

ACUTE HEMATOGENIC OSTEOMYELITIS LITERATURE REVIEW

Berdiyarova Shokhida Shukurullaevna,
assistant at the Department of Clinical and Laboratory Diagnostics
with a course of clinical and laboratory
diagnostics at the Faculty of Postgraduate Education,
Eshnazarova Ruxshona Olimjon qizi
Xakimova Zilola Alisher qizi
Jumanazarov Sardorbek Sanjar ugli
studenty pediatric faculty of Samarkand State Medical University,
Uzbekistan, Samarkand

Annotation. Hematogenous osteomyelitis is one of the most severe purulent-septic diseases, leading to the development of severe sepsis with multiple organ failure, septic shock and death if delayed diagnosis and inadequate treatment. Improvements in diagnostic and treatment methods have made it possible to reduce the mortality rate in acute hematogenous osteomyelitis to 0.5-2.7% and the chronicity of the process to 3.1%, but orthopedic complications are still quite common with this pathology. Diagnosis of acute hematogenous osteomyelitis in children in the early stages of the disease presents certain difficulties, therefore, along with conventional diagnostics, the use of modern non-invasive diagnostic methods (ultrasound, CT) is very important.

Key words: Acute hematogenous osteomyelitis, children, diagnosis, treatment, prevention

ОСТРЫЙ ГЕМАТОГЕННЫЙ ОСТЕОМИЕЛИТ ЛИТЕРАТУРНЫЙ
ОБЗОР

Бердиярова Шохида Шукуруллаевна,
ассистент кафедры Клинико-лабораторной диагностики
с курсом клинико-лабораторной диагностики ФПДО
Эшназарова Рухиона Олимжон кизи
Хакимова Зилола Алишер кизи
Жуманазоров Сардорбек Санжар угли
студенты педиатрического факультета
Самаркандского Государственного Медицинского Университета,
Узбекистан, Самарканд

Аннотация. Гематогенный остеомиелит – одно из самых тяжелых гнойно-септических заболеваний, приводящих при несвоевременной диагностике и неадекватном лечении к развитию тяжелого сепсиса с полиорганной

недостаточностью, септическому шоку и летальным исходам. Совершенствование методов диагностики и лечения позволили снизить летальность при остром гематогенном остеомиелите до 0,5-2,7 % и хронизацию процесса до 3,1 %, но по-прежнему при данной патологии достаточно часто встречаются ортопедические осложнения. Диагностика острого гематогенного остеомиелита у детей в ранние сроки заболевания представляет определенные трудности, поэтому наряду с общепринятой диагностикой очень важным является использование современных неинвазивных методов диагностики (УЗИ, КТ).

Ключевые слова: Острый гематогенный остеомиелит, детей, диагностика, лечение, профилактика.

Introduction. Hematogenous osteomyelitis is one of the most severe purulent-septic diseases, leading to the development of severe sepsis with multiple organ failure, septic shock and death if delayed diagnosis and inadequate treatment. Purpose of the study: to determine the most significant diagnostic criteria, identify the most common localization of the process and features of the clinical course, evaluate the effectiveness of complex treatment of hematogenous osteomyelitis in children. The work is based on the analysis of diagnostic results. All children underwent a clinical examination, laboratory, ultrasound, and x-ray examination methods. Complex treatment included surgery and intensive care. Localization of the process in acute hematogenous osteomyelitis:

- femur
- tibia
- brachial bone
- bones of the forearm
- foot bones
- ischium
- patella

In children with acute hematogenous osteomyelitis from the newborn period to 2 years of age, damage to the metaepiphyseal zone of long tubular bones (femoral – 6 and humeral – 7) was noted. The clinical picture in children of this age group was dominated by anxiety, refusal to eat, a symptom of "pseudoparalysis" or "pseudoparesis" (limb overhang), the presence of swelling in the joint area, expansion of the subcutaneous venous network in the area of the affected joint. In two premature newborns with intrauterine infection, only the symptom of "pseudoparalysis" was observed from the listed symptoms. In a laboratory study, leukocytosis (up to 13×10^9 g/l) with a shift of the formula to the left was noted in the general blood test in children under the age of 2 years, a moderate increase in C-reactive protein was determined

