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INDICATORS OF BONE METABOLISM IN PATIENTS WITH RHEUMATOID ARTHRITIS WITH IMPAIRED BONE MINERAL DENSITY: CHARACTERISTICS, THEIR FEATURES AND DIAGNOSTIC VALUE

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Abstract.

Introduction: Rheumatoid arthritis (RA) is an autoimmune disease with a chronic inflammatory process that affects bone metabolism and leading to impaired bone mineral density (BMD). Therefore, the determination of laboratory markers of bone metabolism contributes to a better understanding of the pathogenesis of metabolic bone diseases.

The aim of the study: To characterize the bone metabolism parameters in rheumatoid arthritis patients with impaired bone mineral density, to find out their features and diagnostic value.

Materials and methods: The study included 76 patients randomly stratified by RA status who were treated in the Rheumatology Department of Lviv Regional Clinical Hospital, a municipal non-profit enterprise of Lviv Regional Council, from 2013 to 2019. The goal was achieved by performing three consecutive stages of the study. At the first stage, markers of bone formation and bone resorption were characterized. At the second stage, the peculiarities of these indicators were determined. The third stage was to determine the diagnostic value of the content of the markers of formation osteocalcin (OCN) and procollagen type 1 amino-terminal propeptide (P1NP) and resorption marker isomerized C-terminal telopeptide specific for the degradation of type I collagen in the bone tissue (β-CrossLaps).

Results: According to the results of the study at the first stage, it was found that, in RA patients with osteoporosis (OP), the serum content of markers of osteoblastic bone function OCN (p=0.000) and P1NP (p=0.035) was significantly lower compared to the healthy individuals of CG, while the content of the marker of bone resorption β-CrossLaps was significantly higher (p=0. 021); in RA patients with OP, the serum content of both markers of osteoblastic bone function OCN (p=0.000) and P1NP (p=0.001) is significantly lower, while β-CrossLaps (p>0.050) is only slightly higher compared to healthy CG subjects. According to the results obtained at the second stage of the study, it can be stated that the content of OCN and P1NP in the blood serum is significantly lower in RA patients both with osteopenia and OP compared to RA patients without BMD disorders.

At the third stage of the study, it was found a significant relationship between the content of P1NP and belonging to a group with osteopenia (AC -0.52). A confirmed relationship was found between the content of OCN and belonging to the group with OP (direct direction of AC 0.57; p=0.017).

Conclusions: Bone structure disorders in rheumatoid arthritis patients with osteopenia are characterized by a weakening of bone formation and increased resorption processes; in rheumatoid arthritis patients with osteoporosis, the weakening of osteoblastic bone function is more pronounced compared to rheumatoid arthritis patients with osteopenia. For rheumatoid arthritis patients with unimpaired bone mineral density, the highest diagnostic value is provided by procollagen type I N-terminal propeptide. For rheumatoid arthritis patients with osteoporosis, osteocalcin is a diagnostically valuable marker.

Key words. Rheumatoid arthritis, osteoporosis, osteocalcin, procollagen type I N-terminal propeptide, β-CrossLaps, bone mineral density.

Introduction.

Rheumatoid arthritis (RA) is a systemic autoimmune disease of unknown etiology with a chronic inflammatory process that usually affects the joints and with increasing severity causes extra-articular lesions [1]. Chronic inflammation in patients with RA affects bone metabolism and disrupts the normal resorption cycle, leading to impaired bone mineral density (BMD) and to osteoporosis [OP] [2]. Changes in bone metabolism occur in patients with RA, which can be manifested by deviations from the reference values of various markers of bone remodeling. From the early stages of RA, bone loss correlates with the activity of inflammation and the patient's condition [3].

Dynamic bone remodeling is ensured by constant bone remodeling. Osteocalcin (OCN), which is a vitamin K-dependent bone non-collagenous protein, a procollagen type 1 amino-terminal propeptide (P1NP), and alkaline phosphatase (ALP), especially its bone-specific fraction, are responsible for osteoblastic bone function. The osteoclast function of bone is indicated by an isomerized C-terminal telopeptide specific for the degradation of type I collagen in the bone tissue (β-CrossLaps).

