Table 2

**The resistance of *St.aureus* to antibiotics in the multidisciplinary surgical hospital in a multidisciplinary surgical hospital 2006-2016, %**

| Antibiotic | *S. aures* | | | | |
|---|---|---|---|---|---|
| | 2006 | 2009 | 2012 | 2014 | 2016 |
| | n=137 | n=169 | n=57 | n=89 | n=149 |
| Ciprofloxacinum | 6.6 | 39.6 | 70.2 | 69.7 | 35.6 |
| Levofloxacinum | 2.9 | 34.9 | 42.1 | 62.9 | 34.2 |
| Amicacinum | 13.1 | 68.0 | 70.2 | 75.3 | 36.9 |
| Doxycuclinum | 8.8 | 16.0 | 22.8 | 69.7 | 40.9 |
| Lincomycinum | 89.1 | 87.0 | 59.6 | 60.7 | 34.9 |
| Erythromycinum | 100.0 | 68.6 | 84.2 | 87.6 | 41.6 |
| Oxacillinum | 0.7 | 39.1 | 54.4 | 68.5 | 39.6 |
| Vancomycinum | 0.0 | 0.0 | 0.0 | 3.4 | 0.7 |
| Linezolidum | - | - | 0.0 | 0.0 | 0.0 |

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# THE DIAGNOSTCS AND TREATMENT OF ENDOGENOUS INTOXICATION IN PATIENTS WITH MANDIBLE TRAUMATIC OSTEOMYELITIS

**ABSTRACT**

Quite often standard methods of treatment of traumatic osteomyelitis of the lower jaw do not lead to a suppression of the purulent-inflammatory process in the bone tissue and the disease acquires a lukewarm torpid nature of the flow with periodic exacerbations. An important task of clinical medicine is to determine the presence and assessment of the severity of endogenous intoxication. For diagnostics, it is usually proposed to determine the level of endotoxic substances and parameters of the cellular composition of the blood, special indexes of intoxication are calculated for facilitating the interpretation of these changes in populations and subpopulations of blood cells, but a sufficient evidence base to facilitate the interpretation of laboratory data is not yet formed.

The **aim** of the study was to determine the diagnostic efficiency of laboratory parameters in endotoxicosis caused by traumatic osteomyelitis of the lower jaw, as well as the development of a diagnostic algorithm and complex treatment depending on the stage of chronic endogenous intoxication. Patients with traumatic osteomyelitis of the lower jaw at the age of 18 to 65 years were examined. In addition to the traditional clinical and laboratory examination, an assessment of the nature and severity of chronic endogenous intoxication was carried out using the developed test suite.

As a result of the study, it was found that the most informative in the prognostic plan is the definition of the level of "medium-mass molecules", diene conjugates and the sorption capacity of erythrocytes. Other parameters investigated, including integral leukocyte indices of intoxication, are inferior to them for diagnostic value. Analysis of the results of clinical and laboratory studies shows the important role of chronic endogenous intoxication in the imbalance of homeostasis systems that caused atypical or torpid manifestations of the disease. The results of the study showed that the most informative methods for detecting the presence and subsequent dynamic monitoring of the level of endogenous intoxication should be recognized as the definition of sorption capacity erythrocytes and the level of "medium-mass molecules". Integral leukocyte indices of intoxication can be used to identify patients at risk of a complicated course of the disease, who need an in-depth biochemical examination.

**Keywords:** traumatic osteomyelitis, sorption capacity of erythrocytes, leukocyte indices of intoxication, endotoxicosis.

**Introduction.** Increasing the effectiveness of treatment of traumatic osteomyelitis of the lower jaw (TOLJ) continues to be one of the urgent problems of maxillofacial surgery. Quite often the standard methods of treatment do not lead to the suppression of the purulent-inflammatory process in the bone tissue and the disease acquires a torpid nature of the flow with periodic exacerbations [1, 2, 5].

Long-term presence of microorganisms and their toxins in the bloodstream, accumulation of under-oxidized metabolic products lead to the development of chronic metabolic stress of the patients' body. Endogenous intoxication is extremely important, and with a certain phase of the disease it becomes a leading pathogenetic element of many chronic inflammatory diseases of the maxillofacial region. According to the definition, endotoxicosis is a complicated autocatalytic process that eventually acquires a universal character,that less and less depends on the mechanisms that triggered it. During an endotoxicosis unbalanced biologically active substances are becoming aggressive agents. The term of "endogenous toxic substances" means substances of biological origin, which accumulating in the body above the normal level, have a damaging effect on organs and systems [3]. In this case, the basic systems of biotransformation and toxic substances get unbalanced, that lead to the development of

chronic endogenous intoxication in the compensated, subcompensated or decompensated stages [1, 2, 8, 9]. In this connection, the conventional complex therapy of TOLJ often turns out to be ineffective, and the disease acquires a torpid flow with frequent exacerbations and recurrences. Such a course of the disease determines an unfavorable clinical prognosis and requires more detailed clinical and laboratory diagnosis and the introduction of new methods of treatment [1, 7, 8].

