APPLICATION OF QUANTITATIVE COEFFICIENTS FOR EVALUATING LONG TERM RESULTS OF TREATMENT FOR CHILDREN WHO HAVE HAD OSTEOMYELITIS OF THE HIP JOINT

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Annotation. *Of 134 patients with acute hematogenous osteomyelitis of the hip joint bones, long-term results of treatment were studied in 104 (77.6%) patients from 1 to 25 years after discharge from the hospital. To qualitatively study the results of treatment, quantitative coefficients were used: limb shortening coefficient and joint mobility coefficient.*

Key words: *hematogenous osteomyelitis, long-term results of treatment, quantitative coefficients, children.*

Relevance. 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 [1, 3]. Improvements in diagnostic and treatment methods have made it possible to reduce the mortality rate in acute hematogenous osteomyelitis to 0.5-2.7% [2, 4, 6] and the chronicity of the process to 3.1% [4, 5]. The incidence of acute hematogenous osteomyelitis of the hip joint bones (AHO HJ) ranges from 6.4-15.5% of all osteomyelitis. In 15-54% of cases, various kinds of orthopedic disorders are observed [2, 7].

The purpose of our study is to use quantitative coefficients to quantify long-term treatment results in children who have undergone AHO HJ.

Materials and methods. To achieve this goal, we examined and treated 134 children with AHO HJ, aged from 6 to 18 years, who were hospitalized in the department of purulent surgery, Specialized Children's Surgical Clinic of Samarkand State Medical University for the period from 2004 to 2022. Based on the type of surgical interventions performed, 134 patients with AHO HJ were divided into two clinical groups. The first group consisted of 53 (39.6%) children, conditionally divided into two groups. Group 1a included 33 children who received conventional surgical treatment after puncture of the hip joint and, if they received purulent exudate, then underwent arthrotomy of the hip joint (HJ) according to Güter (anterior approach). Group 1b, 20 patients, in the light of the achievements of modern medicine, the next step to prevent orthopedic complications in these patients, after arthrotomy, was the fixation of the TM area using an original technique using an Ilizarov apparatus instead of skeletal traction and immobilization with a coxite plaster cast. In group 2, 81 (60.4%) patients, the developed method was used - the method of drainage osteoperforation of the roof

of the acetabulum (DORA) (invention patent of the Republic of Uzbekistan No. IAP 03082 "Method of surgical treatment of acute hematogenous osteomyelitis of the hip joint bones").

Long-term results of treatment for AHO HJ were studied in a period from 1 year to 28 years in 104 (77.6%). Including 45 (84.9%) patients in the first group and 59 (79.2%) patients in the second group.

The following were chosen as criteria for assessing long-term results of treatment of patients with AHO HJ:

- ✓ The presence or absence of ankylosis in the vehicle.
- ✓ The presence or absence of a femoral neck fracture and pathological dislocation.
- ✓ The presence or absence of pelvic deformities.
- ✓ Transition of the disease into a chronic form.
- ✓ *Quantitative coefficients.*

To objectively assess the results of treatment for AHO HJ, we have developed and implemented methods of a quantitative parametric indicator, the limb shortening coefficient (LSC) and the joint mobility coefficient (JMC). The LSC was based on the ratio of the length of the affected femur to the healthy limb. LSC is calculated as follows: measuring the distance between the front-upper bone of the ilium and the upper edge of the patella with the help of a centimeter tape on the healthy and sick extremities. The results were calculated using the formula:

$$LSC = D1/D2$$

where: D1 is the length of the affected femur; D2 is the length of a healthy thigh.

The data of the LSC study were evaluated as follows: if the LSC was equal to 1.0 or was > 0.9 units, the result was assessed as good (I-degree – shortening of the limb to 3.0 cm). If the LSC was < 0.9 but > 0.8 units, the result was assessed as satisfactory (Grade II - shortening of the limb to 6 cm). If the LSC was less than 0.8 units, the result was assessed as unsatisfactory (Grade III – shortening of the limb by more than 6 cm).

The JMC was calculated as follows: the angles of motion in the hip joint in abduction and flexion, on the diseased and healthy hip joint, were added, which were then divided among themselves according to the following formula:

$$JMC = ((<Ad + <Sd))/((<Ah + <Sh))$$

where: <Ad - abduction angle on the diseased vehicle; <Sd - sat is the angle of flexion on the affected HJ; <Ah - is the abduction angle on a healthy vehicle; <Sh - is the angle of flexion on a healthy HJ.

