest and the oldest groups of examinees, as is the case in the study by Stolic et al. (12) who state that age is important for the emergence of itching in the oldest hemodialytic patients, while excluding all other factors for the emergence of itching with respect to itching-free persons.

All the three age groups of hemodialytic examinees do not exhibit statistical significance for the emergence of caliphylaxis, since only two people in the second and five in the third group have this symptom. John et al. (10) state that per total of 200 patients only three of them have calciphylaxis, while Chandran et al. (11) find, per 135 examinees, 4 patients with calciphylaxis and thus they prove that age is of small importance for the emergence of this symptom.

In 5 examinees in the second group or even 14 examinees (7.5%) in the third age group there occur skeletal deformities and/or pathological bone fractures. Comparing the second with the third age group shows statistical significance ($p<0.05$ ($\chi^2=5.83$), that proves age to be included in the factors contributing to the emergence of skeletal deformities with respect to healthy subjects. The studies done by John et al. (10) Stolic et al. (12) point to the same phenomenon and the importance of age for the emergence of skeletal deformities while Buargub et al. (8) have not obtained any statistical significance by comparing age groups on all 103 examinees.

Conclusions

The duration of hemodialysis represents an important factor for the emergence of pain in the bones, joints and muscles, as well as skeletal

deformities and thus affects the development of the renal osteodystrophy symptomatology as can be noticed in the patients who have been on hemodialysis for more than 5 years. The frequency of the emergence of pain in the bones and joints differ in many studies depending on the application of respective therapies, discipline of the patients themselves regarding drug-taking and the hemodialysis quality.

The emergence of fatigue, itching, walking difficulties and calciphylaxis does not depend on the hemodialysis duration.

The impact of gender upon the development of the renal osteodystrophy symptomatology in our study was not proved, except when it camr to the emergence of itching in men which was more frequent than in women.

Age represents an important factor for the emergence of pain in the bones, muscles and joints, walking difficulties and the emergence of skeletal deformities. This has been proved in many other studies. Its significance increases while examining the groups with higher age difference.

Age has no influence upon the emergence of fatigue and on the feeling of weakness as well as the emergence of calciphylaxis in the hemodialytic patients with respect to healthy subjects.

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UTICAJ DUŽINE TRAJANJA HEMODIJALIZE, STAROSTI I POLA NA POJAVU SIMPTOMA RENALNE OSTEODISTROFIJE

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Studija se sastoji od 185 bolesnika koji su na hemodijalizi (HD) u hemodijaliznom centru Klinike za nefrologiju Kliničkog centra u Nišu. Faktori koji su ispitivani kod hemodijaliznih bolesnika su: dužina trajanja hemodijalize u okviru koje su ispitanici podeljeni u 2 grupe (kraće i duže od 5 godina), godine starosti u okviru kojih su ispitanici podeljeni u 3 grupe (mlađi od 30 godina, osobe starosti od 30 do 60 godina i stariji od 60 godina) i pol. Kod svih 185 hemodijaliznih ispitanika ispitivani su najčešći simptomi renalne osteodistrofije na osnovu vizuelizacije i korišćenjem verbalnog samoocenjivanja simptoma (VSS)-verbal symptoms score. Za statističku obradu je korišćen Studentov t-test i Mantzel Haencel-ov test, a razlike na nivou $p<0.01$ i $p<0.05$ uzete su kao statistički značajne i prikazane su kroz dijagrame i tabele. Rezultati istraživanja su pokazali da je signifikantno češći i veći intenzitet bola u kostima, mišićima i zglobovima i kao pojava spontanih preloma i/ili skeletnih deformiteta u grupi koja je na HD duže od 5 godina, dok su pojave svraba, zamaranja i otežanog hoda nesignifikantni u odnosu na grupu koja je na HD kraće od 5 godina. Uticaj pola na pojavu subjektivnih simptoma renalne osteodistrofije nije pokazao statističku značajnost, dok je uticaj starosti pokazao statističku značajnost za pojavu bolova u kostima, mišićima, zglobovima, spontanih preloma i/ili skeletnih deformiteta kod grupe ispitanika između 30 i 60 godina starosti i iznad 60 godina starosti. *Acta Medica Medianae 2008;47(4):19-24.*

Ključne reči: *simptomi, renalna osteodistrofija, hemodijaliza, starost, pol*