MEDICAL SCIENCES

METALS, INCLUDED IN THE PROSTHETIC KNEE JOINTS, IN THE PATIENTS' BODY WITH GONARTHROSIS

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Abstract

The purpose of the research – to determine blood and hair levels of metals included in the composition of prosthetic knee joints in patients with gonarthrosis, to evaluate the clinical and pathogenetic significance of this microelementosis in different variants of disease course. Materials and methods. Were examined 87 patients with gonarthrosis (45% men and 55% women with an average age of 53 years). Atomic absorption spectrometer "SolAAr-Mk2-MOZe" with electrographite atomizer (UK) were used to study the existence of metals in the organism. Results. Microelementhosis in blood of patients with gonarthrosis observed in 41% of cases, while in the hair - 23%, which is accompanied by increased levels of Ti and V in serum on the background of reducing the concentration of Fe, and the hair changes of metals are related to the increasing content of Al, Fe and Ti with decreasing parameters of Co, Cr and Mo. It depends on the radiographic stage of the disease, the presence of synovitis, the prevalence and severity of articular syndrome, involving in the pathogenesis of meniscus lesions, bursitis, trabecular oedema in the patella, forming osteophytes, osteocytes and intraarticular Shtydy bodies, which is correlated with osteoporosis. Conclusions. Gonarthrosis courses with changing levels of metals in blood and hair (Al, Co, Cr, Fe, Mo, Ti, V) contained in the prosthetic knee joints, which depends on the clinical course of the disease, determines the pathogenetic compositions of articular degenerative inflammatory lesions.

Keywords: gonarthrosis, coxarthrosis, metals, blood, hair, course, pathogenesis.

Actuality. Gonarthrosis is one of the most common rheumatologic and orthopedic profile disease [1, p. 450; 2, p. 134; 3, p. 350], which causes a significant health and social damage either to the people with illness or to society as a whole [4, p. 505; 5, p. 144]. Gonarthrosis is accompanied by microelementosis proceeding with a violation of the many essential and toxic metal body levels [6, p. 213; 7, p. 101]. After endoprosthesis replacement of knee joints in the patients' body, the content of such metals as Co, Cr, Ti, and others [8, p. 1042; 9, p. 1927; 10, p. 1537] are able to determine the "durability" of the graft prosthesis and the further course of gonarthrosis [11, p. 391; 12, p. 135].

The purpose and objectives of the research – to determine levels of metals included in the composition of total knee joints (Al, Co, Cr, Fe, Mo, Ni, Ti, V) in patients with gonarthrosis, as well as compare the values with concentrations of these trace elements in hair, comparing with the indicators of Co, Cr, Mo, Ni, Ti and V in the soil of areas of patients residence, to evaluate the clinical and pathogenetic significance of endogenous and exogenous microelements in different variants of the disease.

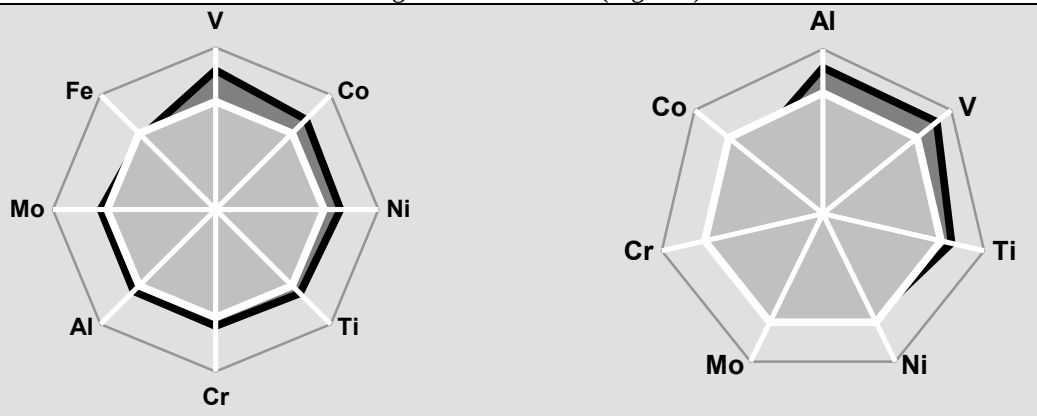
Materials and methods. Were examined 87 patients with gonarthrosis (45% men and 55% women with an average age of 53 years). I, II and III stages of the disease respectively identified in 28%, 41% and 31% of observations, polyarthrosis occurred in 53% of cases, osteochondrosis – in 92%, spondiloarthrosis of arcuate joints in 71%, clinically symptomatic synovitis – 67%. Among these patients diagnosed coxarthrosis was in 36% of cases (main group) and the remaining 64% without any changes of the hip joints constituted the control group. I, II and III stages of the disease respectively identified in 19%, 48%, 32% of cases in the control group, polyarthrosis occurred in 58% of cases, vertebral osteochondrosis in 94%, spondylosis of arcuate joints in 65%, synovitis in 61%. To study the performance of metals in the organism were used atomic absorption spectrometer SolAAr-Mk2-MOZe with electrographite atomizer (UK). As a control, these laboratory parameters were determined in 40 healthy people between the ages of 38 to 79 years.