Determination of the presence and assessment of the severity of endogenous intoxication is an important task for clinical medicine. For the diagnosis of endotoxicosis is usually suggested to determine the level of some endotoxic substances [3] and the parameters of the cellular composition of the blood, which, apparently, reflect the protective reaction of the organism. Moreover, in order to facilitate the interpretation of these changes in populations and subpopulations of blood cells, it was suggested to calculate specific indices of intoxication [4]. Along with this, despite a rather large number of studies, the evidence base, which will facilitate the interpretation of laboratory data has not yet been formed.

**The purpose** of this study is to determine the diagnostic efficacy of laboratory indicators for endotoxicosis caused by traumatic osteomyelitis of the lower jaw, as well as the development of a diagnostic algorithm and complex treatment, depending on the stage of chronic endogenous intoxication.

**Materials and methods of research.** We examined 468 patients with traumatic osteomyelitis of the lower jaw at the age of 18 to 65 years. With the simple randomization method, patients were divided into two clinical groups: the main (with the inclusion of the efferent therapy in the complex treatment scheme) and the comparison group, where patients were treated with a traditional set of therapeutic measures. The criteria for inclusion in the study were: a clinically established and radiologically confirmed diagnosis of traumatic osteomyelitis of the lower jaw, the patient's consent to participate in the study. A group of practically healthy people aged from 20 to 62 years was examined, in order to determine the regional indicators of the norm. Formed groups were representative and comparable to each other in terms of age and sex.

In addition to the traditional clinical and laboratory examination, we evaluated the nature and severity of chronic endogenous intoxication with the help of the complex of tests, which were developed by us [1, 2, 8, 9].

The level of toxemia was determined by the content of average molecular weight (AMW) in blood plasma by spectrophotometric method [3], the level of accumulation in the blood plasma of primary (diene conjugates) and final (dienketones) products of lipid peroxidation - modified Z method Placer et al. (1976), the content of malonic dialdehyde - by the method of M. Mihara, M. Uchiyama (1978).

To determine the degree of membrane damage, the sorption capacity of erythrocytes (SCE) was determined according to A.A. Togaibaevu (1988).

To asess the condition of the antioxidant system, the total antioxidant activity of plasma ( P. Prieto et al. 1999) , the activity of superoxide dismutase (VA Kostyuk et al., 1990) and catalase (MA Korolyuk et al., 1988) in serum and erythrocytes of peripheral blood were determined.

To assess the changes at the system level, the analysis of changes in hemogram and leukocyte formula of the blood was carried out, as well as the calculation of a number of integral indicators: hematological index of intoxication by V. S. Vasiliev (1983), leukocyte index of intoxication (LII) by I. Y. Calf-Caliph (1941), hematological index of intoxication by G. N. Karabanov (1993).

Patients with assosiated somatic pathology in the stage of decompensation or remission of less than 3 months were excluded from the study. Materials for the biochemical study were erythrocytes and blood serum, blood draw was carried out from the cubital vein. The multiplicity of studies was determined by the following parameters: at the time of hospitalization before the beginning of surgical treatment, on the 3rd -4th and on the 8-10th day after the operative intervention. To characterize these indicators, their predictive value (positive predictive value), specificity and sensitivity were determined by R. Fletcher et al. [6].

To define the difference between the compared averages, the t-test of the Student was used, the differences were significant for $p < 0.05$.

**Results and and its discussion.** The clinical picture of traumatic osteomyelitis of the lower jaw among the patients of both clinical groups was characterized by a long torpid course of disease (from 2.5 months to 1.5 years) with repeated relapses (up to 35% in the comparison group), the absence of a clear delineation of the stages of the disease, mild general symptoms of the inflammatory process, lack of correlation between general and local manifestations of the disease.