Indicators of laboratory markers of bone metabolism contribute to a better understanding of the pathogenesis of metabolic bone diseases, they can provide additional information to the one obtained as a result of instrumental diagnosis of BMD disorders, and they can be useful for the clinician in choosing treatment tactics and evaluating its effectiveness [4].

The aim of the study. To characterize the bone metabolism parameters in patients with rheumatoid arthritis with impaired bone mineral density, to find out their features and diagnostic value.

Materials and methods.

After signing a voluntary consent to participate in the study, as required by the Helsinki Declaration of Human Rights, the Council of Europe Convention on Human Rights and Biomedicine, patients were randomly enrolled with preliminary stratification by the presence of RA (seropositive (rheumatoid factor, antibodies to citrullinated vimentin, antibodies to cyclic citrulline peptide); polyarthritis (with lesion of small joints of

the hands, radiocarpal, shoulder, knee joints; X-ray stage II-III; functional joint failure II); active phase, II level activity; duration from 1 to 11 years (average 4.63±0.30)) diagnosed in accordance with the Order of the Ministry of Health of Ukraine No. 676 of 12. 10.2006 p. "On approval of protocols for the provision of medical care in the specialty "Rheumatology"" [5] and the criteria of the American College of Rheumatology [6] and the European League Against Rheumatism 2010, 76 patients (64 women (84.21%) in the premenopausal period and 12 men (15.78%) aged 38 to 60 years (mean age at the time of examination of women - 48.67 ± 2.34 years, men - 45.42 ± 2.78)), treated (receiving methylprednisolone according to the scheme at a dose of 4.0 mg/day and a short course during exacerbation up to 24, 0 mg/day (on average, 7600.0 ± 260.0 mg per course) and those not receiving medications to treat BMD disorders) in the rheumatology department of the Municipal Non-Profit Enterprise of the Lviv Regional Council "Lviv Regional Clinical Hospital" from 2013 to 2019.

BMD was assessed according to the recommendations of the World Health Organization with the determination of the T-criterion [7], obtained by ultrasound bone densitometry (UBD) of the calcaneus with the SONOST-2000 device (OsteoSysCo., Ltd, Seoul, Korea), which, as proved by Abrahamovich U.O. et al.[9], is not inferior in diagnostic value to the "gold standard" of dual-energy X-ray densitometry.

If the standard deviation (SD) was equal or greater than -1.0 SD, we interpreted it as an indicator of normal BMD, if it was less than - 1.0 to -2.4 SD, it indicated the presence of osteopenia, if equal or less than - 2.5 SD, it indicated the presence of OP.

Based on the obtained results, the patients were stratified into the following three groups: 1) 18 patients (15 women (83.33%) and 3 men (16.67%) aged 38 to 52 years) with RA without BMD disorders - comparison group (CPG); 2) 34 patients (31 women (91.18 %) and 3 men (8.82 %) aged 38 to 54 years) with RA and osteopenia - study group 1 (SG1); 3) 24 patients (18 women (75.00%) and 6 men (25.00%) aged 41 to 53 years) with RA and OP - study group 2 (SG2).

The control group (CG) consisted of 22 practically healthy individuals (18 women (81.81%) and 4 men (18.18%), the average age of women at the time of the examination was 42.95± 2.14 years, men - 38.69± 2.11 years), who had a T-criterion value of more than -1.0 SD according to the results of the calcaneal DEXA, which indicated the absence of BMD disorders.

The content in the serum of bone remodeling indicators, namely markers of bone formation (OCN (2.0-22.0 ng/ml), P1NP (women premenopausal - 15.13-58.59 ng/ml; men -15.00-80.00 ng/ml)) and bone resorption (β-CrossLaps (women. premenopause - <0.573 ng/ml; men: 30-50 years - <0.584 ng/ml, 50-70 years - <0.704 ng/ml)) were studied by immunochemical analysis with electrochemiluminescence detection. The reference indicators were based on the reference values provided by the test system manufacturer in the instructions.