during a biochemical blood test; the procalcitonin test (PCT) was more than 2 ng /ml. Ultrasound examination of the affected joints in 11 children of this age group revealed thickening of soft tissues and effusion in the joint already in the first 3 days of the disease. Ultrasound examination of joint pathology did not reveal in two premature babies. Radiological changes in the area of the metaepiphyseal zone and joints were found in all children of this group: 11 patients on day 3-5 of the disease had an expansion of the articular gap, two premature infants had foci of destruction in the metaphyses. Children aged 3 to 15 years complained of pain in the affected limb, impaired limb function (limited mobility), an increase in body temperature to febrile values (up to 38-39 ° C), weakness, fatigue. During clinical examination, children with lesions of long tubular bones had a forced position of the limb; 21 children (extramedullary phase) showed signs of soft tissue phlegmon (swelling, hyperemia, pain on palpation, local hyperthermia, fluctuation); in 27 observations (intramedullary phase) there was a slight swelling of soft tissues, dilation of subcutaneous veins, soreness with percussion, limited mobility and increased pain in the limb when attempting passive movements. Laboratory data indicated pronounced signs of inflammation (leukocytosis up to 19×10^9 g/l, an increase in C-reactive protein up to 100 mg/l, an increase in PCT of more than 5 ng/ml). Changes in bone radiographs were detected only by the end of 2 weeks from the onset of the disease (periostitis, foci of destruction) and therefore could not serve as criteria for early diagnosis. Ultrasound examination conducted in patients with the intramedullary phase made it possible, with damage to the femur and humerus, to detect an increase in volume and a decrease in muscle echogenicity as early as 3-5 days after the onset of the disease. Computed tomography (CT) performed in 8 patients with acute hematogenous osteomyelitis aged 3 to 15 years revealed muscle swelling in the affected area and thickening of the periosteum on 3-4 days after the onset of the disease. 57 children with acute hematogenous osteomyelitis were diagnosed with systemic inflammatory response syndrome, and sepsis (septicopyemic form according to T.P. Krasnobaev) was diagnosed in 3 cases.

The treatment of children with acute hematogenous osteomyelitis was comprehensive and included surgery, immobilization, antibacterial therapy, adequate pathogenetic effects, and symptomatic treatment. Surgical treatment in children aged from the neonatal period to 2 years consisted in most cases of joint puncture and immobilization (Dezo bandage, traction by Shed) – 6 patients. Two children underwent arthrotomy, joint drainage, and immobilization. Three patients of this age group underwent arthrotomy, opening of the paraarticular phlegmon, osteoperforation of the metaphysis and immobilization. Two premature babies with an intrauterine infection received conservative treatment. In children aged 3 to 15 years with acute hematogenous osteomyelitis of long tubular bones in 21 cases (patients with

intramedullary phase of osteomyelitis), osteoperforation was performed with the introduction of intraosseous needles into the bone marrow canal for subsequent administration of antibiotics. In the extramedullary phase of the process (27 children), soft tissue phlegmon was opened and drained, osteoperforation with the introduction of intraosseous needles was performed. In other cases, the localization of the process (sciatic bone, patella, foot bones) was performed by opening and draining the purulent focus. All children underwent immobilization after surgery, which is necessary for this type of lesion using modern fixing materials.

During the puncture of the joint, the resulting pus was necessarily taken for sowing to identify the microbial flora and determine its sensitivity to antibiotics. In children from the neonatal period, pathogenic staphylococcus aureus was sown from the pathological focus in all observations. In older children, staphylococcus aureus prevailed (35 observations), epidermal staphylococcus was isolated from the focus in 5 patients, pyogenic streptococcus in 3, gram-negative flora (proteus, E. coli, enterobacter, acinetobacter) in 9, microflora growth was not obtained in 18 observations. When prescribing the first course of antibiotics, an empirical principle was used, giving preference to drugs from the group of cephalosporins of the II and III generations and aminoglycosides. When prescribing subsequent courses of antibacterial treatment, we focused on the results of the crops obtained and the presence of bone tissue tropicity in the drugs.

