

## Some aspects of long-term results of treatment of acute hematogenous osteomyelitis

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**Key words:** acute hematogenous osteomyelitis; long-term results.

**Summary.** *Objective.* The aim of the study was to evaluate the treatment results of acute hematogenous osteomyelitis over 10 years and to determine the relationship between them and clinical course of the disease.

*Materials and methods.* The patients with acute hematogenous osteomyelitis diagnosed 10 years ago (1995–1996) were enrolled in the study. The post mail or phone contacts with them or their parents were obtained, the questions were submitted, and the patients were invited for medical examination. The current complaints and limitations in physical activity were assessed. The amplitude of joint movements, tenderness during palpation, and deformations were evaluated during physical examination. Patients were divided into two groups: with and without complaints. The duration and severity of the disease, age, gender, presence of sepsis, arthritis, and subperiosteal abscess, the type of bone affected and bone lesion on x-ray, duration of fever, and maximal erythrocyte sedimentation rate during the acute period were compared between groups.

*Results.* We made 50 phone calls and sent seven letters to the patients with acute hematogenous osteomyelitis who were treated in our department. In 14 (28%) cases, phone contact was obtained, and 7 of them were examined. Five answers (71%) to the letters were received. The overall response rate was 33%. Thirteen (68%) former patients had no any complaints; six (32%) had minor complaints, which were probably linked to acute hematogenous osteomyelitis. Fifteen (79%) former patients had no limitations in any physical activities, and four (21%) of them limit their physical activities. Seven patients were examined, but neither visible deformities and tenderness nor limitations in movement amplitude were found. Comparing the groups with complaints and without complaints by age, gender, presence of sepsis and arthritis, duration of the disease, and the presence of periosteal abscess, no statistically significant difference in any of variables was found.

*Conclusions.* According to our data, 37% of the patients have complaints 10 years after acute hematogenous osteomyelitis, and these complaints are not associated with the clinical course of the disease.

### Introduction

The treatment of pediatric acute hematogenous osteomyelitis (AHO) is long and difficult. AHO can be the cause of a permanent disability. Acute osteomyelitis treated in the correct manner may be just a short episode in a child's life, but if badly managed, it is life threatening at worst and, at best, a debilitating, crippling illness (1). Long-term results of AHO treatment are not easy to obtain. If the mean age of the patients with disease is 10 years, 10 years later former patients are 20, and usually they have already changed their residence, started to study or work.

The fall in the incidence and severity of AHO over

the last 30 years could be linked to improved standards of living and hygiene (2). However, the prevalence of AHO in some of Eastern Europe countries is still high (3), and there is a large number of former patients who might have complaints and sequelae after AHO. This number might be even higher than after surgery due to congenital anomalies or after other serious pediatric conditions. There are not many studies on long-term results of AHO treatment as well as quality of life of these patients (4).

The aim of this study was to evaluate the 10-year results of AHO treatment and to determine the relationship between them and clinical course of the disease.

### Materials and methods

We studied the group of the patients with AHO treated in the Department of Pediatric Surgery of Kaunas University of Medicine Hospital 10 years ago (1995–1996). The diagnostic criteria of AHO in our department are local pain and fever plus one or more of the following: positive blood culture, positive culture from the bone or inflammatory signs in the smear from the bone, pus in the bone discovered during the operation, and a lesion in the bone confirmed radiologically. These criteria are very close to “classical” described by Peltola, Unkila-Kalio, Scott, and others (5–10). Patients younger than 1 year were excluded from the study because of different clinical features and manifestations of AHO in this age group (11, 12). The patients with septic arthritis were not included into the study.

