

Acute Hematogenic Osteomyelitis of the Bones of the Hip Joint in Children: Modern Aspects of Diagnostics and Treatment

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Abstract. We examined 134 patients with osteomyelitis of the bones of the hip joint at the age from 6 to 18 years. All patients were divided into two groups according to the type of surgical treatment performed. 1a group of 33 children who underwent traditional treatment, arthrotomy of the hip joint according to Gunther. 1b group of 20 patients who, after arthrotomy, used the original method of applying the Ilizarov apparatus to immobilize and unload the joint. In group 2, 81 patients were used the original method of drainage osteoperforations of the acetabular roof, which we introduced. When analyzing long-term results, it was revealed that the use of the developed method of treatment led to early activation and a decrease in the length of hospital stay from 43 to 22 bed-days, a relatively low proportion of orthopedic complications (from 68.9% to 15.3%), to reduce the transition of the disease to a chronic form (from 31% to 0) and mortality (from 9.1% to 0). Good and satisfactory results were obtained in 85% of children in the long-term period.

Key words: acute hematogenous osteomyelitis of the bones of the hip joint, draining osteoperforation of the acetabular roof, children.

Relevance. According to the World Health Organization, “among acute surgical pathology of childhood, acute hematogenous osteomyelitis (AHO) is 2.2-10%, and among purulent-septic infections from 12.5% to 47%” [1, 2, 11]. Diagnostics of the AHO of the bones of the hip joint (BHJ) presents certain difficulties not only at the prehospital stage, but also for the doctor of a specialized hospital. In this case, the incidence of diagnostic errors reaches 50%. In 16.2 - 53.7% of cases, the disease is complicated by various orthopedic disorders that lead the

child to disability [5, 9, 10].]. "The success of AHO treatment in children depends on early verification of the disease and optimal surgical intervention, carried out even before the development of threatened conditions and septic complications." A wide variety of therapeutic techniques makes it possible to solve one practical problem in different ways. But at the same time "there are certain difficulties associated with the need to select the most optimal therapeutic measures for a specific infectious process." The severe course, the high probability of severe complications, even with low prevalence rates of this pathology, determine the rather high relevance of studies aimed at improving the results of complex treatment of AHO BHJs [7, 12].

When analyzing the literature, the opinion can be traced that "AHO BHJ is a rather rare pathology, the prevalence of which ranges from 6.4-15.5% of all pelvic osteomyelitis." This "often becomes the reason for an insufficiently deep and comprehensive study of the problems associated with this nosological form" (Garvenko Y.E.) [3]. According to Zavadovskaya. And [4], "with numerous approaches in the diagnosis of AHO BHJ in children, special importance is attached to instrumental research methods, such as ultrasound scanning and computed tomography of the osteoarticular system". Analysis of the world literature data on the diagnosis and surgical treatment of AHOs of the DHJ testifies, on the one hand, to the authors' great attention to this problem, and on the other hand, reveals many unresolved, moreover, contradictory views [8, 10, 11].

The aim of the study was to improve the diagnosis and surgical treatment of acute hematogenous osteomyelitis of the bones of the hip joint in children.

Materials and research methods. This work is based on the analysis of the results of examination and treatment of 134 patients with AHO BHJ who received treatment at the 2-clinic SamMI for the period from 1991 to 2018. The ratio of boys to girls was 2.5 / 1. Thus, children of AHO BHJ of primary school age (6-11 years old) accounted for 30.6% (41), middle school age (12-15 years old) - 56% (75) and older (15-18 years old) - 13, 4% (18). The majority of children, 85.1%, were admitted later than 3 days from the onset of the disease. 42% of patients had a septic-pyemic form of AHO BHJ, the local form was found in 58.2% of children. The lesion of the proximal femur (head and neck of the femur) was diagnosed in 90 (67.2%) children, pelvic bones in 44 (38.2%), of which 34 children had a lesion of the ileum, 9 in the sciatic and 1 - pubic bones.

All patients underwent a comprehensive examination, including clinical, radiological, computed tomography (CT), ultrasound examination (UE) and indicators of endogenous intoxication (EI).

The degree of EI was judged by the value of the leukocyte index of intoxication (LII) by the method of Ya.Ya. Kalf-Kalifa, blood toxicity index (BTI), determined by the paramecium test according to Garib F.Yu., and the Harkavi index (HI).