As a result of the study, it was found that the most informative in the prognostic plan is the definition of the level of "medium-mass molecules", diene conjugates and the sorption capacity of erythrocytes. The value of these indicators exceeded 91%. Other parameters, including integral leukocyte indices of intoxication, were inferior in diagnostic value. In this case, the sensitivity of determining the level of "medium-mass molecules" and the sorption capacity of erythrocytes was absolute, and the specificity was 82% and 91%, respectively. While the sensitivity of determining diene conjugates was only 70%. The predictive value of the determination of TBA-positive products did not exceed 60%, and the total antioxidant activity - 80%.

Analysis of the results of clinical and laboratory studies has convincingly demonstrated the important role of chronic endogenous intoxication in the imbalance of homeostasis systems, which caused atypical or torpid manifestations of the disease.

The received data pushed us to a revision of the traditional scheme of treatment of traumatic osteomyelitis of the mandible in the direction of expanding the methods of a fight against existing endotoxicosis. For each stage of chronic endogenous intoxication, we have developed the concept of complex treatment,in addition to traditional therapy, we have included various methods of extracorporeal detoxification, (discrete plasmapheresis, intravenous laser irradiation of blood, indirect electrochemical oxidation of blood, reinfusion with ultraviolet irradiated blood, enterosorption), application of antihypoxic drugs, according to the medical evidence - etiotropic antibiotic therapy, and a new approach for choose the right time of surgical oparations. As a result, among the patients of the main group with a sub- and decompensated stage of chronic endogenous intoxication, the level of endogenous intoxication on the 8th day after the operation was significantly decreased in comparison with the corresponding parameters in the comparison group (Table 1).

The results of the remaining studies also indicated a significant decrease in the level of chronic endogenous intoxication.

The proposed scheme of complex treatment of patients with sub- and de-

Table 1

**Dynamics of indices of endogenous intoxication among the patients with traumatic osteomyelitis of the lower jaw**

| Indicator | Stage of chronic endogenous intoxication | Level while hospitalization | On the 8th day after the operation with traditional treatment (comparison group) | On the 8th day after operation (main group) |
|---|---|---|---|---|
| Level of AMW (254 нм),standard units | Decompensated | 0.543 ± | 0.387 ± | 0.256 ± |
| | Subcompensated | 0.480 ± | 0.347 ± | 0.268 ± |
| | Compensated | 0.358 ± | 0.288 ± | 0.247 ± |
| Level of AMW (280 нм),standard units | Decompensated | 0.727 ± | 0.429 ± | 0.309 ± |
| | Subcompensated | 0.577 ± | 0.425 ± | 0.329 ± |
| | Compensated | 0.464 ± | 0.393 ± | 0.306 ± |
| Level of SCE, % | Decompensated | 50.9 ± | 39.7 ± | 28.4 ± |
| | Subcompensated | 45.3 ± | 33.4 ± | 26.0 ± |
| | Compensated | 39.6 ± | 30.9 ± | 29.2 ± |
| Leukocyte intoxication index (LII), standard units | Decompensated | 2.33 ± | 1.67 ± | 0.93 ± |
| | Subcompensated | 2.17 ± | 1.32 ± | 0.74 ± |
| | Compensated | 2.08 ± | 1.36 ± | 1.01 ± |

Note. In the Tables 1 and 2 * - significant differences from the comparison group, $p < 0.05$.

compensated stage of chronic endogenous intoxication led to a significant reduction in the duration of inpatient treatment among patients of the main group (Table 2). Clinical recovery was achieved in 91.1% of patients in the main group, compared with 64.8% in the comparison group.

**Conclusions.** Thus, the results of the study showed that the definition of the sorption capacity of erythrocytes and the level of "medium molecular weight " should be recognized as the most informative methods for detecting the presence and subsequent dynamic monitoring of the level of endogenous intoxication. Integral leukocyte indices of intoxication can be used to identify patients at risk of a complicated course of the disease, who need an in-depth biochemical examination.

Carried out treatment according to the developed program made it possible to significantly improve the results of treatment of patients with decompensated and subcompensated stage of chronic endogenous intoxication, allowed to optimize the course of the postoperative period, to reduce the number of complications and relapses of the disease.