The post mail or phone contacts with the former patients or their parents were obtained, the questions were submitted, and they were invited for a medical examination. The present complaints, restrictions of physical activity were evaluated; the limitations in the amplitude of joint movements, tenderness during palpation, and visible deformations were considered during physical examination. Patients were divided into two groups: without the complaints (Group A) and with the restrictions in physical activity or complaints, which we have noticed or patients have complained (Group B). Clinical data of all responders, gathered 10 years ago, were analyzed retrospectively: age, gender, the duration of the disease, localization of the osteomyelitis, presence of sepsis and arthritis (as osteomyelitis complication), time to surgery, the operative findings, duration of fever during the treat-

ment, and x-ray changes. The groups of patients with long, short, and flat bones affected were formed. Three levels of x-ray changes at the end of hospital treatment were defined: without visible lesions, with minor destructive lesions, and with major destructive lesions. All these data were compared between Groups A and B.

Statistical methods for the analysis of parametric and nonparametric data were used. Shapiro-Wilk W test was used in testing samples for normality. Frequency tables and cross-tabulations were formed. Pearson chi-square test was used comparing frequencies; Student's and Mann-Whitney U tests were applied comparing means and medians. Standard level of probability of the first type of mistake alpha (0.05) was used concluding statistically significant difference.

### Results

We attempted to contact 57 patients treated in the Department of Pediatric Surgery of Kaunas University of Medicine Hospital. Fifty phone calls were made, and seven letters were sent. In 14 cases (28% from all calls), phone contact was obtained; seven patients agreed to come and be examined. We got 5 (71%) answers to the letters. The total response rate was 33% (Fig. 1). The mean age of the patients at the time of disease was 10.2 years (SD 3.4), and in the group where long-term results were evaluated (group of responders), the mean age was 19.7 years (SD 3.5). Thirteen (68%) former patients had no complaints; 6 (32%) had minor complaints (unpleasant feelings, minor pain during weather changes, some malaise), which were linked to AHO. Fifteen (79%) former patients had no limitations in any physical activity, and 4 (21%) of them had limited physical activities.

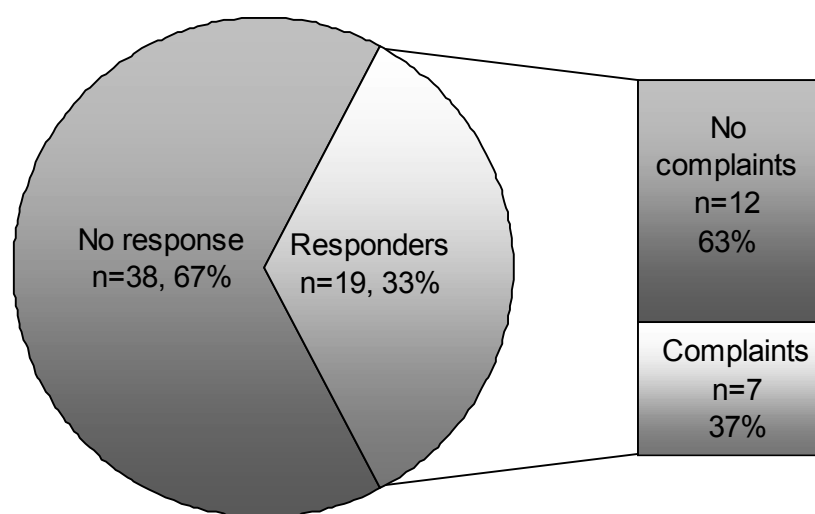


Fig. 1. Distribution of patients with acute hematogenous osteomyelitis

Only seven patients agreed to be examined, but no visible deformities, tenderness during palpation, and limitations in movement amplitude were found, and these results have not been analyzed. Therefore, Group A consisted of 12 patients (63%) without complaints and limitations in physical activity, and Group B consisted of 7 (37%) patients with complaints, limitations, or both (Fig. 1). We analyzed the clinical data and clinical course of the disease of all responders (Table). All, except one, were operated on. Osteoperforations (drilling), soft tissue and joint drainage were performed. All patients were routinely given intravenous antimicrobial treatment. Only *Staphylococcus aureus* was detected in blood, joint, bone, or soft tissues in this series. Comparing Groups A and B by age, gender, duration of the disease until hospitalization, presence of sepsis, arthritis and periosteal abscess, type of bone affected, time to surgery, duration of febrile fever during the treatment, maximal erythrocyte sedimentation rate, and degree of bone lesion on plain x-ray, no statistically significant difference was found in any of variables (Table).

