



UDC 616.71-018:616.152.21.46-002-037

COMPARATIVE PARAMETERS OF SIGNIFICANT DIFFERENCES BETWEEN CELLS OF THE IMMUNE SYSTEM IN THE DYNAMICS OF CHRONIC AND ACUTE EXPERIMENTAL OSTEOMYELITIS

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✓ *Resume*

Purpose: to study quantitative and qualitative changes in the cells of the immune system in acute and chronic osteomyelitis in experimental studies, comparative analysis.

Methods: Experimental study of the degree of changes in the cells of the central and peripheral organs of the immune system in laboratory animals, as well as methods for determining the intensity of quantitative changes in the cells of the immune system.

Results: The results of an experimental study of indicators of quantitative and qualitative changes in the cells of the central and peripheral organs of the immune system are presented.

Conclusion. Early diagnosis of osteomyelitis of various forms is devoted to determining the indicators of quantitative changes in the cells of the central and peripheral organs of the body's immune system as a result of exposure to acute and chronic osteomyelitis. In experimental studies, the dynamics of acute and chronic osteomyelitis in laboratory animals increases the therapeutic efficacy of the treatment of this disease, taking into account the severity of changes in quantitative and qualitative indicators of changes in cells of the central and peripheral organs of the immune system. Studies on laboratory animals gave their results on the study of quantitative and qualitative changes in the cells of the immune system as a result of the impact of acute and chronic osteomyelitis on the cells of the central and peripheral organs of the immune system.

Keywords: acute osteomyelitis, chronic osteomyelitis, immune system, experimental studies, leukocytes, thymus, bone marrow, osteomyelitis, laboratory animals.

СУРУНКАЛИ ВА ЎТКИР ТАЖРИБАВИЙ ОСТЕОМИЕЛИТЛАР ДИНАМИКАСИДА ИММУН ТИЗИМ ХУЖАЙРАЛАРИ ОРАСИДАГИ ИШОНАРЛИ ФАРҚЛАР ҚИЁСИЙ ПАРАМЕТРЛАРИ

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✓ *Резюме*

Мақсад: тажрибавий тадқиқотларда ўткир ва сурункали остеомиелитларда иммун тизими аъзолари хужайраларидаги миқдорий ҳамда сифатий ўзгаришларни ўрганиш, қиёсий таҳлил қилиш.

Усуллари: иммун тизимининг марказий ва периферик аъзолари хужайраларининг ўзгаришлар даражасини лаборатория ҳайвонларида экспериментал ўрганиш ҳамда иммун тизим хужайралари миқдорий ўзгаришлар интенсивлигини аниқлаш усуллари.

Олинган натижалар: иммун тизимининг марказий ва периферик аъзолари хужайраларида миқдорий ва сифатий ўзгаришлар кўрсаткичларини экспериментал ўрганиш натижалари келтирилган.

Хулоса: Турли кўринишдаги остеомиелитларни эрта диагностикаси ўткир ва сурункали остеомиелит кечишининг таъсири натижасида организм иммун тизими марказий ва периферик аъзолари хужайраларидаги миқдорий ўзгаришлар кўрсаткичларини аниқлашга бағишланган. Тажрибавий тадқиқотларда лаборатория ҳайвонларида ўткир ва сурункали остеомиелитлар кечиш динамикасида иммун тизими марказий ва периферик аъзолари хужайраларига миқдорий ва сифатий кўрсаткичлари ўзгаришлар интенсивлигини эътиборга олган ҳолда даволаш чораларини белгилаш, ушбу касалликни даволашнинг тиббий самарадорлигини оширади. Лаборатория ҳайвонларида ўтказилган тадқиқотларда ўткир ва сурункали остеомиелитларнинг иммун тизим марказий ва периферик аъзолари хужайраларига таъсири натижасида иммунитет тизими аъзолари хужайраларидаги миқдорий ва сифат ўзгаришлар кўрсаткичларини ўрганиш натижалари келтирилган.