The goal was achieved by performing three consecutive stages of the study.

In the first stage, characterizing the markers of bone formation OCN and P1NP, as well as bone resorption β-CrossLaps, these indicators were evaluated in patients with RA with osteopenia of SG1 and in patients with RA with OP of SG2, compared to similar indicators in practically healthy individuals of the CG.

In the second stage, the peculiarities of these indicators were determined in patients with RA with osteopenia of SG1 and in patients with RA with OP of SG2, compared to patients with RA without BMD disorders of the CPG.

The actual material was processeaad on a personal computer using MS Excel and SPSS software, applying descriptive statistics with the help of point-biserial correlation, Fisher's correlation coefficient, determining the p-value for the correlation coefficient in order to establish the reliability of the strength and direction of the relationship between the two criteria, the difference was considered statistically significant if $p< 0.05$.

The third stage was to determine the diagnostic value of the content of OCN formation markers, P1NP, and the bone resorption marker β-CrossLaps and there constellations. To achieve this goal, we analyzed the contingency table to calculate the sensitivity, specificity, and diagnostic efficiency (accuracy), as well as association coefficient (AC) among RA patients. Validity and reliability of the defined indicators was determined using sensitivity (a truly positive proportion that reflects the proportion of positive results, correctly identifying a sick subject as a sick subject), specificity (a truly negative proportion that reflects information about the proportion of negative results, correctly identifying a healthy subject as such) and accuracy (the proportion of correctly diagnosed cases based on information about a positive or negative result), AC or contingent coefficient (CC)), which characterize the extent to which relationship between qualitative features is close [8]. The relationship between the disease severity and the indicator value was considered as confirmed when the modulo of AC exceeded 0.5 (or 0.3 for CC).

Results.

The results of the first and second stages of the study with information on the average content of bone remodeling markers in patients with RA of CPG, SG1, SG2 and in healthy subjects of the CG are shown in Table 1.

Table 1. *Mean values of bone remodeling markers in patients with rheumatoid arthritis of the comparison group, study groups and control group (M±m; n; p).*

Groups of patients with RA and healthy control group CG (n)	**Markers of bone formation (M±m; p)**		**Marker of bone Resorption (M±m; p)**
	OCN	P1NP	β-Cross Laps
CPG (18 patients)	24.91±2.75	40.34±4.58	0.35±0.01
SG1 (34 patients)	17.77±1.21	30.16±2.17	0.38±0.02
SG2 (24 patients)	15.38±2.60	26.58±2.03	0.36±0.03
CG (22 persons)	20.37±0.76	37.40±2.37	0.31±0.01
p- value	p1=0.008 p2=0.002 p3=0.000 p5=0.000 p6=0.000	p1=0.026 p2<0.005 p5=0.035 p6=0.001	p5=0.021

Notes: p1- significance of differences between SG1 and CPG; p2- significance of differences between SG2 and CPG; p3- significance of differences between CPG and CG; p4- significance of differences

between SG1 and SG2; p5- significance of differences between SG1 and CG; p6- significance of differences between SG2 and CG.

Characterizing the markers of bone formation of OCN and P1NP, as well as bone resorption β-CrossLaps, at the first stage of the study, it was found that the content of OCN was significantly lower in patients with RA with osteopenia of SG1 (17.77±1.21 ng/ml) compared to practically healthy individuals of CG (20.37±0.76 ng/ml; p=0.000), the content of P1NP was significantly lower in RA patients with osteopenia of SG1 (30.16±2.17 ng/ml) compared to practically healthy individuals of the CG (37.40±2.37 ng/ml; p=0.035), and the content of β-CrossLaps was significantly higher in RA patients with SG1 osteopenia (0.38±0.02 ng/mL) compared to practically healthy CG subjects (0.31±0.01 ng/mL; p=0.021).