### Discussion

Phone calls were made or letters were sent to 57 patients with AHO who were treated in the Department of Pediatric Surgery of Kaunas University of

Medicine Hospital 10 years ago. Nineteen patients responded, and their data were analyzed retrospectively (Fig. 1). Despite the small number of patients, it was possible to perform statistical analysis, dividing them in two groups according to the long-term results of treatment. The way of forming the group of responders is close to random, and the hypothesis that the sample is representing the entire group is possible. If the data of the group of responders were compared with our previous data where larger series of patients has been analyzed (3) as well with the reports from other countries (2, 6, 10, 13, 14), it would be possible to see that the characteristics of responders (age, gender, duration of the disease, *etc.*) are similar. The division of responders into groups “with complaints” and “without complaints” could reflect some outcomes of the treatment among these 19 former AHO patients.

Our treatment strategy for AHO differs from the United States and Western Europe due to different clinical course (3). Almost all our patients (18 of the 19) were operated on. The epidemiology and severity could vary depending on different geographical, environmental, and social conditions (2, 3, 13–16). During the last decades, the clinical course of AHO is changing, and there are more possibilities to treat AHO patients conservatively (3, 9, 10, 17–19).

**Table. Characteristics of all responders divided into Group A (patients without complaints) and Group B (patients with complaints)**

Characteristic	All responders (n=19)	Group A (n=12)	Group B (n=7)	Statistical test	P value (A versus B)
Age, mean±SD	10.3±3.4	10.25±4.09	10.28±2.21	t=0.02	P=0.98
Male to female ratio	2.8:1	1.3:1	4:1	χ <sup>2</sup> =0.83	P=0.36
Duration of symptoms until hospitalization, median (range), days	3 (2–8)	3 (2–7)	3 (2–8)	z=0.59	P=0.54
Long bone, %	68.4	58.3	85.7	χ <sup>2</sup> =2.97	P=0.23
Flat bone, %	21.1	33.3	14.3		
Short bone, %	10.5	8.3	0		
Arthritis, %	42	33.3	57.1	χ <sup>2</sup> =1.03	P=0.31
Sepsis, %	32	16.7	57.1	χ <sup>2</sup> =3.35	P=0.067
Time to surgery, median (range), h	18.5 (5–72)	18 (5–24)	24 (7–72)	z=1.18	P=0.23
Subperiosteal pus, %	37	71.4	28.6	χ <sup>2</sup> =0.33	P=0.57
Duration of fever, mean±SD, days	7.1±3.8	7.4±4.6	6.6±2.4	t=−0.38	P=0.71
Maximal ESR, mean±SD, mm/h	38±20	40±19	35±23	t=−0.43	P=0.67
No x-ray destruction, %	11.5	16.7	0	χ <sup>2</sup> =1.6	P=0.44
Minor destruction on x-ray, %	57.9	58.3	57.1		
Major destruction on x-ray, %	32.6	25	42.9		

ESR – erythrocyte sedimentation rate.

χ<sup>2</sup> – Pearson chi square test; t – Student’s test; z – Mann Whitney U test.

The questions, which were given to the former patients, were very simple (any complains which were linked to the disease and limitations in physical activity). Examination of the patients was also simplified; deformities, painfulness, and limitations of joint movements were assessed. No any objective changes were found in the group of seven patients who have come and have been examined, despite some of them had complaints. Due to small sample, these patients have not been analyzed.