According to the type of surgical interventions performed, 134 patients with CSO CS were divided into two clinical groups. The first group consisted of 53 (39.6%) children, conditionally divided into two groups. **1a**, a group of 33 children from 1991 to 2000, who received conventional surgical treatment after puncture of the hip joint (HJ) and if they received purulent exudate, then underwent arthrotomy of the hip joint according to Hüter (anterior approach). **1b** group, 20 patients from 2000-2003, in the light of the achievement of modern medicine, the next step to prevent orthopedic complications in patients with AHO BHJ, after arthrotome, was fixation of the HJ region using the original technique using the Ilizarov apparatus instead of skeletal traction and immobilization with a coxite plaster cast (fig. 1).

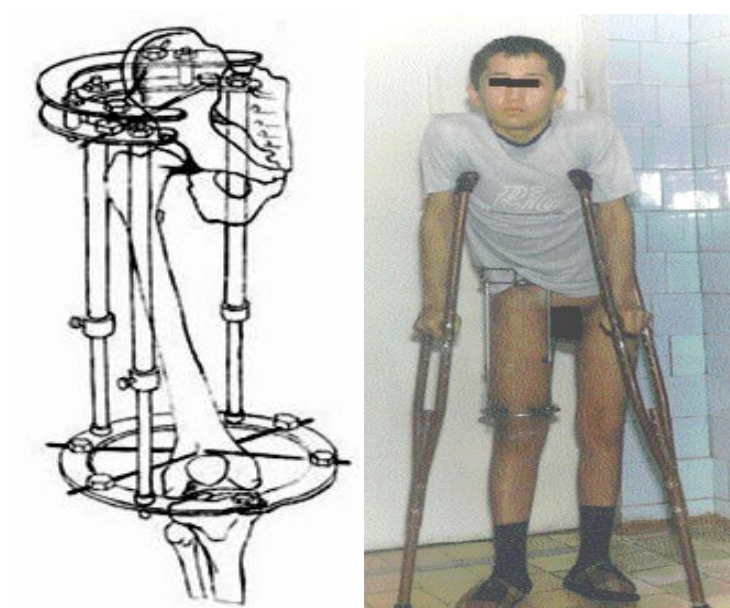


Figure: 1. Diagram of the installation of the Ilizarov apparatus for AHO BHJ in children, and a general view of the patient with the superimposed Ilizarov apparatus.

In-group 2, 81 (60.4%) patients, the approaches to the diagnosis and surgical treatment of AHO BHJ were radically revised, the developed method was applied - the method of draining osteoperforation of the acetabular roof (DOAR) (patent for invention RUz No. IAP 03082 "Method surgical treatment of acute hematogenous osteomyelitis of the bones of the hip joint ") (Fig. 2, 3).

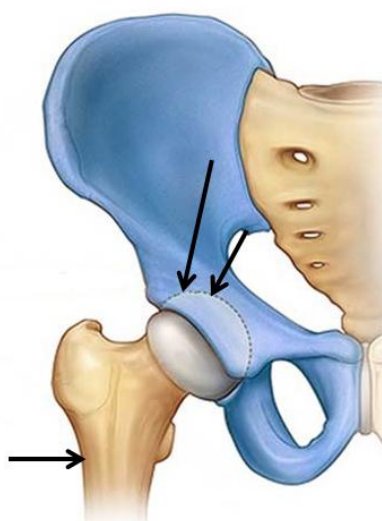


Figure: 2 Drainage osteoperforations of the acetabular roof (diagram).

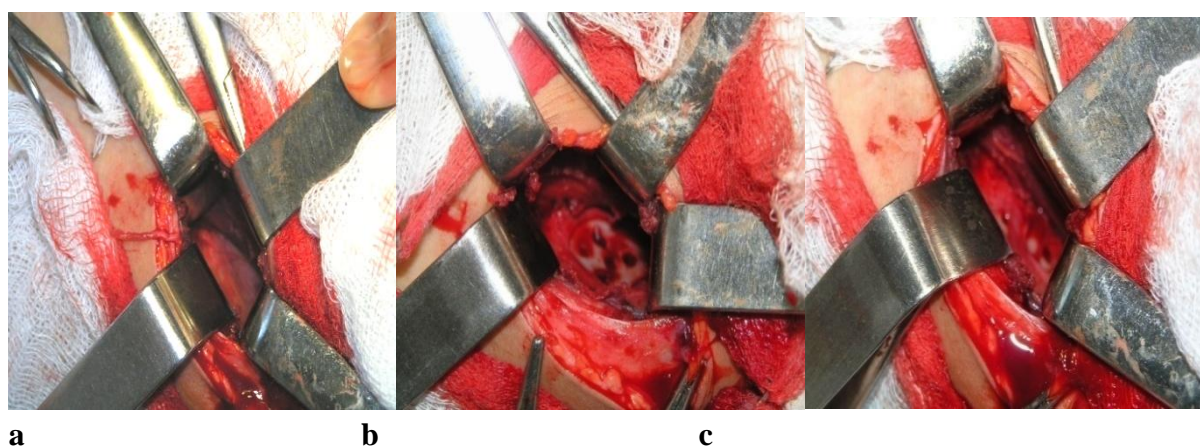


Figure: 3. The iliac fossa (a), draining osteoperforations of the roof of the acetabulum (b) and osteoperforations on the roof of the acetabulum from which pus is released from the cavity of the HJ (c) are exposed by an acute and blunt way.