In patients with RA with OP SG2, the index of OCN was significantly lower (15.38±2.60 ng/ml) compared to practically healthy individuals of the CG (20.37±0.76 ng/ml; p=0.000), the content of P1NP was significantly lower in patients with RA with OP SG2 (26.58±2.03 ng/ml) compared to practically healthy individuals of the CG (37.40±2.37 ng/ml; p=0.001), the content of β-CrossLaps was not significantly higher in RA patients with DG2 OP (0.36±0.03 ng/ml) compared to practically healthy CG subjects (0.31±0.01 ng/ml).

According to the results of the study, at the first stage, it can be stated that in patients with RA with osteopenia, the serum content of markers of osteoblastic bone function OCN and P1NP was significantly lower compared to healthy CG subjects, while the content of the bone resorption marker β-CrossLaps was significantly higher; in patients with RA with OP, the serum levels of both markers of osteoblastic bone function OCN and P1NP are significantly lower, while β-CrossLaps is only slightly higher compared to healthy CG subjects.

The second stage of the study consisted in defining the peculiarities of the indicators of OCN and P1NP bone formation markers, and β-CrossLaps bone resorption markers. It was found that OCN content was significantly lower in RA patients with osteopenia of SG1 (17.77±1.21 ng/ml), compared to RA patients without impaired BMD of CPG (24.91±2.75 ng/ml; p=0.008 ng/ml), P1NP indicator was significantly lower in RA patients with osteopenia of SG1 (30.16±2.17 ng/ml), compared to RA patients without impaired BMD of CPG, (40.34±4.58 ng/ml; p=0.026), and the content of β-CrossLaps did not show significant difference between the values in RA patients with osteopenia of SG1 (0.38±0.02 ng/ml), compared to RA patients without impaired BMD of CPG (0.35±0.01 ng/mL; p>0.050).

In RA patients with OP of SG2, it was found that the index of OCN was significantly lower (15.38±2.60 ng/mL) compared to RA patients without impaired BMD of CPG (24.91±2.75 ng/ml; p=0.002), P1NP indicator was significantly lower in RA patients with OP of SG2 (26.58±2.0 ng/ml), compared to RA patients without impaired BMD of CG (40.34±4.58 ng/ml; p<0.005), and β-CrossLaps content did not show a significant difference between the values in RA patients with OP of SG2 (0.36±0.003 ng/ml), compared to RA patients without impaired BMD of CG (0.35±0.01 ng/ml; p>0.050).

Comparing OCN and P1NP markers of bone formation, as well as β-CrossLaps bone resorption in RA patients with osteopenia of SG1 and with OP of SG2, no significant difference was found between them. According to the results of the second stage of the study, it can be argued that OCN and P1NP content in the blood serum is significantly lower in RA patients both with osteopenia and OP, compared to RA patients without BMD disorders. β-CrossLaps content did not show a significant difference between the values in RA patients with osteopenia of SG1 and with OP of SG2.

The results of the third stage of the study, which consisted in the determination of sensitivity, specificity, and accuracy of bone remodeling markers in RA patients with BMD disorders, are shown in Table 2.

The sensitivity in RA patients with osteopenia of SG1 compared with RA patients without BMD disorders (CPG) is 26.64%, specificity - 72.22%, accuracy - 42.31%. There was no confirmed relationship between the content of OCN and belonging to SG1 (reverse direction of AC was 0.03, p>0.050). The sensitivity of P1NP in RA patients with osteopenia of SG1 compared with RA patients without BMD disorders (CPG) is 5.88%, specificity - 83.33%, accuracy - 32.69%. A significant relationship was found between the content of P1NPs and belonging to SG1 group (inverse direction of AC -0.52). The sensitivity of β-CrossLaps content in RA patients with osteopenia of SG1 compared with RA patients without BMD disorders (CPG) is 8.23 %, specificity - 100.00 %, accuracy - 40.38 %. No significant relationship was found between the content of β-CrossLaps and belonging to SG1 (inverse direction of AC - 0.18, p>0.050).