The data of the JMC study were evaluated as follows: if the JMC was equal to 1.0 or was > 0.7 units, the result was assessed as good (grade I, the angle of flexion in the affected joint corresponded to the healthy one). If the JMC was < 0.7 but > 0.5 units, the result was assessed as satisfactory (grade II, the angle of flexion

in the affected joint is limited). If the JMC was 0 units, i.e. there was no movement in the affected hip joint (ankylosis), the result was assessed as unsatisfactory (grade III).

Outcomes. Out of 134 patients with AHO HJ, the long-term results of treatment were studied in 104 (77.6%) patients within the period from 1 to 25 years after discharge from the hospital. Including 45 (84.9%) patients of the first group (group 1a, 26 (78.8%) patients and group 1b of 19 (95%) patients), and 59 (72.8%) patients of the second group. The terms of follow-up of long-term results after discharge of patients from the hospital by groups are shown in Table 1. The outcomes of AHO HJ treatment were observed in terms of 1-2 years in 4.5%, 3-5 years in 7.5%, 6-15 years in 29.8%, and 16 years and above in 35.8% of patients.

Table 1

Timing of catamnestic follow-up of patients with AHO HJ in different groups

groups	Follow-up periods, years				Total
	1-2	3-5	6-15	16 and above	
1st, n=53	2(3,7%)	-	5(9,4%)	38(71,7%)	45(84,9%)
2nd,n=81	4(4,9%)	10 (12,3%)	35(43,2%)	10(12,3%)	59(72,8%)
Total n=134	6(4,5%)	10(7,5%)	40(29,8%)	48(35,8%)	104(77,6%)

The following parameters served as criteria for assessing the results of treatment of AHO HJ: the presence or absence of complaints in the patient, examination data, the presence or absence of orthopedic complications (ankylosis of the hip joint, stiff mobility, shortening of the affected limb and pelvic deformity), the state of limb function. The transition of the disease to a chronic form (the presence of pain, fistulas, recurrences of the disease, etc.) and clinical and radiological restoration of the bone structure of the affected bones were taken into account.

Table 2

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

Осложнения	Group 1 (n=45)	Group 2 (n=59)	Total (n=104)
Ankylosis	28 (62,2%)	3 (5,1%)	31
Tight mobility	12 (26,7%)	11(18,6%)	23
Shortening of the limb	41(91,1%)	17(28.8%)	58
pelvic deformity	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.

The comparative analysis showed (Table 2) that the largest 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 DORA was used as a surgical treatment, it was 5%. The same trend was characteristic when comparing other complications: Stiffness in the hip joint in group 1 – 26.7%, in group 2 – 18.6%; shortening of the affected limb in group 1 – 91.1%, in group 2 – 28.8%, i.e. 3.16 times less frequent; pelvic deformity in group 1 – 55.5%, in group 2 – 5.1%; Transition to a chronic form in group 1 – 31.1%, in group 2 – was not detected.

Thus, the advantages of the proposed method of surgical treatment are confirmed both in the postoperative and in the remote period of observation. The results in subgroup 1b, where the Ilizarov apparatus was used to immobilize HJ, were comparable to similar results in subgroup 1a. We attribute this dynamics to the fact that in this study group we included mainly severe cases of AHO HJ with a late date (seven or more days) of referral to a specialized hospital. These patients already had prerequisites for pathological fractures and dislocations upon admission, which forced us to resort to this method of immobilization. An important achievement in this group of patients, in our opinion, is the absence of fatal cases. This result became possible due to the early activation of patients, which prevented a number of fatal complications in the postoperative period (congestive pneumonia, bedsores, muscle atrophy of the motor sphere, joint contractures, etc.).

Long-term treatment outcomes were assessed on a **three-point scale**. We considered the long-term results to be **good** in those individuals who did not complain, the general physical condition corresponded to age, there were no functional disorders in the hip joint, pelvic deformities were not noted, no orthopedic complications were observed, and X-ray showed full repair of the affected bones.