The feasibility of the proposed method of treatment is justified by several points:

- drainage and sanitation of a purulent focus in the HJ is achieved by access through the iliac fossa - a medial approach aimed at minimizing the degree of trauma to the massive muscle layer surrounding the hip joint, ligamentous apparatus and its capsule, providing adequate drainage and sanitation of the focus, preventing the spread of the purulent process outside the joint.

Results of the study: For the differential diagnosis of AHO BHJ with other inflammatory diseases of the HJ region, 32 sick children with acute reactive coxitis (RK) were examined (comparison group). When comparing the factors that preceded the development of the disease in the groups of patients with AHO BHJ and RK, it should be noted that trauma to the area of the hip joint was more common in patients with HJ, the acute onset of the disease was more common in patients with RK than in the group of patients with AHO BHJ, patients with AHO BHJ more often localized pain in the groin area and in the upper third of the thigh. In patients with AHO BHJ, when compared with RK patients, an increase in temperature above 39°C was approximately 10 times more likely (60.5% versus 6.2%). Patients with RC more often complained of pain in the groin area. In all clinical groups, on admission, an increase in EI indices was revealed compared to the norm.

Thus, the BTI of patient's with AHO BHJ significantly exceeded the values of children with RK by 1.6 times, LII - by 1.5 times, and the values of the Harkavi index tended to increase even more. The use of ultrasound and CT allows you to diagnose AHO BHJ before the appearance of radiological signs in the bone tissue. The early CT specificity was 92%, the sensitivity was 84.4%, and the accuracy was 87.7%. Ultrasound has a lower ability to detect AHO BHJ, the specificity was 87.5%, the sensitivity was 65.3% and the accuracy was 75%.

The proposed tactics of surgical treatment of AHO BHJ made it possible to statistically significantly reduce the duration of the hyperthermia period from $9,36 \pm 0,88$ to $3,57 \pm 0,18$ and the length of hospital stay from $43,18 \pm 3,08$ to $22,89 \pm 0,66$ bed-days in the second group. Only in group 1a we had lethal cases, which amounted to 9.1% (Table 1). In patients of the first group, the course of the main process was more protracted, as evidenced by a relatively long period of fever. The percentage of complications associated with the function of external respiration (66.7%), the formation of purulent foci in soft tissues (42.4%), metastases to other bones (15.1%), bedsores (27.3%) was also relatively high. In addition, we observed pathological

fractures and dislocations during treatment (18.2%). Only in this group we had lethal cases, which amounted to 9.1%.

Table 1

The main results of treatment of children with AHO BHJ in different groups

Indicators	First group, n = 53		Second group, n=81
	1a, n=33	1b, n=20	
period of hyperthermia (days)	9,36±0,88	5,60±0,30	3,57±0,18
bed days	43,18±3,08	29,6±2,51	22,89±0,66
Mortality	3 (9,1%)	-	-

In patients using DOAR, the percentage of early postoperative complications was also reduced. Complications associated with the function of external respiration (39.5%), the formation of purulent foci in soft tissues (2.5%), metastases to other bones (2.5%), bedsores and pathological fractures with dislocations were not observed during treatment. No mortality was noted in this group.

The proposed method of surgical treatment had a beneficial effect not only on the main pathological process, but also on the systemic parameters of the EI of the body of sick children caused by it.

Bacteriological examination of pus from the cavity of the hip joint of the primary focus was performed in 97 (85.1%) of 134 patients. The absolute majority of patients (69.1%) had *Staphylococcus aureus* in monoculture. Almost all identified pathogens of hematogenous osteomyelitis had a high sensitivity to fluoroquinolone - ofloxacin (95.8%). Microflora in more than half of the patients (54.2%) was sensitive to clofaran.

Comparative analysis of long-term results of treatment of AHO BHJs in children. Out of 134 patients with AHO BHJ, long-term results of treatment were studied in 104 (77.4%) patients in the period from 1 to 28 years after discharge from the hospital. Including in 45 (84.9%) patients of the first group, and in 59 (72.8%) of the second group.