Калит сўзлар: ўткир, сурункали, иммун тизими, тажрибавий тадқиқотлар, лейкоцитлар, тимус, суяк қўмиги, остеомиелит, лаборатория ҳайвонлари.

СРАВНИТЕЛЬНЫЕ ПАРАМЕТРЫ ДОСТОВЕРНЫХ РАЗЛИЧИЙ МЕЖДУ КЛЕТКАМИ ИММУННОЙ СИСТЕМЫ В ДИНАМИКЕ ХРОНИЧЕСКОГО И ОСТРОГО ЭКСПЕРИМЕНТАЛЬНОГО ОСТЕОМИЕЛИТА

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Цель: изучить количественные и качественные изменения клеток иммунной системы при остром и хроническом остеомиелите в экспериментальных исследованиях, сравнительный анализ.

Методы: Экспериментальное изучение степени изменений клеток центральных и периферических органов иммунной системы у лабораторных животных, а также методы определения интенсивности количественных изменений клеток иммунной системы.

Результаты: Представлены результаты экспериментального изучения показателей количественных и качественных изменений клеток центральных и периферических органов иммунной системы.

Заключение. Ранняя диагностика остеомиелита различных форм посвящена определению показателей количественных изменений клеток центральных и периферических органов иммунной системы организма в результате воздействия острого и хронического остеомиелита. В экспериментальных исследованиях динамика острого и хронического остеомиелита у лабораторных животных повышает лечебную эффективность лечения этого заболевания с учетом выраженности изменений количественных и качественных показателей изменений клеток центральных и периферических органов иммунной системы. Исследования на лабораторных животных дали свои результаты по изучению количественных и качественных изменений клеток иммунной системы в результате воздействия острого и хронического остеомиелита на клетки центральных и периферических органов иммунной системы.

Ключевые слова: острый остеомиелит, хронический остеомиелит, иммунная система, экспериментальные исследования, лейкоциты, тимус, костный мозг, остеомиелит, лабораторные животные.

Relevance

Currently, the incidence of osteomyelitis, musculoskeletal disorders, long-term purulent inflammatory process in the bones, musculoskeletal disorders in 78% of people due to long-term purulent inflammation in the bones up to 55% of patients with disabilities remains one of the most pressing problems in medicine [5,6]

Acute and chronic osteomyelitis are accompanied by an increase in immunodeficiency due to the impact on the immune system [4], a septicemia form of acute osteomyelitis develops in children with a decrease in protective factors as a result of various internal and external adverse effects on the human body. It is noteworthy that it ranges from 7% to 16.2-18.3% [1, 10].

To date, the immuno-microbiological aspects and pathogenetic mechanisms of various forms of osteomyelitis have not been clearly evaluated, as there is a need for immediate treatment with the detection of the disease [2,3]. It does not allow to study the immuno-microbiological laws of development in dynamics [4,8]. Analysis of the scientific work of domestic and foreign researchers on the problem under study showed that with the help of experimental models of osteomyelitis it is possible to accurately determine the laws of formation, development and progression of acute and chronic osteomyelitis.

Improving the experimental models of osteomyelitis in accordance with modern requirements, creating new models, increasing their economic and medical effectiveness, to assess the microbiological and immunological aspects of osteomyelitis, which have not been fully and insufficiently studied to date, remain relevant. This requires experts in the field to conduct a number of scientific studies and research in this area [9].

Purpose: to study quantitative and qualitative changes in the cells of the immune system in acute and chronic osteomyelitis in experimental studies, comparative analysis.

Materials and methods

In order to conduct this study, experiments were performed on a total of 72 white mice. Ethical principles and biological safety rules for the selection, grouping, care, feeding and handling of laboratory animals and their experiments with laboratory animals were strictly followed [7]. Collective strains of microorganisms (*S. Aureus* and *P. aureginosa*) were used in the formation of experimental osteomyelitis in laboratory animals.