Table 2

**Postoperative bed-day among the patients with TOLJ with complicated course of the postoperative period**

| Stage of chronic endogenous intoxication | Traditional treatment of TOLJ (comparison group), days | Including the complex treatment of efferent therapy (main group), days. |
|---|---|---|
| Decompensated | 25.6 ± | 19.6 ± |
| Subcompensated | 24.0 ± | 17.6 ± |
| Compensated | 19.6 ± | 19.3 ± |

## References


1. Кирпичников М.В. Эффективность комплексного лечения травматического остеомиелита нижней челюсти с применением эфферентных методов: Автореф. дис. ... канд. мед. наук. – Волгоград, 2004; 22. [Kirpichnikov MV. Efficiency of complex treatment of traumatic osteomyelitis of the lower jaw with the use of efferent methods: Author's abstract. dis. ... cand. med. sciences. Volgograd, 2004; 22. (In Russ.).] http://www.dissercat.com/content/effektivnost-kompleksnogo-lecheniya-travmaticheskogo-osteomielita-nizhnei-chelyusti-s-primen

2. Кирпичников М.В., Ярыгина Е.Н. Комплексная диагностика эндогенной интоксикации у больных хроническим и атипично текущими гнойно-воспалительными заболеваниями лица и шеи. *Медицинский алфавит*. 2008; 5 (2): (Стоматология). 20-22. [Kirpichnikov MV Complex diagnostics of endogenous intoxication in patients with chronic and atypically ongoing purulent-inflammatory diseases of face and neck. Medical alphabet. 2008; 5(2): (Stomatology).20-22. (In Russ.).] .https://elibrary.ru/item.asp?id=30693176

3. Карпищенко А.И. Медицинская лабораторная диагностика: программы и алгоритмы. Руководство для врачей / А.И. Карпищенко и др.; под ред. проф. А.И. Карпищенко. – 3-е изд., перераб. и доп. – М.: ГЭОТАР-Медиа, 2014;692. [Karpischenko AI. Medical laboratory diagnostics: programs and algorithms. A guide for doctors / A.I. Karpischenko et al.; by ed. prof. A.I. Karpischenko. - 3rd ed., pererab. and add. - M .: GEOTAR-Media, 2014; 692. (In Russ.).] https://elibrary.ru/item.asp?id=25874190

4. Островский В.К., Мащенко А.В., Янголенко Д.В., Макаров С.В. Лейкоцитарный индекс интоксикации и некоторые показатели крови при оценке тяжести течения и определении прогноза воспалительных, гнойных и гнойно-деструктивных заболеваний разных локализаций. *Анестезиология и реаниматология*. 2005; 6:25-29. [Ostrovsky V.K., Mashchenko A.V., Yangolenko D.V., Makarov S.V. Leukocyte index of intoxication and some blood counts in assessing the severity of the course and determining the prognosis of inflammatory, purulent and purulent-destructive diseases of different localizations. *Anesthesiology and resuscitation*. 2005; 6:25-29. (In Russ.).] .https://elibrary.ru/item.asp?id=9295730

5. Фомичев Е.В., Кирпичников М.В., Ярыгина Е.Н. Современные особенности клинических проявлений одонтогенного и травматического остеомиелита нижней челюсти. Вестник ВолгГМУ. 2013;1(45):7-11. [Fomichev E.V., Kirpichnikov M.V., Yarygina E.N. Modern features of clinical manifestations of odontogenic and traumatic osteomyelitis of the lower jaw. Bulletin of VolgGMU. 2013;1(45):7-11. (In Russ.)] http://www.volgmed.ru/uploads/journals/articles/1524479622-bulletin-2017-4-3135.pdf

6. Флетчер Р., Флетчер С., Вагнер Э. Клиническая эпидемиология. Основы доказательной медицины: Пер. с англ. – М.,1998; 352. [FletcherR. Clinical Epidemiology. Basicsof Evidence-Based Medicine: Trans. With English. / FletcherR., FletcherS., WagnerE. - M., 1998; 352. (In Russ.).] http://kingmed.info/knigi/Infektsionnye_bolezni_Epidemiologia/book_3455/Klinicheskaya_epidemiologiya_Osnovi_dokazatelnoy_meditsini-Fletcher_R_Fletcher_S_Vagner_E_-1998-pdf

7. Фомичёв Е.В., Кирпичников М.В., Подольский В.В. Анализ этиологических

факторов травматического остеомиелита нижней челюсти. Волгоградский научно-медицинский журнал. 2010;4:41-44. [Fomichev E.V., Kirpichnikov M.V., Podolsky V.V. Analysis of the etiological factors of traumatic osteomyelitis of the lower jaw. Volgograd Scientific Medical Journal. 2010; 4: 41-44. (In Russ.).] https://readera.ru/analiz-jetiologicheskih-faktorov-travmaticheskogo-osteomielita-nizhnej-cheljusti-142148866

