**DIAGNOSIS AND TREATMENT OF HEMATOGENIC OSTEOMYELITIS**

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**Abstract:** Inflammatory diseases of the skeleton are one of the most severe and common diseases of the musculoskeletal system in children and adolescents, including a large group of destructive bone lesions of various etiologies, united by the general term "osteomyelitis". At the same time, the clinical, laboratory and radiological picture of both infectious (specific granulomatous and nonspecific purulent) and non-infectious ("non-bacterial, abacterial") osteomyelitis may have a similar picture, which leads to inevitable diagnostic errors and, accordingly, the choice of erroneous treatment methods.

**Keywords:** Osteomyelitis, children, bacterial, pathogenesis, immuno

**ДИАГНОСТИКА И ЛЕЧЕНИЕ ГЕМАТОГЕННОГО ОСТЕОМИЕЛИТА**

**Аннотация:** Воспалительные заболевания скелета - одно из наиболее тяжелых и распространенных заболеваний опорно-двигательного аппарата у детей и подростков, включающее большую группу деструктивных поражений костей различной этиологии, объединенных общим термином «остеомиелит». В то же время клинико-лабораторная и рентгенологическая картина как инфекционного (специфического гранулематозного и неспецифического гнойного), так и неинфекционного («небактериального, абактериального») остеомиелита может иметь схожую картину, что приводит к неизбежным диагностическим ошибкам и, соответственно выбор ошибочных методов лечения.

**Ключевые слова:** остеомиелит, дети, бактериальный, патогенез, иммунологический

**INTRODUCTION**

Inflammatory diseases of the skeleton are one of the most severe and common diseases of the musculoskeletal system in children and adolescents, including a large group of destructive bone lesions of various etiologies, united by the general term "osteomyelitis". At the same time, the clinical, laboratory and radiological picture of both infectious (specific granulomatous and nonspecific purulent) and non-infectious ("non-bacterial, abacterial") osteomyelitis may have a similar picture, which leads to inevitable diagnostic errors and, accordingly, the choice of erroneous treatment methods [Mika J., 2012, Whyte M.R., 2009, Tapaka S., 2013].

Among all osteomyelitis, the so-called "non-bacterial osteomyelitis" (NBO) causes the greatest interest and complexity. NBO is a relatively rare, little-studied skeletal disease, occurring mainly in children and adolescents, characterized by both a recurrent course and the possibility of spontaneous remission [Jansson A. et al, 2007, Gikas P.D. et al, 2009, Stern S., Ferguson P, 2013]. NBO refers to autoinflammatory bone diseases, the pathogenesis of which is based on an imbalance between pro-inflammatory and anti-inflammatory cytokines, namely, a decrease in the production of interleukin-10 by monocytes and an increase in tumor necrosis factor-a (TNF-a) [Hofmann SR, 2011; Hofmann SR, 2012]. It is known that NBO can be associated with other immune-mediated diseases, such as juvenile rheumatoid arthritis, inflammatory bowel disease, uveitis, psoriasis, Takayasu's arteritis, SAPHO syndrome, Majid's syndrome, DlRA syndrome. Particular aspects of this pathology were previously discussed in the domestic literature as part of orthopedic diagnostics [Berezhnykh A.n., 1998, Ochkurenko A.A., 1999], however, these studies, based on the understanding of its pathogenesis, did not address the issues of using antirheumatic and immunomodulatory therapy.

**MATERIALS AND METHODS**

Insufficient awareness of physicians about the clinical and radiation features of this pathology, the lack of algorithms for differentiating NBO and other local focal destructive diseases of the skeleton leads to their late diagnosis, unreasonable prescription of antibiotic therapy (often quite long and aggressive) and inadequate surgical interventions, delayed appointment of pathogenetic therapy [Barraní M., 2015, Mikulich, 2012]. However, with the established diagnosis of NBO, therapy should not be the same in all cases: with different variants of the disease, different treatment regimens can be effective [Girschick N. J, 2007]. Standardization of NBO diagnostic methods, algorithms for choosing treatment regimens requires the creation of a clear system for organizing staged medical care for such patients, which was the basis for this study.