For the purpose of pathogenetic effects, anticoagulants, disaggregants, proteolytic enzymes, and immunopreparations were included in the complex treatment of children with acute hematogenous osteomyelitis. Symptomatic therapy consisted of prescribing painkillers and anti-inflammatory drugs. All patients with acute hematogenous osteomyelitis received adequate infusion therapy aimed at replenishing the volume of circulating blood and detoxification. The complex treatment included sessions of hyperbaric oxygenation (HBO therapy). Extracorporeal detoxification (hemofiltration) was used in patients with sepsis. When the condition was stabilized, patients were prescribed physiotherapy: magnetic fields, electrophoresis with antibacterial drugs, calcium chloride. All children were discharged in satisfactory condition. There were no fatal outcomes. In two observations, the process turned into a chronic stage. All children over 3 years of age are recommended sanatorium treatment in a local specialized sanatorium. Follow-up is recommended for all patients. The problem of osteomyelitis has attracted the attention of doctors since ancient times. The term "osteomyelitis" has been proposed. Raynod, but the first mention of "human suffering associated with bone damage" is found in the writings of Hippocrates. For a long time it was believed that a more accurate term is "panostitis", which characterizes the essence of this inflammatory process, taking into account the rapid involvement of all parts of the bone, including the periosteum. The first attempts to systematize the

accumulated knowledge about the etiology and pathogenesis of osteomyelitis were made by E. Lexer V., who proposed the vascular (embolic) theory. This theory was supported by A.A. Bobrov, who also believed that the peculiarities of blood supply to bones in childhood with a slowdown in blood flow in the densely branching and blindly ending vessels of metaphysics contribute to the settling of pyogenic microbes in the bone. According to this theory, age-related anatomical and physiological features of blood supply and bone structure in children are of great importance in the occurrence and development of hematogenous osteomyelitis (HOM). The embolic theory explained the pathogenesis of secondary, or metastatic, osteomyelitis, which is often observed in septicopyemia of any nature. However, this theory could not fully explain the sudden onset of primary acute GOM (OGOM), which developed without any previous inflammatory disease, against the background of full health, as it could not explain the occurrence of GOM in children over 2 years old, since by this age the terminal vessels in metaphysics disappear. Neuroreflective and allergic theories have become such an explanation. According to the neuro-reflex theory, which appeared in the middle of the XX century and was supported by N.N. Elansky et al., pathological irradiation from the focus of the inflammatory process is associated with a sharp irritation of the interoreceptor apparatus of the bone and a reflex effect on the state of the central nervous and cardiovascular systems. The necessary starting conditions for the development of acute inflammation of the bone marrow were shown by the allergic theory of S.M. Derizhanov. S.M. Derizhanov created an experimental model of GOM in which the area of bone lesion was determined by the localization of traumatic effects. The allergic theory proves that increased reactivity and sensitization of the body play an important role in the pathogenesis of osteomyelitis. The state of immunity plays an important role in the development of OGOM. The study of immunological reactivity, the state of immunoglobulins and lymphocytes, conducted by a number of scientists, highlighted another link in the pathogenesis of the disease. The conducted studies, determining the degree of stress of the immunological protection of the child's body, allowed us to find ways to influence the course of the pathological process and determine the prognosis of the disease. Sarkisov emphasized in his works that the occurrence of osteomyelitis is the result of "close interaction" of micro- and macroorganisms, which makes it possible to consider osteomyelitis as an infectious process occurring with a number of immunological reactions. Considering that none of the theories could fully explain the causes and mechanisms of the occurrence of OGOM, gradually accumulated and systematized data allowed us to approach the understanding of pathogenesis by generalizing the known facts into a single whole. So, L.V. Prokopova and A.R. Tatur suggested that the antigen–antibody complexes that arise under the influence of adverse factors in a sensitized organism contribute to the development of microcirculation disorders, as well as damage capillaries and the