The criteria for evaluating the long-term results of the treatment of AHO BHJs were: the presence or absence of complaints in the patient, examination data, the presence or absence of orthopedic complications (ankylosis of the hip joint, stiffness, shortening of the affected limb and pelvic deformity), coefficient of limb shortening, coefficient of joint mobility, transition to the chronic form of the disease (the presence of pain, fistulas, relapses).

Table 2

Characteristics of complications in the long-term period after the treatment of AHO BHJ in children, depending on the method of treatment

Complications	1st group (n=45)	2nd group (n=59)	Total (n=104)
ankylosis	28 (62,2%)	3 (5,1%)	31
joint stiffness	12 (26,7%)	11(18,6%)	23
limb shortening	41(91,1%)	17(28,8%)	58
deformity of the pelvis	25 (55,5%)	3(5,1%)	28
transition to a chronic form	14 (31,1%)	-	14

Note: some patients had 2-3 complications at the same time.

As can be seen from Table 2, the greatest number of complications in the long-term after discharge of patients from the hospital was noted in-group 1, where ankylosis of the hip joint was observed in 62.2% of patients. In-group 2, where DOAR was used as a surgical treatment, it was 5.1%. The same trend was characteristic when comparing other complications: Stiffness in the hip joint in the 1st group - 26.7%, in the 2nd - 18.6%; shortening of the affected limb in the 1st group - 99.1%, in the 2nd - 28.82%, i.e. 3.64 times less often; deformity of the pelvis in the 1st group - 55.5%, in the 2nd - 5.1%, i.e. 5.1 times less often; the transition to the chronic form in the 1st group - 31.1%, in the 2nd group - was not detected.

For an objective assessment of the results of the treatment of AHO BHJ, we have developed methods of a quantitative parametric indicator, limb shortening coefficient (LSC) and joint mobility coefficient (JMC).

When analyzing long-term results, the LMC of the 1st degree was the highest 35 (59%) in the 2nd group of patients (good result), treated with DOAR. Grade 3 (unsatisfactory result) in this group was only 17 (28%) patients, while grade 3 LMC (unsatisfactory result) was the highest in group 1 of 28 (62%) patients, and grade 1 LMC (good result) in this group was only 12 (27%) children. The same indicators for the groups were obtained with the use of JMC. Grade 1 JMC (good result) was the highest in 83% in group 2 patients treated with DOAR, and grade 3 JMC (unsatisfactory result) was the highest in group 1 in 62% of patients.

Table 3

Indicators of long-term outcomes of treatment of AHO BHJ

Patient group	good		satisfactory		dissatisfaction	
	abc	%	abc	%	abc	%
2nd group	34	57,6	16	27,1	9	15,3
1st group	8	17,8	6	13,3	31	68,9
Total, n=104	42	40,3	22	21,2	40	38,5

Thus, good results out of all patients were observed in 58% of patients (Table 3). The best results were obtained in patients in the 2nd group - 57.6%, which was significantly higher compared to the first - 17.8%. The unsatisfactory result of treatment in the 2nd group was only 15.3%, while in the 1st group it was 4.6 times higher and amounted to 68.9%. In 85% of children, good and satisfactory results were obtained in the long term.

Conclusion

1. The frequency of AHO BHJ in the structure of acute hematogenous osteomyelitis is 8%. The specificity of CT in the early stages of AHO BHJ CT was 92%, the sensitivity was 84.4% and the accuracy was 87.7%. Ultrasound has a lower ability to detect this pathology, the

specificity was 87.5%, the sensitivity was 65.3% and the accuracy was 75%. The introduction into the complex of methods for determining EI (LII, BTI, HI) to assess the severity of the pathological process made it possible to increase the possibilities of differential diagnosis of purulent lesions of the hip joint in the early stages of development and to optimize the choice of adequate treatment tactics and control of the effectiveness of treatment.

2. A method of surgical treatment of AHO BHJs has been developed based on the use of an original technique of draining osteoperforation of the acetabulum roof, which achieves the most complete sanitation of the focus of purulent lesions with minimal damage to the surrounding soft tissues; only for local status, but also for the general condition of children.

3. Application of the developed method of treatment led to early activation and a decrease in the length of hospital stay from 43 to 22 bed-days, a relatively low proportion of orthopedic complications (from 68.9% to 15.3%), to a decrease in the transition of the disease into chronic form (from 31% to 0) and mortality (from 9.1% to 0). Good and satisfactory results were obtained in 85% of children in the long-term period.

4. The proposed algorithm for the diagnosis and treatment of AHO BHJ made it possible to improve the results of treatment of this category of patients due to a complex differentiated approach and saving surgical tactics.

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