All studies were performed in dynamics and results were observed on days 7, 14, 21, 30, and 45 of the experiment. All laboratory animals were divided into 2 large groups.

The main first group (n = 36) were white pedigree mice called acute osteomyelitis. They were divided into three groups. Group 1a - Laboratory animals whose results were studied on day 7 after acute osteomyelitis was called (n = 12); Laboratory animals whose results were studied on day 14 after group 1b acute osteomyelitis was called (n = 12); Laboratory animals (n = 12) whose results were studied on day 21 after 1v acute osteomyelitis was called.

Control (second) group (n = 36) - inactive white mice without acute osteomyelitis. They were also anesthetized on days 7 (n = 12), 14 (n = 12), 21 (n = 12), 30 (n = 12), and 45 (n = 12) of the experiment, respectively, according to the main group. .

Statistical methods were also used in the comparative analysis.

Results and discussion

In experimental studies, it was observed that the pathological process was different from the acute appearance when chronic experimental osteomyelitis was caused by pathogenic strains of *S. Aureus* and *P. aureginosa*, causing lesions in the tubular bone in laboratory animals, ie white mice. On the 30th day after the onset of the pathological condition, 4 of the studied materials, namely antibody-forming cells (AFC), AFC in 1 million cells, nuclear-storing cells in the spleen (SNSC), LNC (lymph node cells), quantitative indicators were reliable in the main group (relative to the control group). in the case of a decrease ($P < 0.05$) 2, the quantitative indicators of thymus cells (TC) and bone marrow cells (BMC) decreased reliably ($R > 0.05$), although a downward trend was observed. This situation was also confirmed by the detection of negative changes in all stimulation indices. The fact that the mean number of leukocytes in the blood was also statistically significant ($P < 0.001$) in the main group compared to the control group indicates that the quantitative indicators of the cells of the immune system changed in sync.

All these grounds indicate that on the 30th day of the formation and development of chronic experimental osteomyelitis there is a deep immunodeficiency in the immune system, the influence of this system on the course of the pathological process is insufficient. It was found that this chronic process differs in many respects from the acute pathological condition under consideration. The most important conclusion is explained by the fact that the immune system is less involved in the pathological process than in the acute case in the chronic state. This indicates that the outcome of the ongoing chronic pathological process is unfavorable.

In the next stage of our experiment, an analysis of the results of the study of quantitative indicators of cells of the immune system 45 days after the formation of the pathological process in laboratory animals called chronic experimental osteomyelitis was presented.

The results showed that the amount of all indicators studied was significantly lower in the main group than in the control group -6 out of 6 indicators compared with the previous ones (Table 1)

Table 1

Comparative parameters of reliable differences between cells of the immune system in the dynamics of chronic and acute experimental osteomyelitis

Indicators		The figures are convincing		
		Increased	decreased	There is no difference
Acute osteomyelitis	7-day	3/50,0	3/50,0	0/0
	14-day	3/50,0	3/50,0	0/0
	21-day	0/0	2/33,3	4/66,7
Forgive chronic experimental osteomyelitis	30-day	0/0	4/66,7	2/33,3
	45-day	0/0	6/100,0	0/0

Note: Absolute in the picture, relative (%) in the denominator

It can be seen that in the first and second weeks of the development of acute experimental osteomyelitis is characterized by sharp changes in the activity of cells of the immune system. Over time (third week) there is a gradual decline in immune system activity.

In chronic experimental osteomyelitis, a total decrease in the activity of the immune system was observed on days 30 and 45, which is explained by the weakening of the body's compensatory-adaptive mechanisms, the immune response to external influences (chronic purulent-inflammatory process).

In order to give a comparative, clear picture of the results, we presented the figures obtained in Figure 1.

