

## Clinical and Laboratory Features of Chronic Hematogenous Osteomyelitis in Children

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**Abstract:** Osteomyelitis in children is a purulent lesion of the bone marrow, which spreads to all layers of tissue around the bone. Often it has a hematogenous nature. It is manifested by severe hyperthermia, weakness, tremors and a general condition disorder, which is soon joined by very strong drilling, tearing pains. Cellulite develops and a fistula appears. Exacerbation and remission alternate with chronicity. Pathology is diagnosed on the basis of clinical manifestations, X-ray, CT and laboratory tests. Treatment includes antibiotic therapy, opening and drainage of abscesses, and sequestrectomy.

**Key points:** Causes, Pathogenesis, Classification, Symptoms, Hematogenous osteomyelitis in children, Exogenous osteomyelitis in children.

In children, osteomyelitis is diagnosed in half of cases between the ages of 6 and 14. Almost a third of patients are children under 1 year of age. Girls suffer half as often as boys, which depends on certain anatomical features. Any bone structure can be involved, but the metaphyses of long tubular bones are most often affected: femur, tibia, humerus. Children's osteomyelitis is a serious problem due to the severity of the patient's condition, the possibility of death, the risk of dangerous complications and the chronicity of the process.

### Reasons

Osteomyelitis develops when infected with pathogenic microorganisms. In children, 80-85% of cases are caused by *Staphylococcus aureus*. In rare cases, pathogens include streptococci, pneumococci, *Escherichia coli* or *Pseudomonas aeruginosa*, *Klebsiella* and *Proteus vulgaris*. Specific causes of osteomyelitis are tubercle bacillus, brucella, and spirochete pallidum. Microbes enter the bone marrow by a hematogenous route, from the external environment or from nearby tissues. Sources of hematogenous infection:

dental pathologies: carious teeth;

ENT diseases: sinusitis, tonsillitis, acute otitis media;

purulent processes: superficial and deep pyoderma;

minor injuries: infected wounds and abrasions;

skin lesions in babies: diaper rash, non-healing umbilical wounds.

The high prevalence of hematogenous osteomyelitis in childhood is associated with the structural characteristics of bone structures. In children, there are many vessels in the area of the metaphysis, and blood flow slows down due to the need for intensive nutrition of the growing bone. Many small vessels end blindly near the epiphysis. As a result, pathogenic bacteria accumulate in the metaphysis, they begin to multiply when the condition of the body deteriorates.

The cause of contact infection is open cracks, wounds after operations on bone structures and nearby tissues, deep purulent wounds that spread to the bone (abscesses, cellulitis). Immune

disorders that occur against the background of the following conditions are a predisposing factor in the development of all types of osteomyelitis:

acute and chronic common infections;

hypothermia;

diabetes mellitus;

oncological pathologies;

somatic diseases.

#### Pathogenesis

With a hematogenous lesion, the abscess first forms in the bone marrow and then spreads from the inside to the outside. In the form of contact, periostitis first appears, then pus moves from the outside to the bone marrow. In both cases, microbes penetrate the previously healthy layers of the bone through the Haversian channels, the periosteum is cleaned, the bone stops receiving nutrients and becomes necrotic.

Substances released by pathogenic bacteria, the remains of dead microbes and the immune system's own cells accumulate in the affected area. Toxins are absorbed into the blood and spread throughout the body, causing intoxication. During hematogenous osteomyelitis, due to the high pressure of pus on the inelastic bone, very sharp pain occurs, the intensity of which decreases slightly after the periosteum dissolves and breaks into soft tissues.

In other types of osteomyelitis, there is no primary abscess stage in the bone tissue while preserving the integrity of other layers, so the pain syndrome is less pronounced. Pus dissolves not only the bone, but also the surrounding soft tissue. Phlegmon is formed, then it forms a fistula. With open cracks and surgical incisions, pus comes out of the wound.

#### Classification

Osteomyelitis in children can be endogenous (hematogenous) or exogenous. The following forms of exogenous bone inflammation are distinguished:

Post-injury. It is observed in victims of open fractures.

After surgery. It is determined in children who have undergone osteosynthesis, bone grafting and other bone interventions. Sometimes it is formed after the insertion of wires (wire osteomyelitis).

Communication. Phlegmon, abscesses, deep infected soft tissue wounds spreading to the bone were diagnosed.

Armed osteomyelitis and atypical variants of the disease (sclerosing osteomyelitis Garre, Brody's abscess) are very rare in children. At first, the disease is acute, but later it becomes chronic.

#### Symptoms

##### Hematogenous osteomyelitis in children

The most common septic-pyemic form of the disease manifests itself violently. The child's body temperature rises to 39-40 ° C, the general condition worsens sharply, weakness, weakness, headache and repeated vomiting appear. Convulsions, confusion and delirium are possible. A number of children develop hemolytic jaundice. The skin becomes dry and pale, the mucous membranes have a bluish tint. Hypotension, tachycardia, tachypnea and hepatosplenomegaly are observed.

After 1-2 days, pain appears in the affected segment. Sometimes there are several injuries in different bones. The pain quickly increases, has the character of pulling, drilling, tearing. The slightest movement causes an explosion of pain, so children freeze in bed. Limbs are swollen, hyperemic, hot to the touch. Against the background of severe intoxication, metabolic diseases develop, liver and kidney function is disturbed.

Local and toxic forms of osteomyelitis are less common. In the local form, general symptoms are mild, children are bothered by the manifestations of the affected limbs; The toxic form is characterized by the predominance of general symptoms, severe toxicosis, strong electrolyte disturbances and acute cardiovascular failure. Death is possible even before pain in the limbs.