Despite the constant improvement of diagnostic and treatment methods, chronic osteomyelitis remains one of the most common and severe diseases of the human musculoskeletal system (Borisov I.V., 2007; Babovnikov A.V. et al., 2009; E.A. Bullygina E.A. , 2010; Klyushin N.M., 2015; Perron A.D. et al., 2003; Lazzarini L. et al., 2004; Betlejewski S.J., 2007; Calhoun H. et al., 2009) A long-term chronic purulent-necrotic process, accompanied by alternating exacerbations and remissions, impaired support ability and limb function lead to pathological changes in almost all anatomical and structural formations of the segment and the limb as a whole (Gostishchev V.K., Malyshev E.S. et al. , 2001; Karmazanovsky G. G., 2013; Klyushin N. M., 2015; Girschick H. J. et. al., 2007). Practical experience shows that when performing surgery on an osteomyelitis focus, it is often difficult to determine a clear boundary between the affected and healthy bone (Klyushin N.M., et al., 2011; Klyushin N.M. et al., 2015).

The necessary observance of one of the key principles of purulent osteology: radicalness in relation to necrotic tissue and saving in relation to unaffected bone tissue, must now be ensured not only by the experience of the surgeon, but also with the obligatory use of modern technologies for visualizing tissue viability (Zavadovskaya V.D. 2004; Gotthardt R.F., 2010; Wang G.L. et al., 2010; Hiasa K. et al., 2011; Capozza M. et al., 2013) , lead to numerous changes not only in the zone of the inflammatory focus, but also in the surrounding tissues. In this regard, there is a need to assess the quality of the bone, those areas of the limb segment that will be involved in the chosen treatment method (Gostishchev V.K. et al., 2009, 2010; Boskey A. L. et al., 2011). The term "bone quality" has been used in the literature for more than 15 years, however, its meaning is not clearly formulated (Wallach S., et al., 1992; Watts N.B., 2002; Tommasini S.M. et al., 2005;. Compston J,, 2006; Guo X.E., 2008). As for orthopedics and, in particular, chronic osteomyelitis, the study of many bone parameters (its density, architectonics, anatomical features, quality assessment) has not been carried out in detail by modern diagnostic methods (Vovk E.A., 2010; Ikpeme I.A., et al., 2010 Van der Bruggen W. et al., 2010; Palestro C.J. et al., 2012).

**RESULTS**

Osteomyelitis is one of the most complex variants of the inflammatory process, as evidenced by the difficulties of diagnosis, treatment, a relatively large number of complications and the complexity of rehabilitation.

The lack of specific methods for detecting the hematogenous nature of osteomyelitis in the early stages is the cause of diagnostic and therapeutic-tactical errors exceeding 50%. Post-traumatic osteomyelitis is easily recognized but also difficult to treat.

The incidence of acute hematogenous osteomyelitis, which is predominantly a pathology of the child's body, according to many authors, is 6-10% of the number of patients with purulent diseases. In recent years, this percentage has significantly decreased to 2-3%. However, the age structure of morbidity has changed and moved to the newborn age and prenatal period. The transition of the disease to the chronic stage is still high and ranges from 10 to 40%.

The issues of prevention of complications and treatment of the consequences of hematogenous osteomyelitis cause discussion among scientists and clinicians. Failures and complications in the treatment of the consequences of HO occur in 12-31%, and for certain types - in 54.5% of treated children. Most of these cases require repeated surgical interventions at significant risk to life, and often with a poor functional prognosis of the affected segment.

The mechanisms of such complications as chronicity, generalization of infection and extensive osteonecrosis processes are not fully disclosed and studied.

One of the main pathogenetic factors in HO is endotoxicosis. Probably, the solution of the problem of infectious-inflammatory toxicosis is associated with the further development of the concept of endotoxicosis, the study of its deeper and more subtle mechanisms. The modern complex of intensive care for osteomyelitis (DPA, immunotherapy with T-activin, HBO, antioxidant treatment, local exposure to RT using GNL) is effective, has a positive effect and stabilizes the general condition of the patient.

However, the main treatment remains surgical sanitation of the focus. In the surgical treatment of osteomyelitis, there is a problem of control and management of the inflammation process occurring in the area of ​​surgical intervention, this complicates the treatment and aggravates the course and prognosis of the disease.

The operation of osteoperforation in the acute stage of the severe course of the disease of hematogenic nature and fistulosequestrnecrectomy in the chronic phase is not effective enough. Requires repeated traumatic operations. This contributes to an increase in the frequency of transition of osteomyelitis to the chronic stage or generalization of the osteomyelitis process with the development of sepsis. The formation of a chronic, long-existing purulent focus is difficult to treat. An important point in the complex of therapeutic measures is their pathogenetic justification. Radical removal of the focus in children is not acceptable. This indicates the urgency of the problem of osteomyelitis in children and encourages researchers to study issues of the greatest practical importance.