The analysis of the constellations of laboratory parameters revealed the constellation of P1NP and OCN (inverse direction of AC -0.73), which indicates that the constellation of these parameters is not typical for RA patients with osteopenia, but is typical for RA patients without BMD disorders (CPG).

OP is 3.38 times more common in RA patients if the content of OCN is below the reference values compared to RA patients without BMD (CPG). The sensitivity of OCN in RA patients of SG2 compared with RA patients without BMD disorders was 56.52 %, specificity - 72.22 %, accuracy - 63.41 %. A confirmed direct correlation was found between the content of OCN and belonging to the group with OP (AC 0.54; p<0.048). The sensitivity of P1NP in RA patients with OP of SG2 is 0.00 %, specificity - 83.33 %, accuracy - 36.58 %. A significant inverse relationship was found between the P1NP content and belonging to SG2 (CC - 0.31). The sensitivity of the β-CrossLaps content in SG2 was 8.69 %, specificity - 100.00 %, accuracy - 48.78 %. No significant relationship was found between the content of β-CrossLaps and belonging to SG2 (CC 0.2).

Analyzing the constellations of laboratory parameters, a constellation of P1NP and OCN, a significant relationship was found (inverse direction of CC -0.31), which indicates that the constellation of these parameters is not typical for RA patients with OP, but it is typical for RA patients without impaired BMD of CPG.

OP is 3.60 times more common in RA patients of SG2 compared with RA patients with osteopenia of SG1, if the OCN content is lower than the reference values. The sensitivity of OCN in RA patients with OP of SG2 compared with RA patients with osteopenia (SG1) is 56.52 %, specificity - 73.52

Table 2. *The results of comparison of the diagnostic value of bone remodeling parameters in RA patients without (CG) and with impairments (SG1, SG2) of BMD (% sensitivity; % specificity; % accuracy; AC (in units); CC (in units)).*

Groups of RA patients		**Indicators of bone remodelling**	**Indicators of diagnostic value**					
			Sensitivity, %.	**Specificity, %.**	**Accuracy, %.**	**AC**	**CC**	**p**
SG1	SG1 and CPG	OCN	26,64	72,22	42,31	- 0,03	-	0,254
		P1NP	5,88	83,33	32,69	-0,52*	-	0,271
		β-CrossLaps	8,23	100,00	40,38	1	0,18	0,176
		β-CrossLaps +OCN	0,00	100,00	34,61	-	-	1
		β-CrossLaps+ P1NP	0,00	100,00	34,61	-	-	1
		P1NP+OCN	2,94	83,33	49,01	-0,73*	-	0,102
		β-CrossLaps+ P1NP+OCN	0	100,00	34,61	-	-	1
SG2	SG2 and CPG	OCN	56,52	72,22	63,41	0,54*	-	0,048#
		P1NP	0,00	83,33	36,58	-1	-0,31^	0,077
		β-CrossLaps	8,69	100,00	48,78	1	0,2	0,308
		β-CrossLaps +OCN	0	100,00	43,90	-	-	1
		β-CrossLaps+ P1NP	0	100,00	43,90	-	-	1
		P1NP+OCN	0	83,33	36,58	-1	-0,31^	0,077
		β-CrossLaps+ P1NP+OCN	0	100,00	43,90	-	-	1
	SG2 and SG1	OCN	56,52	73,52	66,67	0,57*	-	0,017#
		P1NP	0,00	94,11	56,11	-1	-0,15	0,352
		β-CrossLaps	8,69	91,17	57,89	-0,008	-	0,362
		β-CrossLaps +OCN	0,00	100,00	59,64	-	-	1
		β-CrossLaps+ P1NP	0,00	100,00	59,64	-	-	1
		P1NP+OCN	0,00	97,06	57,89	-1	-0,11	0,596
		β-CrossLaps+ P1NP+OCN	0,00	100,00	59,64	-	-	1

*Notes: * - statistically significant relationship between indicators and group membership (AC 0.5 or more), ^ - statistically significant relationship between indicators and group membership (AC 0.3 or more), # - statistically significant difference between the frequency of cases in the groups (p < 0.050).*