#### Exogenous osteomyelitis in children

For post-traumatic and postoperative types of the disease, more leveled symptoms are characteristic. The child's condition worsens, hyperthermia appears, signs of intoxication are observed. A purulent discharge appears in the wound, the tissues around it redden and swell. The intensity of pain increases, but the pain syndrome does not reach the severity as in patients with hematogenous osteomyelitis.

The size of the purulent process depends on the initial condition. With linear cracks, only the damaged area is affected. When fragments are present, there is a tendency for the infection to spread through the segment. After surgery, pus gets under the metal constructions or causes transplant rejection. Uncomplicated severe toxicosis is not characteristic.

Contact osteomyelitis is formed against the background of an already existing purulent process in soft tissues and is accompanied by increased pain, increased intoxication, and hyperthermia. After some time, a fistula appears, after which the pain decreases and the patient's condition improves.

#### Chronic osteomyelitis in children

If the symptoms last more than 4-6 months, osteomyelitis is chronic, with variable remission and exacerbation. Tensions are often provoked by overload, acute infections and worsening of somatic diseases. The fistula is periodically closed, after which inflammation is activated and symptoms similar to the muted clinical picture of acute osteomyelitis appear. After the next opening of the fistula tract, the condition returns to normal.

#### Complications

Hematogenous osteomyelitis, as well as osteomyelitis with intra-articular and peri-articular cracks, is often complicated by purulent arthritis. As a result, contractures are formed. With all types of osteomyelitis, sepsis can develop with the formation of secondary purulent foci. Sometimes destructive pneumonia and purulent pericarditis are observed. The death of a large area of the bone can lead to a pathological fracture.

During the period of bone restoration, its dystrophic restructuring takes place, which leads to the growth and deformation of the child's limbs. Chronic osteomyelitis adversely affects the condition of the heart, kidneys and liver, causes amyloidosis of internal organs and causes the development of chronosepsis in some children.

#### Diagnostics

Diagnosis of osteomyelitis in children is carried out by orthopedists. In the early stages, the pathology is determined on the basis of clinical signs, because imaging methods show changes 7-10 days before the onset of the first symptoms of the disease, and the results of laboratory tests are non-specific and can be observed. in any severe purulent process. The following methods are used to confirm the diagnosis:

Radiography. About 2 weeks after the onset of the disease, it becomes informative. Initially, images show signs of periostitis. Then changes are identified that indicate the rarity of the spongy substance. After 2-4 months, the sequestration will begin to appear on radiographs.

Ultrasound. It is used to determine the thickening of the periosteal bone in the initial stage of the disease. It allows you to confirm the presence of osteomyelitis before the radiographic signs appear.

MRI with contrast. Shows characteristic disorders of blood circulation. This is another method used for early diagnosis of osteomyelitis.

Fistulography. Produced in the presence of chronic osteomyelitis. Allows you to clarify the location of the fistula paths. It is prescribed at the stage of planning operations and, if necessary, is carried out during the operation.

Laboratory tests. A general blood test reveals an increase in ESR, leukocytosis with a shift to the left. During biochemical research, acute phase proteins are identified. Bacteriological blood culture may indicate the presence of bacteremia.

Treatment of osteomyelitis in children

Conservative therapy

The patient is urgently admitted to the pediatric orthopedic department. The following conservative measures are taken:

Immobilization. Limbs are fixed using plastic or plaster.

Antibiotic therapy. Begins upon acceptance. Semi-synthetic penicillins or cephalosporins are administered parenterally for 4 or more weeks. After normalizing the protein level in the acute phase, they switch to oral medications.

Infusion therapy. The purpose of infusions is to reduce the severity of intoxication, correct water-salt and acid-alkaline metabolism, and improve local blood circulation. Plasma, colloid and crystalloid solutions are used

Symptomatic therapy. The child is prescribed painkillers. According to indications, medicines are used to improve the functioning of internal organs.

Extracorporeal hemocorrection. For severe toxicosis, lymphosorption or hemosorption is indicated, they can reduce the manifestation of intoxication and reduce the risk of developing dangerous somatic complications;

Surgical treatment

The tactics of surgical treatment are determined by the characteristics of the stage and stage of development of osteomyelitis. The following activities can be arranged for children:

Opening, drainage. Immediately after the formation of an abscess in the bone, it is opened with a cutter, and drainage through the stream is carried out with the help of proteolytic enzymes and antibacterial drugs.

Decompression of the subperiosteal space. In the presence of immunodeficiency or an atypical course of the disease, surgical or aspiration decompression is performed.

Arthrotomy. May be required for the development of purulent arthritis. In relatively mild cases, repeated punctures with washing the joint space with antibiotic solutions are recommended.

Sequestrectomy. The operation is performed for chronic osteomyelitis. Sequestrations, cavities, granulations and fistulas are cut and lavage drainage is performed.

Osteoplastic technique. In order to eliminate the deformation or shortening of the limbs, it is indicated after complete sanitation of the infectious focus.

Joint interventions. It is required for patients with purulent arthritis. Like bone grafting, they are performed after sanitizing the affected area. Arthroplasty, arthrolysis, or arthrodesis can be used to improve limb function.

Prognosis

The prognosis is determined by the form of the disease, the timeliness and adequacy of therapeutic measures, and the presence of complications. With a late start of therapy, the toxic form of hematogenous osteomyelitis, the development of sepsis, purulent damage to internal organs, and the death of the patient are possible. Complete recovery is observed in about 70% of children, in other cases the process is chronic;

## Prevention

Preventive measures include eliminating the foci of infection, strengthening the immune system and preventing injuries in children. Bone operations are performed taking into account existing contraindications, strict adherence to the rules of asepsis and mandatory postoperative antibiotic therapy.

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