connective tissue surrounding them. This, in turn, triggers a cascading mechanism of inflammation, and a number of pathological reactions that have arisen are aggravated by a rigid bone tube, which additionally supports the conditions of ischemia and the development of the inflammatory process. And, despite all the research and accumulated knowledge, the pathogenesis of OGOM has not yet been fully studied. The expansion of ideas about the etiology, pathogenesis and clinical manifestations of OGOM in children required systematization and creation of classification schemes. According to the International Classification of Diseases, Injuries and Causes of Death (ICD 10) proposed by WHO, osteomyelitis is divided into acute (M 86.1), subacute (M 86.2) and chronic (M 86.6). This classification is intended for reporting by medical institutions and does not provide complete information about osteomyelitis (it does not include the etiology, form, phase and stage of the disease, the nature of secondary complications). Therefore, clinical classifications are used for in-depth study of the problem in the hospital. In the available literature, we found classifications according to the clinical course, etiology and pathogenesis of OGOM. T.P. Krasnobaev proposed the first classification of OGOM, in which he identified three forms according to the clinical course of the disease: 1) toxic or adynamic; 2) septic (septicopyemic); 3) local (locally focal). This classification has undergone changes in attempts to systematize new knowledge. Among the classifications based on the principle of Krasnobaev, the classification of I.S. Vengerovsky turned out to be the most convenient for practical application, according to which, taking into account the etiology and pathogenesis, the following forms of OGOM are distinguished:

I. Hyperacute forms with a predominance of general intoxication phenomena:

- a) septicotoxic form with a predominance of acute intoxication phenomena;
- b) septicopyemic form with metastatic lesions of internal organs and cavities, the functioning of which is of vital importance;

II. More favorably occurring forms with metastases (multiple lesions of bones, joints, intermuscular and subcutaneous phlegmons and ulcers come to the fore):

- a) with metastases in other bones;
- b) with joint damage;
- c) with metastases in subcutaneous tissue, muscles, lymph nodes and other tissues and organs;

III. Focal forms occur in which local symptoms come to the fore: a) with a lesion of one bone;

b) with localization under the periosteum without visible bone damage;

IV. Atypical forms that are rare in childhood:

- a) acute diffuse osteomyelitis;
- b) sclerosing osteomyelitis;
- c) albuminous osteomyelitis;

d) an intraosseous abscess.

This year, an attempt was made to streamline the knowledge accumulated by that time on the severity and stages of the course of OGOM, as well as to reflect the nature of the complications that arise. According to the classification of A.F. Dronov and Yu.P. Gubov, osteomyelitis is divided by genesis into primary and secondary (metastatic). According to the severity of the course, there are acute and torpid course of the disease, intramedullary and extra-medullary stages. By the nature of complications, there is a generalization of infection and a local form of pathology (subcostal and intermuscular phlegmons, reactive and purulent arthritis, etc.). This classification reflected new aspects of the disease, but did not reveal the essence of the disease, in particular, it did not take into account the peculiarities of etiological factors and risk factors for the development of OGOM in children.

In 2002, V.A. Shalygin et al. proposed a classification of osteomyelitis based on the addition and unification of the classifications of I.S. Vengerovsky, G.N. Akzhigitov et al. and ICD 10 (2000). According to this classification, osteomyelitis is divided into:

- according to the etiology of the disease (monoculture, association or pathogen is not isolated);
- according to the form of osteomyelitis (acute hematogenic, post-traumatic, iatrogenic, gunshot, radiation, chronic);
 - by phase and stage of the disease (acute, subacute, chronic stages); by localization of the pathological process (tubular bones: epiphyseal, diaphyseal, metaphyseal, mixed, diffuse; flat bones);
- according to the clinical course (generalized – septicotoxic and septicopyemic; focal — fistulous and fistless);
- for complications of osteomyelitis (local and general).

Despite the variety of proposed classifications, the classification of T.P. Krasnobaev is currently the most common in clinical practice. The features of the pathogenesis and course of the inflammatory process in GOM in children should be understood as acute purulent inflammation of the bone marrow, bone and underlying soft tissues of various etiologies. OGOM in children proceeds with various pathoanatomical changes and in some cases can lead to the formation of deformity of the affected bone. From the standpoint of general pathology, osteomyelitis is a special case of infectious inflammation. Infectious inflammation is generally considered to be the result of the interaction of macro- and microorganisms. In this case, the inflammatory process can be caused not only by exogenous, but also by activation of conditionally pathogenic automicroflora, in conditions of a decrease in specific immunological mechanisms of protection and resistance of the body.