Assessment of anthropogenic trace element contamination of soil by metals is made by sanitary stations and the regional offices of the State committees for Hydrometeorology, environmental control and environmental safety.

Statistical analysis of the results of the research was carried out using computer variational, nonparametric, correlation, regression, one – (ANOVA) and multivariate (ANOVA / MANOVA) variance analysis (Microsoft Excel and Statistica-Stat-Soft, USA). Average values (M), their standard deviations (SD) and errors (SE), Pearson parametric correlation coefficients and nonparametric Kendall coefficients, multiple regression criteria, Brown-Forsyth dispersion and Wilcoxon-Rao variance, Student and McNamara-Fisher differences, and reliability of statistical indices were

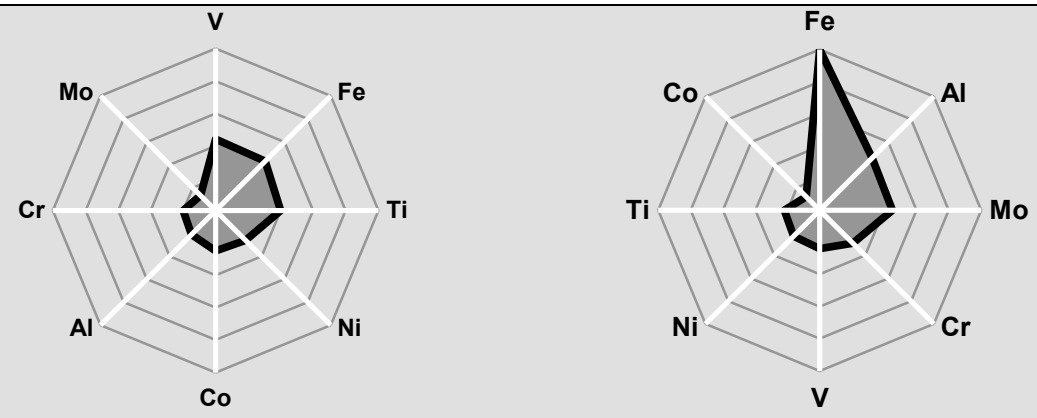
evaluated. Critical level of significance in testing statistical hypotheses in this study was assumed to be 0.05.

Results. Microelementhosis in blood of patients with gonarthrosis observed in 41% of cases, while in the hair - 23%, which is accompanied by increased levels of Ti and V in the serum on the background of reducing the concentration of Fe that is accordingly observed in 40%, 44% and 43% of patients, and hair changes of metals are related to the increasing content of Al, Fe and Ti with decreasing parameters of Co, Cr and Mo in 46%, 100%, 22%, 12%, 29% and 45% of cases (Fig. 1-2).