%, accuracy - 66.67 %. A confirmed relationship was found between the content of OCN and belonging to the group with OP (direct direction of AC 0.57; $p<0.017$). The sensitivity of P1NP in RA patients with OP of SG2 is 0.00 %, specificity - 94.11 %, accuracy - 56.11 %. No significant relationship was found between P1NP content and belonging to SG2 (reverse direction of CC - 0.15). The sensitivity of β-CrossLaps in RA patients with osteopenia of SG2 compared with RA patients with osteopenia of SG1 was 8.69 %, specificity - 91.17 %, accuracy - 57.89 %. No significant relationship was found between the content of β-CrossLaps and belonging to SG2 (reverse direction of CC -0.008). When analyzing the constellations of laboratory parameters in RA patients with OP, we did not find statistically significant changes.

Conclusion.

1. Bone structure disorders in patients with RA with osteopenia are characterized with a weakening of bone formation and increased resorption processes; in patients with RA with OP, the weakening of osteoblastic bone function is more pronounced compared to patients with RA with osteopenia, and only a slight increase in bone resorption processes.

2. We did not find any particular differences in the weakening of bone formation and resorption in patients with RA with osteopenia and OP, assessed by the results of determining the fserum markers of osteoblastic OCN and P1NP, as well as osteoclastic β-CrossLaps functions.

3. For rheumatoid arthritis patients with intact bone mineral density, the highest diagnostic value is provided by an increase in the amino-terminal procollagen type I propeptide or a constellation of a decrease in osteocalcin and an increase in the amino-terminal procollagen type I propeptide.

4. As a result of the study of the diagnostic value of single markers of bone formation osteocalcin and amino-terminal procollagen type I propeptide, as well as bone resorption of carboxy-terminal telopeptide of type I collagen, and their constellations in patients with rheumatoid arthritis with osteopenia, we did not find statistically significant changes in sensitivity, specificity, and accuracy.

5. For osteoporosis in patients with rheumatoid arthritis, a decrease in a single indicator of osteocalcin is a diagnostically valuable marker; we did not find statistically significant changes in the sensitivity, specificity, and accuracy of constellations of bone formation indicators of osteocalcin and amino-terminal procollagen type I propeptide and bone resorption of cardoxy-terminal telopeptide of type I collagen.

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ძვლის მეტაბოლიზმის მაჩვენებლები რევმატოიდული ართრიტის მქონე პაციენტებში ძვლის ქსოვილის მინერალური სიმკვრივის დარღვევით: მათი მახასიათებლები, თავისებურებები და დიაგნოსტიკური მნიშვნელობა.