1-figure

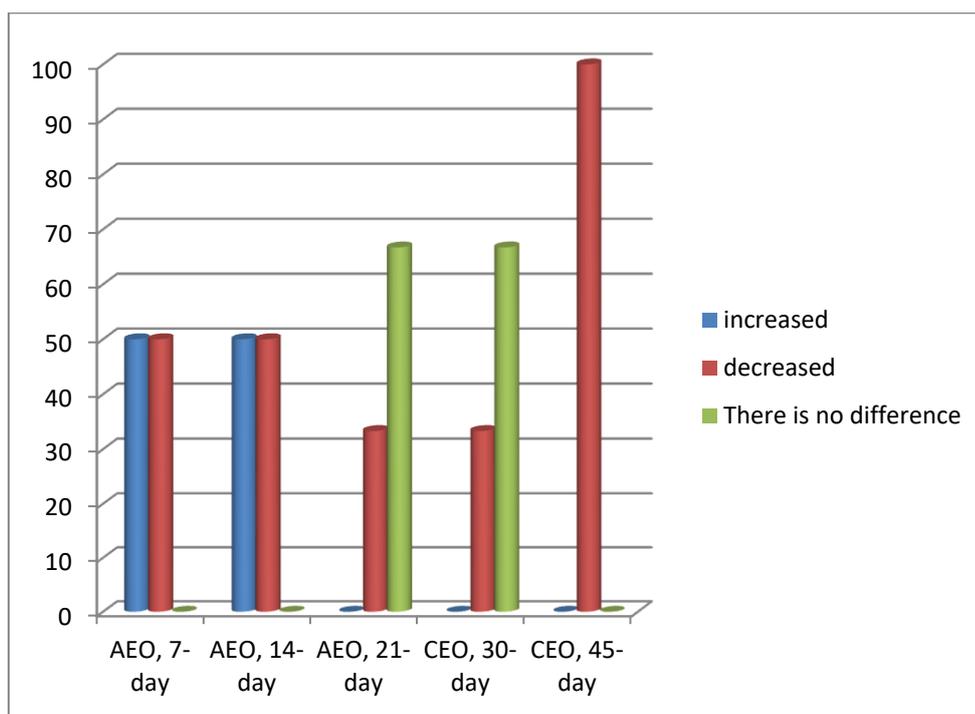


Figure 1 Comparative indicators of the reliable difference between the cells of the immune system in the dynamics of experimental acute and chronic osteomyelitis.

Figure 1 shows that the changes are interrelated, the effect of the appearance and duration of the pathological process on the quantitative indicators of the cells of the immune system is reflected.

Forty-five days after the onset of chronic experimental osteomyelitis, specific changes in immune system cells were observed.

These peculiarities were manifested by the following cases: first, all indicators were convincingly lower in the main group than in the control group of immune system cells ($P < 0.001$); second, the intensity of the decline was characterized by a significantly lower than the previous period (30-day) parameters; third, cells of the central (thymus, bone marrow) and peripheral organs (lymph nodes) of the immune system decreased at the same intensity (Table 2)

Table 2

Comparative indicators of quantitative changes in the cells of the immune system at 45 days of experimental osteomyelitis

Indicators	Control group n=12	Main group n=12	
AFC	2786 ± 145	1387 ± 159*	↓
AFC in 1 mln cells	24 ± 2	17 ± 3*	↓ ↓
SNSC	152 ± 5	124 ± 6*	↓
Thymus cells	52 ± 2	42 ± 5	↔
Bone marrow cells	15 ± 1	10 ± 2	↔
Lymph node cells	21 ± 1	20 ± 1*	↓

Note: * - a reliable difference sign relative to the control group; ↓, ↑ - phase directions.

As shown in Table 2, the AFC deficit was 2786 ± 1.45 cells to $1387 \pm$ cells (2.01 times, ($P < 0.001$)) in other immune system cells. Although SNSC in the main group was slightly less than the deficit AFC in the control group, it was characterized by a convincing difference in results — 152 ± 5 cells per 124 ± 6 cells (* 1.23 times, $R < 0.001$), respectively.