Thus, in the study of the etiology and pathogenesis, as well as the treatment of osteomyelitis, its relapses and complications, there are many unresolved problems, the in-depth development of which can contribute to improving the results of complex treatment of the disease under study and solving the problem as a whole. The above circumstances confirm the need for further study of the pathogenesis of GO, without which treatment becomes less effective. THE AIM OF the WORK is to improve the results of treatment of osteomyelitis and its complications in children by developing a new surgical method for treating the disease, based on a new conceptual approach and pathogenetic effects on the inflammatory process.

Hematogenous osteomyelitis is an inflammatory disease that begins in the bone marrow, in the vast majority of cases occurs in children and is called acute hematogenous osteomyelitis (OGO). In the case of the transition of the process to chronic (HRGO), it accompanies the patient throughout his life, periodically [remembering himself with relapses of the disease. Due to this feature, doctors of various specialties are engaged in this pathology - surgeons, pediatric surgeons, orthopedic traumatologists, pediatricians, outpatient network doctors. From the historical background on the development of views on the pathogenesis of CSOs, it is clear that his opinion was based on the positions held by the authors of a particular theory of pathogenesis and their followers. The use of conservative and various surgical methods of rehabilitation of the affected bone reflected the corresponding ideas about the causes of osteonecrosis (Shtin V.P. 1987; Lomachenko I.N., Pleshkov V.G. 1973; Mazurova V.K., 1974; . Bartkowski S.B. at al 1994). Nevertheless, the basic principle of puy surgery: ubi puss, ubi evacuata - remained immutable in the treatment of CSOs. Only the qualitative and quantitative approach to the problem has changed. The main emphasis in the treatment of CSOs has always been on antibiotic therapy (Grinev M.V., 1977; Bismildin H.B., co-author, 1993; Verpigora I.P., co-author, 1999; Christiansen R., at al, 1999; Song KM, Sloboda, 2001; Carek at al, 2001;

**DISCUSSION**

In surgical pathology of childhood, acute hematogenous osteomyelitis continues to be a common and severe purulent-septic disease (Chernenko L. Yu., Tsap N.A., 2012; Barskaya M.A. et al., 2015; Rumyantseva G.N. et al., 2017). The urgency of the problem is associated with diagnostic difficulties in recognizing the disease due to polymorphism of the clinical picture in the early stages of CSO, its prevalence in childhood, which in developed countries ranges from 1 to 13 per 100,000 population (Parshikov V.V., Zheleznov A.S., 2008; Chernenko L. Yu., Tsap N.A., 2012; Alexios D. Iliadis, Ramachandran M., 2017).

Among all purulent pathology, acute hematogenous osteomyelitis is 6-12.2% (Garkavenko Yu.E., Pozdeev A.P., 2013). According to Russian and foreign literature, in 77-86.2% of cases there is late hospitalization of patients associated with diagnostic errors (25.1–58.3% of cases) and late treatment of patients (Gilmutdinov M.R. et al., 2010; Garkavenko Yu.E., Pozdeev A.P., 2013; Fitous F. Et al, 2007).

However, not enough attention is paid to the issues of diagnostic errors, late hospitalization in the literature, so the task remains important to draw the attention of pediatricians, general surgeons, traumatologists and other doctors of related specialties, to whom patients primarily turn, to the issues of early diagnosis of CSOs and timely referral of patients to a specialized hospital. Equipping hospitals with high-tech equipment (ultrasound, MRI, CT) makes it possible to recognize the disease at an earlier time. However, there is no clarity in the indications for the choice of methods, their sequence and timing of application depending on the phase of the inflammatory process (Strelkov N.S., Razin M.P., 2018).

**CONCLUSIONS**

The timeliness and adequacy of the initiated antibacterial and surgical treatment of the primary focus ensures a more favorable course of the purulent process, improves its outcome and reduces the frequency of chronization of the disease (Yeryukhin I.A. et al., 2006; Barskaya M.A. et al., 2015; Howard-Jones AR, Isaacs D., 2013; Alexios D. Iliadis, Ramachandran M., 2017). In addition, in the complex treatment of this severe purulent process, it is necessary to take into account the comorbid conditions of the patient, which are characterized by the level of regulatory systems, the presence of stigmas of connective tissue dysplasia, trophic status, etc. The results of these studies should be included as criteria determining the timing and scope of therapeutic and preventive measures during the medical examination of patients who have undergone CSD.

Until recently, only the data of X-ray examination, laboratory diagnostics are used as objective tests. The discutability of many provisions of the severe purulent-septic process served as the basis for choosing the purpose, objectives of the study to develop a more effective complex of therapeutic and diagnostic measures and scientifically based principles of rehabilitation.

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