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შესავალი რევმატოიდული ართრიტი (RA) - ეს არის აუტოიმუნური დაავადება ქრონიკული ანთებითი პროცესით, რომელიც გავლენას ახდენს ძვლოვანი ქსოვილის მეტაბოლიზმზე და არღვევს რეზორბციის ნორმალურ ციკლს, რაც იწვევს ძვლის ქსოვილის მინერალური სიმკვრივის (BMD) დარღვევას. გამომდინარე ამისა, ძვლის ცვლის ლაბორატორიული მარკერების განსაზღვრა ხელს უწყობს ძვლის მეტაბოლური დაავადებების პათოგენეზის უკეთ გააზრებას.
კვლევის მიზანი ძვლის მეტაბოლიზმის მაჩვენებლების დახასიათება რევმატოიდული ართრიტის მქონე პაციენტებში ძვლის მინერალური სიმკვრივის დარღვევით, მათი მახასიათებლებისა და დიაგნოსტიკური ღირებულების გარკვევა.
მასალები და მეთოდები კვლევაში მონაწილეობას იღებდა რანდომიზებული წესით წინასწარი სტრატიფიკაციით არჩეული რევმატოიდული ართრიტის მქონე 76 პაციენტი, რომლებიც მკურნალობდნენ 2013 წლიდან 2019 წლამდე ლვოვის საოლქო საბჭოს კომუნალური არაკომერციული საწარმოს "ლვოვის საოლქო კლინიკური საავადმყოფო"-ს რევმატოლოგიურ განყოფილებაში. მიზნის მიღწევა განხორციელდა კვლევის სამი თანამიმდევრული ეტაპის შესრულებით. პირველ ეტაპზე ახასიათებს ძვლის წარმოქმნის მარკერებს, აგრეთვე ძვლის რეზორბციას. მეორე ეტაპზე დაზუსტდა ამ მაჩვენებლების თავისებურებები. მესამე ეტაპი იყო OCN, P1NP და რეზორბციული მარკერის β-CrossLaps-ის ფორმირების მარკერების შემცველობის დიაგნოსტიკური მნიშვნელობის განსაზღვრა.
შედეგები კვლევის შედეგების მიხედვით პირველ ეტაპზე დადგინდა, რომ პაციენტებში RA ოსტეოპენიით, ძვლების OCN (p=0.000) და P1NP (p=0.035) ოსტეობლასტური ფუნქციის მარკერების შრატში შემცველობა ჯანმრთელ ადამიანებთან შედარებით მნიშვნელოვნად დაბალი იყო, ხოლო ძვლის რეზორბციის მარკერის შემცველობა მნიშვნელოვნად მაღალი β-CrossLaps იყო (p=0,021); RA პაციენტებში OP, ოსტეობლასტური ძვლის ფუნქციის OCN (p=0.000) და P1NP (p=0.001) ორივე მარკერის შრატში შემცველობა მნიშვნელოვნად დაბალია, ხოლო β-CrossLaps (p>0.050) მხოლოდ ოდნავ მაღალია ჯანმრთელ CG სუბიექტებთან შედარებით. კვლევის მეორე ეტაპზე მიღებული შედეგების მიხედვით, შეიძლება ითქვას, რომ OC და P1NP შემცველობა სისხლის შრატში მნიშვნელოვნად დაბალია RA პაციენტებში, როგორც ოსტეოპენიით, ასევე OP-ით, შედარებით RA პაციენტებთან BMD დარღვევების გარეშე. კვლევის მესამე სტადიაზე აღმოჩნდა საპირისპირო სანდო კავშირი P1NP შემცველობასა და ოსტეოპენიის ჯგუფს შორის (KA-0.52). ნაპოვნია დადასტურებული კავშირი OCN-ის შინაარსსა და OP ჯგუფს შორის (KA 0.57-ის პირდაპირი მიმართულება; p=0.017).
დასკვნა რევმატოიდული ართრიტის მქონე პაციენტებში ოსტეოპენიით, ძვლის სტრუქტურის დარღვევას ახასიათებს მათში ძვლის წარმოქმნის პროცესების შესუსტება და რეზორბციის პროცესების მატება; რევმატოიდული ართრიტის მქონე პაციენტებში ოსტეოპოროზით, ძვლის ოსტეობლასტური ფუნქციის შესუსტება უფრო გამოხატულია, ვიდრე პაციენტებში რევმატოიდული ართრიტით ოსტეოპენიით.
რევმატოიდული ართრიტის მქონე პაციენტებისთვის ძვლის ქსოვილის მინერალური სიმკვრივის დარღვევების გარეშე, ყველაზე დიდი დიაგნოსტიკური მნიშვნელობა აქვს I ტიპის პროკოლაგენის N-ტერმინალური პროპეპტიდის მაჩვენებელს. რევმატოიდული ართრიტის მქონე პაციენტებისთვის ოსტეოპოროზით, დიაგნოსტიკურად ღირებული მარკერი არის ოსტეოკალცინი.
საკვანძო სიტყვები: რევმატოიდული ართრიტი, ოსტეოპოროზი, ოსტეოკალცინი, I ტიპის პროკოლაგენის N-ტერმინალური პროპეპტიდი, β-CrossLaps, ძვლოვანი ქსოვილის მინერალური სიმკვრივე.