There are not many studies on long-term results of AHO treatment published (4). Trobs *et al.* (18) reported that 16.9% of patients had late sequelae after osteomyelitis, but the patients with chronic osteomyelitis and neonatal osteomyelitis were included in this study. Risk factors for the development of sequelae are the following: 1) age up to 1 year (newborns and infants), 2) involvement of epiphysis, 3) presence of fever that fails to respond within 5 days (13, 18). Trobs *et al.* reported that 19% of the 170 re-examined patients with acute and chronic osteomyelitis had sequelae after about 10 years (18).

Our hypothesis that characteristics of the patients and clinical course of AHO (age, gender, the duration of the disease, localization of osteomyelitis, presence of sepsis and arthritis, time to surgery, the operative findings, duration of fever during the treatment, and x-ray changes) can differ in the groups of long-term results was not confirmed in our study. The closest to statistically significant difference is the difference in the percentage of patients with positive blood cultures. The percentage of patients with positive blood cultures

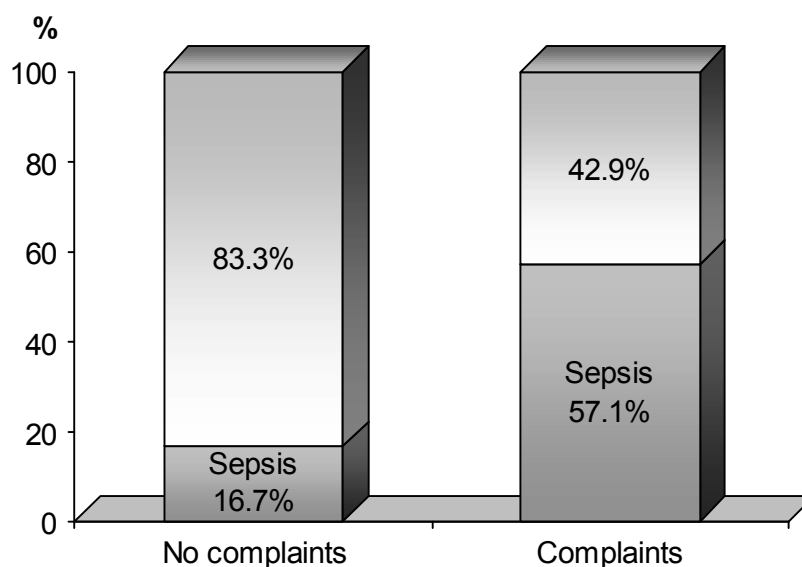
is higher in Group B (with the complaints), and just couple more cases would make this difference statistically significant (Fig. 2). So it could be similar to the study by Chang *et al.* (20), where authors compared children with culture-negative and culture-positive septic arthritis and reported that clinical course of culture-positive arthritis was more complicated.

The differences in the frequency of arthritis, bone type, and median time to surgery between groups are also not far to be statistically significant. It should be noted that the time to surgery is shorter, and the frequency of subperiosteal abscess is higher in Group A (without complaints) (Fig. 3). It is expected that only in the presence of the subperiosteal abscess, urgent surgery could be beneficial. In Group B, long bones were affected more frequently. Arthritis was more common in this group also (Fig. 4). Primary purulent coxitis or coxitis as a complication of osteomyelitis is the most frequent cause of sequelae and poor long-term results (18). Our study shows that patients with AHO complicated with arthritis could have more complaints 10 years after the treatment.