BLOOD *HAIR*

Fig. 1. The differences of blood and hair metal levels of the patients with Gonarthrosis, parameters of healthy people is taken as 100%



BLOOD *HAIR*

Fig. 2. Frequency (%) of metal indicators deviation in blood and hair of patients with gonarthrosis comparing to the same parameters in healthy people

It depends on the radiographic stage of the disease, the presence of synovitis, the prevalence and severity of articular syndrome, involving in the pathogenesis of meniscus lesions, bursitis, trabecular oedema in the patella, forming osteophytes, osteocytes and intraarticular Shtydy bodies, which is correlated with osteoporosis (Al, Co, Cr, Ni) values of Cr, Ti and V in different objects of study (blood, hair) are correlated to each other, as well as have prognostic significance.

If in the blood serum of gonocoxarthrosis is accompanied by a significant rise of blood levels of Ti to 25% V 43%, in hair – Al to 27%, Fe to 6.1% and Ti by 14% while reducing the first object of study Fe 4%, and in the second object – Co to 30%, Cr to 34% and Mo to 10%, with the additional development of lesions of the hip joints occurs with higher blood Ti to 19%, V to 18%, in the hair – Ti to 9% on the background of oppression of Cr content of 22%, which indicators correlate among themselves, depend on the degree of severity of the disease (Ni, V), make influence on the severity of degenerative-inflammatory changes in the compositions (Fe, Ni), and the difference between gonocoxarthrosis from the isolated gonarthrosis is high frequency of microelements Cr, Mo and Ti (Table 1).

The level of Ti in soil is directly correlated with the concentrations of Fe and Mo in serum, and the settings in hair of Al, Co, Cr, Mo, Ni, Ti and V depend on the content in the soil of Co, Cr, Ni and V, and the integral indexes of the severity of microelements in blood and hair of patients with gonarthrosis have direct dispersion-correlation connections, respectively, with the indices Cr and V in the soil, with Co, Ti and V have an impact on the formation of the epiphyseal osteoporosis, ligamentos, trabecular edema of the femur and of the patella, damage to the anterior cruciate ligament.

Table 1

Indicators of metals in blood and hair of healthy people, patients with gonoarthrosis and gonocoxarthrosis (M±SD±SE)

Indicators		Surveyed groups		
		healthy (n=40)	patients	
			gonarthrosis (n=56)	gonocoxarthrosis (n=31)
Blood	Al, μg/l	2,7±1,76±0,27	3,0±1,43±0,19	2,9±1,46±0,26
	Co, μg/l	8,3±5,58±0,84	10,1±6,07±0,81	9,2±4,94±0,89
	Cr, ng/l	1,2±0,55±0,08	1,3±0,49±0,07	1,3±0,51±0,09
	Fe, mg/l	443,1±21,70±3,27	427,1±33,54±4,48	425,0±33,46±6,01
	Mo, μg/l	1,6±0,87±0,13	1,7±0,56±0,07	1,8±0,89±0,16
	Ni, μg/l	3,9±2,11±0,32	4,4±1,92±0,26	4,6±2,43±0,44
	Ti, μg/l	2,0±0,31±0,05	2,1±0,42±0,06	2,5±0,60±0,11 *
	V, μg/l	1,4±0,69±0,10	1,7±0,70±0,09	2,0±0,80±0,14 *
Hair	Al, μg/g	2,2±0,72±0,11	2,6±0,87±0,12	2,8±0,85±0,15
	Co, ng/g	18,1±14,17±2,14	14,8±8,69±1,16	12,7±6,14±1,10
	Cr, ng/g	43,1±22,60±3,41	36,5±18,63±2,49	28,4±15,69±2,82 *
	Fe, μg/g	1,7±0,20±0,03	10,3±4,00±0,53	10,3±4,59±0,83
	Mo, μg/g	1,9±0,17±0,03	1,6±0,35±0,05	1,7±0,32±0,06
	Ni, μg/g	3,9±1,77±0,27	3,6±1,85±0,25	3,7±1,76±0,32
	Ti, μg/g	2,1±0,39±0,06	2,2±0,42±0,06	2,4±0,54±0,10 *
	V, ng/g	104,7±113,34±17,0	116,1±110,81±14,8	150,5±115,17±20,6

* differences between patients with gonarthrosis and gonocoxarthrosis are authentic.