The intensity of the decline in the cells of the immune system is lower, but it is noteworthy that the numbers obtained are reliably different from each other - the numbers on the thymus cells are $42 \pm$ and 52 ± 2 cells (1.24 times, $R < 0.05$), respectively, bone marrow. 10 ± 2 and 15 ± 1 cells (1.5 times, $R < 0.001$), and 16 ± 1 and 21 ± 1 cells (1.31 times, $R < 0.05$) for lymph node cells.

In order to confirm these figures and determine the degree of quantitative deficiency in the cells of the immune system, we present the results of the study of stimulation indices during this period.

Figure 2

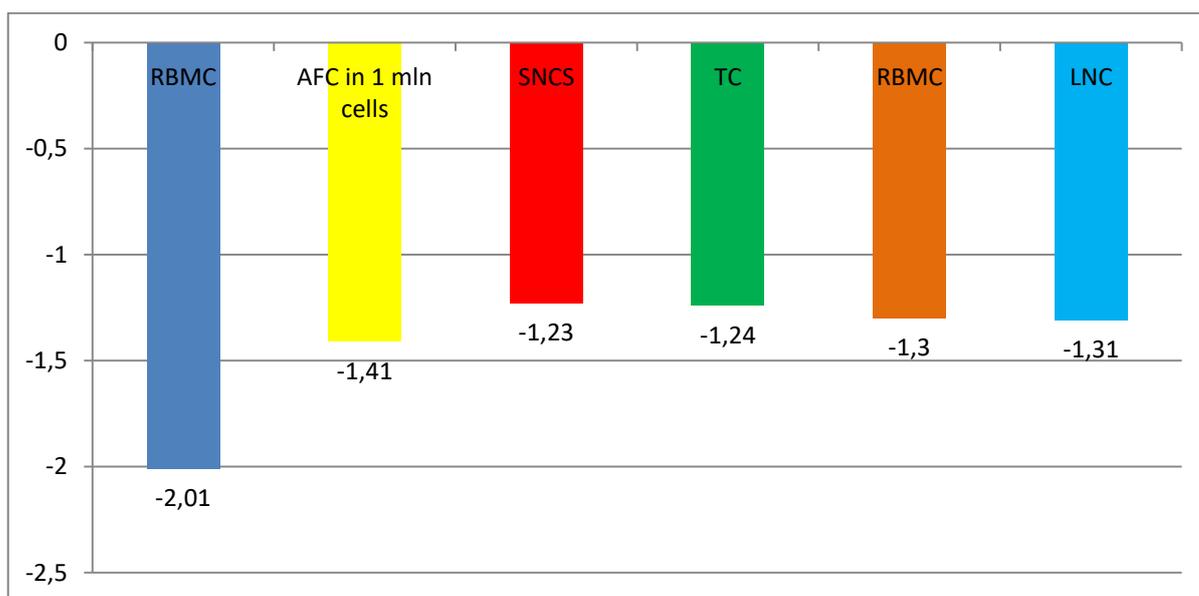


Figure 2 Comparative indicators of stimulation indices on day 45 of experimental chronic osteomyelitis, unit

If we compare with 30 days of chronic experimental osteomyelitis, we see that the results are more profound, and it is also noteworthy that all indicators have changed convincingly.

Conclusions

1. In chronic experimental osteomyelitis, a total decrease in the activity of the immune system was observed on days 30 and 45, which is explained by the compensatory-adaptive mechanisms of the organism, the weakening of the immune response to external influences.

2. 45 days after the onset of chronic experimental osteomyelitis, specific changes in the cells of the immune system were observed. These peculiarities were manifested by the following cases: first, all indicators were convincingly lower in the main group than in the control group of immune system cells.

3. The results of a comparative study of stimulus indices with increasing observation time in experimental osteomyelitis showed that the development of chronic osteomyelitis represents the depth of secondary immunodeficiency, which indicates a decrease in the intensity of the differences.

4. The involvement of the immune system in the pathological process was found to be less in the chronic state than in the acute state. This indicates that the outcome of the ongoing chronic pathological process is unfavorable.

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Entered 09.01.2022