Conclusions:

1. Acute hematogenous osteomyelitis is a severe purulent-septic pathology affecting children of all age groups.
2. In CSO, children are most often affected by long tubular bones.
3. Acute hematogenous osteomyelitis in children of different age groups has certain features of the course.
4. Minimally invasive methods – ultrasound and CT - play an important role in the early diagnosis of acute hematogenous osteomyelitis.
5. The key to successful treatment of acute hematogenous osteomyelitis is timely diagnosis and adequate pathogenetically based treatment.
6. Children who have undergone CSOs must necessarily be registered at a dispensary to resolve the issue of further rehabilitation.

List of literature

1. Разин, Стрелков: Гематогенный остеомиелит у детей – М.: ГЭОТАР-Медиа, 2018. – 432 с.
2. Р. Койко, Д. Саншайн, Э. Бенджамини. Иммунология. – М.: Академия, 2008. – 368 с.
3. Р.М. Хаитов, Г.А. Игнатъева, И.Г. Сидорович. Иммунология. – М.: Медицина, 2000. – 432 с.
4. ХИ Ширинов, НС Ибрагимова, БФ Ибрагимов, НЕБЛАГОПРИЯТНЫЕ ИСХОДЫ СИНДРОМА ПОЛИКИСТОЗНЫХ ЯИЧНИКОВ У МОЛОДЫХ ЖЕНЩИН, Journal of new century innovations 26 (3), 185-189
5. Kudratova Z. E. et al. The Role of Cytokine Regulation in Obstructive Syndrome of Atypical Genesis in Children //Annals of the Romanian Society for Cell Biology. – 2021. – С. 6279–6291-6279–6291.
6. Даминов Ф. А. и др. Синдром кишечной недостаточности и его коррекция у тяжелообожженных //Журнал Неотложная хирургия им. ИИ Джанелидзе. – 2021-№. S1. – С. 20-21.
7. IN Sabirovna, KL Alikhanovna The significance of clinical-laboratory and instrumental research methods in the diagnosis of echinococcosis // Web of Scientist: International Scientific Research Journal 3 (10), 240-244, 2022
8. Бердиярова Ш.Ш., Юсупова Н.А., Ширинов Х.И. Клинико-лабораторная диагностика внебольничных пневмоний у детей, Вестник науки и образования, 80-83
9. Набиева Ф.С., Ибрагимова Н. С. Бобокулов О. О. Использование *Saccharomyces cerevisiae* для получения конъюгатов для ИФА (литературный обзор) //Журнал Биомедицины и практики. – 2022. – Т. 7. – №. 3.
10. Berdiyarova Sh.Sh., Ahadova M.M., Ochilov S.A. COMPLICATIONS OF TREATMENT OF ACUTE HEMATOGENOUS OSTEOMYELITIS,

LITERATURE REVIEW, Galaxy International Interdisciplinary Research Journal
293-298

11. Nabieva F.S. et al. Prospects for Developing Modifications of Methods for Producing Conjugates for Elisa //Annals of the Romanian Society for Cell Biology. – 2021. – С. 4120-4125.
12. Erkinovna K. Z., Berdirasulovich K. G., Andreevna Y. I. THE IMPORTANCE OF SOME LABORATORY INDICATORS IN LUNG DISEASES //Вестник науки и образования. – 2020. – №. 22-2 (100). – С. 70-72.
13. IN Sabirovna, T Asomiddin, E Umidjon, E Rukhshona, Dysfunctions of the Immune System and Their Role in the Development of Diseases, The Peerian Journal 23, 49-52
14. Nabieva F.S., Umarova S.S., Ruzmetova. S.U. Use of Saccharomyces cerevisiae for obtaining conjugates for ELISA //Thematics Journal of Microbiology. – 2022. -Т. 6.- №. 1.
15. IN Sabirovna, BF Shekhrozovna, DIAGNOSTIC CRITERIA AND TREATMENT OF TYPE 2 DIABETES MELLITUS, Galaxy International Interdisciplinary Research Journal 11 (10), 237-240
16. Tursunov Feruz O’Ktam O’G’Li, Raximova Gulchiroy Olim Qizi, Isroilova Umidaxon, Turayeva Shaxnoza ASSESSMENT OF CARBOHYDRATE METABOLISM IN PATIENTS WITH DIABETES AND COVID-19 // ReFocus. 2022. №4.
17. Бердиярова Ш.Ш., Юсупова Н.А. Особенности иммунометаболических нарушений иммунологической реактивности при гематогенных остеомиелитах, Вестник науки и образования, 29-32