Conclusions. Gonarthrosis courses with changing levels of metals in blood and hair (Al, Co, Cr, Fe, Mo, Ti, V) contained in the prosthetic knee joints, which is closely associated with the same level of metals in the soil of the region of patients residence. Combined lesions of the knee and hip joints accompanied by increased microelements that flows with the changes of levels in blood and hair of such metals as Cr, Ti and V which contained in the endoprosthesis of hip and knee joints, which depends on the clinical course of the disease, determines the pathogenetic of compositions of articular degenerative inflammatory lesions and necessitates the study of microelements in the body of patients in the process of dynamic observation after joint replacement taking into account the nature of the environmental areas.

REFERENCES:

1. Lamberg EM, Streb R, Werner M, Kremenic I, Penna J (2016) The 2- and 8-week effects of decompressive brace use in people with medial compartment knee osteoarthritis. Prosthet Orthot Int 40(4):447-453.
2. Leung YY, Ma S, Noviani M, Wong SB, Lee CM, Soh IA et al. (2017) Validation of screening questionnaires for evaluation of knee osteoarthritis prevalence in the general population of Singapore. Int J Rheum Dis 21(12):132-138.
3. Nelson AE (2017) Osteoarthritis year in review 2017: clinical. Osteoarthritis Cartilage 8(12):348-351.
4. Malzahn J (2014) Conservative and operative treatment of working age patients with gonarthritis. Economic considerations. Orthopade 43(6):503-510.
5. Vina ER, Kwoh CK (2017) Epidemiology of osteoarthritis: literature update. Curr Opin Rheumatol 8(12):142-149.
6. Colotti G, Ilari A, Boffi A, Morea V (2013) Metals and metal derivatives in medicine. Mini Rev Med Chem 13(2):211-221.
7. Kubaszewski L, Zioła-Frankowska A, Frankowski M, Rogala P, Gasik Z, Kaczmarczyk J et al. (2014) Comparison of trace element concentration in bone and intervertebral disc tissue by atomic absorption spectrometry techniques. J Orthop Surg Res 25(9):99-109.
8. Kazi HA, Perera JR, Gillott E, Carroll FA, Briggs TW (2013) A prospective study of a ceramic-on-metal bearing in total hip arthroplasty. Clinical results, metal ion levels and chromosome analysis at two years. Bone Joint J 95(8):1040-1044.
9. Lützner J, Hartmann A, Dinnebier G, Spornraft-Ragaller P, Hamann C, Kirschner S (2013) Metal hypersensitivity and metal ion levels in patients with coated or uncoated total knee arthroplasty: a randomised controlled study. Int Orthop 37(10):1925-1931.
10. Barlow BT, Ortiz PA, Boles JW, Lee YY, Padgett DE, Westrich GH (2017) What are normal metal ion levels after total hip arthroplasty? A serologic analysis of four bearing surfaces. J Arthroplasty 32(5):1535-1542.
11. Czekaj J, Ehlinger M, Rahme M, Bonnomet F (2016) Metallosis and cobalt-chrome intoxication after hip resurfacing arthroplasty. J Orthop Sci 21(3):389-394.
12. Steinberg J, Shah KM, Gartland A, Zeggini E, Wilkinson JM (2017) Effects of chronic cobalt and chromium exposure after metal-on-metal hip resurfacing: An epigenome-wide association pilot study. J Orthop Res 18(1):133-139.