Rare complaints of pain, deformation in the area of the HJ with its normal function or stiffness, the absence of chronic purulent process phenomena were considered to be **satisfactory results**, radiographically: partial lysis of the femoral head was noted, the gap in the hip joint was narrowed, but traceable, there were no signs of pathological dislocation.

With an **unsatisfactory result** of treatment, there were complaints of pain in the limb, fistulas with purulent or serous discharge, the presence of recurrences of osteomyelitis, the occurrence of orthopedic complications, such as ankylosis, deformities of the limb and pelvis, pathological dislocations and fractures of the femoral neck and shortening of the limb. X-rays revealed complete destruction of the hip joint and/or the presence of the proximal femur outside the acetabulum, as

well as the transition to a chronic stage. This category of patients required further repeated surgical interventions (sequestrectomy and hip arthroplasty with correction of the length of the shortened limb).

Figure 1 shows that 12 patients (26.7%) had grade 1 LSC, grade 2 patients (11.1%), and 28 patients (62.2%) of grade 3 patients. At the same time, in-group 2 patients treated with DORA, grade 1 LSC was high and was observed in 35 (59.3%) patients (good result), which is 2 times higher than in-group 1 is. Grade two (satisfactory result) in this group was detected in 7 (11.9%) patients and did not differ significantly from the indicators of group 1. Whereas grade 3 LSC (unsatisfactory result) was the lowest and was observed in 17 (28.8%), which is 2.5 times less common than in-group 1 is.

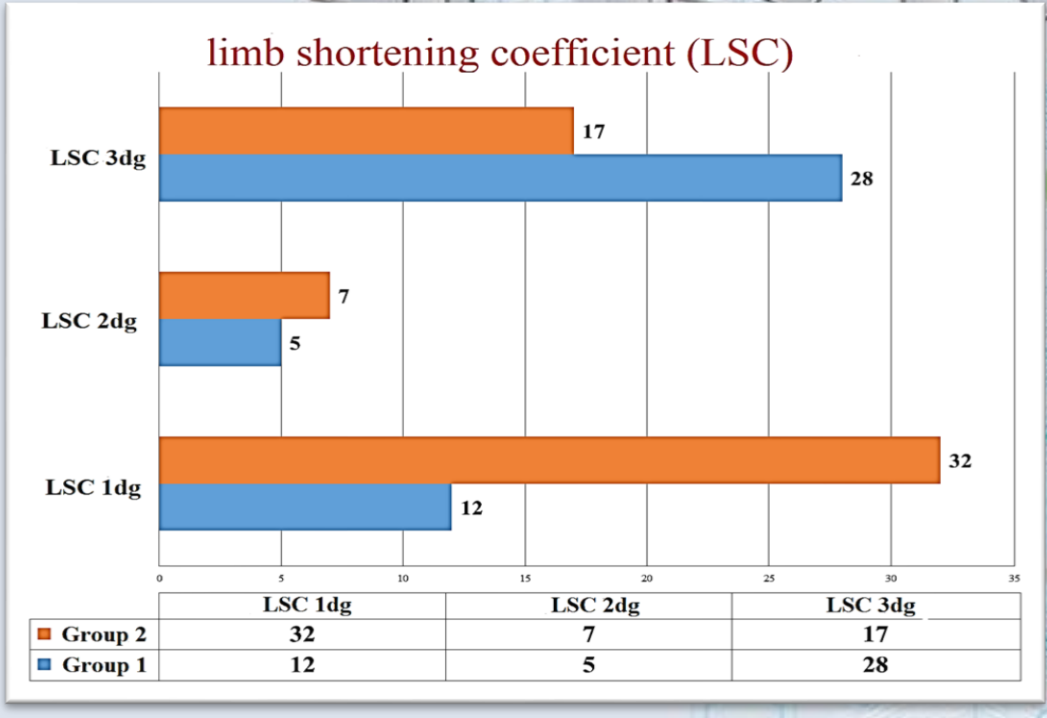

Figure 1. Indicators of LSC in treated patients with AHO HJ.