8. Фомичёв Е.В., Островский О.В. Кирпичников М.В. Эффективность лечения больных травматическим остеомиелитом нижней челюсти с помощью эфферентных методов. Волгоградский научно-медицинский журнал. 2010;3:42-45. [Fomichev E.V., Ostrovsky O.V. Kirpichnikov M.V. Effectiveness of treatment of patients with traumatic osteomyelitis of the lower jaw by means of efferent methods. Volgograd Scientific Medical Journal. 2010. 3:42-45. (In Russ.).] https://cyberleninka.ru/article/n/effektivnost-lecheniya-bolnyh-travmaticheskim-osteomielitom-nizhney-chelyusti-s-pomoschyu-efferentnyh-metodov

9. Ярыгина Е.Н., Смотрова Е.В., Кирпичников М.В. Диагностика эндогенной интоксикации у больных атипично текущими флегмонами и челюстно-лицевой области и травматическим остеомиелитом нижней челюсти. Вестник Российского государственного медицинского университета. 2006;2: 202. [Yarygina E.N., Smotrova E.V., Kirpichnikov M.V. Diagnosis of endogenous intoxication in patients with atypically flowing phlegmon and maxillofacial area and traumatic osteomyelitis of the lower jaw. Bulletin of the Russian State Medical University. 2006; 2:202. (In Russ.).] https://cyberleninka.ru/article/n/sovremennye-osobennosti-klinicheskih-proyavleniy-odontogennogo-i-travmaticheskogo-osteomielita-nizhney-chelyusti

10. Mihara M, Uchiyama M, Fukuzawa K. Thiobarbituric acid value on fresh homogenate of rat as a parameter of lipid peroxidation in aging, CCl4 intoxication and vitamin E deficiency. *Biochem. Med.* 1980; 3 (23):302–311. https://www.ncbi.nlm.nih.gov/pubmed/7417237

11. Prieto P, Pineda M, Aguilar M. Spectrophotometric Quantitation of Antioxidant Capacity through the Formation of a Phosphomolybdenum Complex: Specific Application to the Determination of Vitamin E. *Anal Biochem.* 1999;269:337-41. https://www.ncbi.nlm.nih.gov/pubmed/10222007

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# PATTERNS OF COMPLICATIONS IN THE PERIOPERATIVE PERIOD AND MORTALITY IN PATIENTS WITH ANEURYSMAL SUBARACHNOID HEMORRHAGE

ABSTRACT

The article presents the results of studying the patterns of complications and mortality from aneurysmal subarachnoid hemorrhage (aSAH) at the Anesthesiology, Reanimation and Intensive Care Unit (ARICU) of the Republic's Hospital No. 2 – Center for Emergency Medical Aid (ARICU RH No. 2 – CEMA) of the Sakha Republic (Yakutia) for the period of 2015-2017. During the study period, various complications were diagnosed in the preoperative period in 67.3% of the patients and in 64.7% of cases following surgery, and the mortality rate of this group of patients was 5.8% (9 patients).

The dominating pattern of the preoperative complications was cerebral vasospasm, with the specific gravity of 81.9%. Other complications of this period included ruptured aneurysms and cerebral edema with dislocation syndrome, 9.0% and 4.8% of the complications, respectively.

The complications during surgeries were of a technical nature and observed in 12.8% of the cases, leading to changes in surgical planning. These included ruptured aneurysm (85% of intraoperative complications), as well as pronounced cerebral edema and the impossibility of applying clips.

In the postoperative period, 64.7% of the patients had various intra- and extracerebral complications, which amounted to 61.38% and 38.6%, respectively, in the patterns of complications. Among the intracerebral complications, delayed cerebral ischemia (DCI) with 39.60% ranked first. This complication was more often observed in patients transported by air ambulance from district hospitals (32.1%) than among patients from the city of Yakutsk (19.2%). Among the extracranial complications, nosocomial pneumonia (NP) and severe cerebrocardiac syndrome (CCS) were more often diagnosed, making 20.79% and 12.87% in the patterns of postoperative complications.

Of the total number of treated patients, 62.2% of the patients were discharged with full recovery, 21.1% - with mild neurological deficit, 10.3% - with moderate neurological deficit, and 0.6% - in the vegetative state.

The data presented indicate the relevance of the issues related to treating patients with aSAH in the region, as well as the importance of measures for further improvement of the treatment, diagnostic and organizational-tactical approaches aimed at reducing complications and mortality in this group of patients.

**Keywords:** aneurysmal subarachnoid hemorrhage, intracerebral complications, extracerebral complications, cerebral vasospasm, nosocomial pneumonia.