MOLECULAR-GENETIC AND EPIDEMIOLOGICAL CHARACTERISTICS OF BLADDER FORMS OF LEUKEMIES IN LARGE INDUSTRIAL PROVINCE OF WESTERN SIBERIA

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МОЛЕКУЛЯРНО-ГЕНЕТИЧЕСКАЯ И ЭПИДЕМИОЛОГИЧЕСКАЯ ХАРАКТЕРИСТИКА БЛАСТНЫХ ФОРМ ЛЕЙКОЗОВ В КРУПНОЙ ПРОМЫШЛЕННОЙ ПРОВИНЦИИ ЗАПАДНОЙ СИБИРИ

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Abstract

Based on the complex retrospective analysis for 10 years of follow-up (2007-2017), the incidence of various forms of acute leukemia in the province of Western Siberia - the Novosibirsk region and the city of Novosibirsk - was determined. Immunophenotypic characteristics of acute leukemia of patients living in this area were carried out. The structure of genetic and molecular-genetic anomalies occurring in blast cells in acute myeloid and lymphoid types of leukemia was investigated. The correlation of recurrent variants of acute leukemia is determined in accordance with the genetic and molecular biological criteria of WHO classification. The value of data from molecular genetic (FISH and microarray genechipping) studies has been shown to assess the prospects for treatment and the prognosis of the disease.

Аннотация

На основании комплексного ретроспективного анализа за 10-лет наблюдения (2007-2017 гг) определена заболеваемость различными формами острых лейкозов в провинции Западной Сибири - Новосибирской области и г.Новосибирске. Проведена иммунофенотипическая характеристика острых лейкозов пациентов, проживающих на данной территории. Исследована структура генетических и молекулярно-генетических аномалий, встречающихся в бластных клетках при острых миелоидных и лимфоидных типах лейкоза. Определено соотношение рекуррентных вариантов острых лейкозов в соответствии с генетическими и молекулярно-биологическими критериями классификации ВОЗ. Показано значение данных молекулярно-генетических (FISH и mycroarray геночипирование) исследований для оценки перспектив лечения и прогноза заболевания.

Keywords: epidemiology of acute leukemias in Western Siberia, molecular biology, molecular genetics, flow immunocytofluorimetry of lymphoid and myeloid leukemia, DNA microarrays, immunocytochemistry, prevalence of recurrent leukemia variants

Ключевые слова: эпидемиология острых лейкозов в Западной Сибири России, молекулярная биология, молекулярная генетика, проточная иммуноцитофлюориметрия лимфоидных и миелоидных лейкозов, microarray геночипы, иммуноцитохимия, распространенность рекуррентных вариантов лейкозов

Острый лейкоз представляет собой не только наиболее злокачественную форму гемобластоза, но и нозологию в отношении которой мировой медициной сделан наиболее значительный рывок в плане прироста эффективности лечения. На основе глубокого изучения биохимизма опухолевых клеток, раскрытия патогенетических механизмов опухолевой прогрессии были разработаны технологии программной терапии злокачественных бластных неоплазий, отработана терапия сопровождения. Эти действительно революционные перемены в лечебно-диагностических подходах не замедлили сказаться на результативности терапии, выживаемости и качества жизни пациентов. Острый лейкоз стал индикаторной нозологией в отношении качества работы гематологических клиник во всем мире. На международных форумах были обсуждены и приняты, новые положения ВОЗ-классификации, стандарты лечения и алгоритмы профилактики осложнений миелоаблативных химиотерапевтических программ. В последние годы определено место аллогенной трансплантации костного мозга и периферических стволовых клеток как основы консолидации ремиссии и средства борьбы с резидуальной опухолевой болезнью как способа биологического моделирования in vivo иммунной реакции трансплантат против лейкозах [1].

Дальнейшее продвижение в прогнозировании опухолевой прогрессии и эффективности терапии, было связано с верификацией молекулярно-генетических аномалий в геноме опухолевой бластной клетки, что выявило чрезвычайную гетерогенность данной нозологии. Эта позиция отразилась в пересмотрах ВОЗ-классификации острых лейкозов, выделении особых вариантов, ассоциированных с комплексом иммунофенотипических, цитогенетических и молекулярно-генетических маркеров [2]. К настоящему времени доказана тесная ассоциация варианта опухоли с особенностями клинического течения, эффективностью стандартных протоколов лечения и прогнозом заболевания. Большое значе-