Figure 2 shows that grade 1 JMC was observed in 8 patients (17.8%) in group 1 patients, grade 2 in 9 patients (20%), and grade 3 in 28 patients (62.2%). In the 2nd group of patients treated with DORA, the AHO HJ of the 1st degree was high and was noted in 49 (83%) patients (good result), which is 4.8 times higher than in the 1st group. Grade 2 (satisfactory result) in this group was detected in 7 (11.9%) patients and did not differ significantly from the indicators of group 1. Whereas CPS of the 3rd degree (unsatisfactory result) was the lowest and was noted in 3 (5.1%), which is 12 times less frequent than in the 1st group.

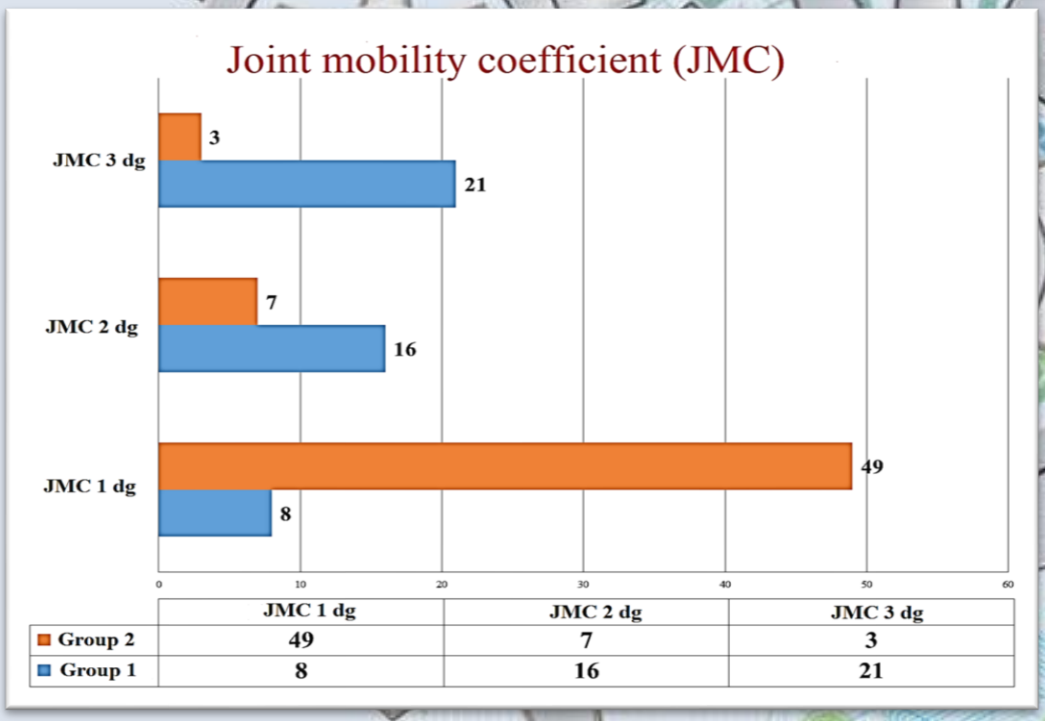

Figure 2. Indicators of JMC in treated patients with AHO HJ.

At the final stage, we analyzed the long-term results of AHO HJ treatment, taking into account the above criteria by groups (Table 3).

Table 3

Indicators of long-term outcomes of AHO HJ treatment

Group of patients	Good		Satisfactory		Unsatisfactory	
	Абс	%	абс	%	абс	%
Group 2	34	57,6	16	27,1	9	15,3
Group 1	8	17,8	6	13,3	31	68,9
Total, n=104	42	40,3	22	21,2	40	38,5

In the 1st group of patients, good results were observed in 8 (17.8%) treated patients, satisfactory in 6 (13.3%) patients, and unsatisfactory in 31 (68.9%) patients. The best results were obtained in patient's in-group 2. Thus, good results were found in 34 (57.6%) patients, which is 3.3 times higher than in group 1; satisfactory treatment results were observed in 16 (27.1%), which is slightly higher than in group 1; Unsatisfactory results were observed in 9 (15.3%), which is 4.5 times lower than in group 1. In 85% of children in the long-term period, good and satisfactory results were obtained.

Conclusion. The use of the developed treatment method led to a relatively low proportion of orthopedic complications (from 68.9% to 15.3%), to a decrease in the transition of the disease to a chronic form (from 31% to 0) and mortality

(from 9.1% to 0). In 85% of children in the long-term period, good and satisfactory results were obtained.

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