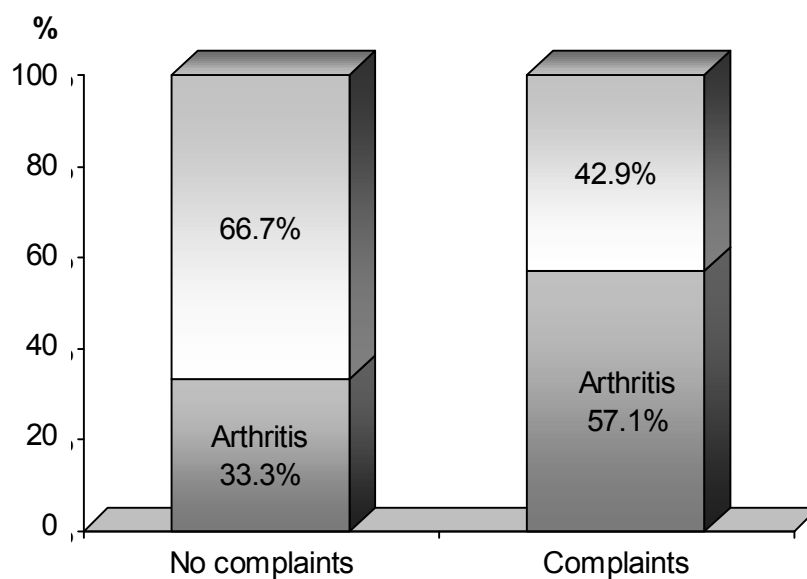
The results indicate that assessment of quality of life after AHO using valid standardized questionnaires is necessary.

### Conclusion

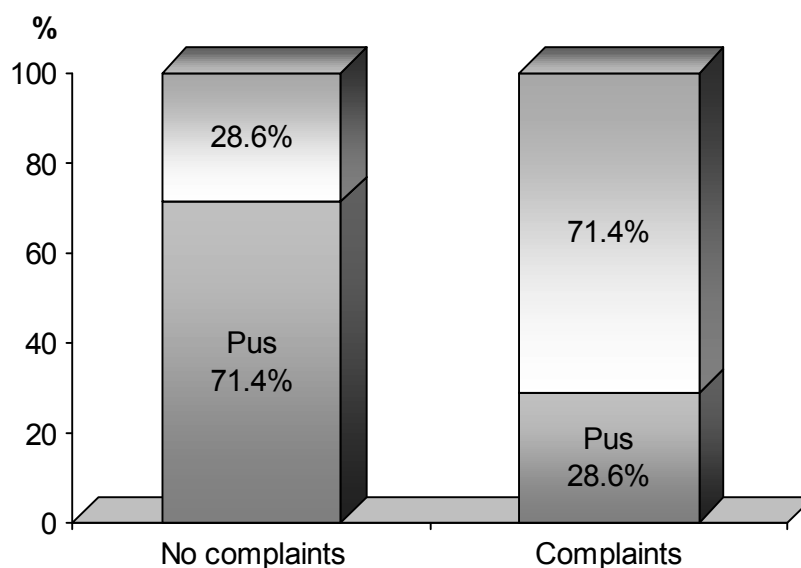
According to our data, 37% of the patients have complaints 10 years after acute hematogenous osteomyelitis, and there is no statistically significant difference in characteristics of clinical course between groups with and without the complaints.



**Fig. 2.** Percentage of patients with positive blood culture in the groups with and without complaints



**Fig. 3.** Percentage of patients with arthritis ratio in the groups with and without complaints



**Fig. 4.** Percentage of patients with subperiosteal abscess in the groups with and without complaints

## Kai kurie ūminio hematogeninio osteomielito vėlyvųjų gydymo rezultatų aspektai

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**Raktažodžiai:** ūminis hematogeninis osteomielitas, vėlyvieji rezultatai.

**Santrauka.** *Darbo tikslas.* Įvertinti vaikų ūminio hematogeninio osteomielito vėlyvuosius gydymo rezultatus ir nustatyti gydymo rezultatų ryšį su ligos klinicine eiga.

*Tyrimo medžiaga ir metodai.* Atrinktos ligos istorijos pacientų, gydytų prieš 10 metų (1995–1996) Kauno medicinos universiteto Vaikų chirurgijos skyriuje dėl ūminio hematogeninio osteomielito. Šie pacientai ar jų tėvai buvo apklausti telefonu arba laišku. Norintys buvo pakviesti pasitikrinti. Įvertinti esantys skundai, fizinės veiklos apribojimai (atvykusiųjų sveikata buvo patikrinta). Sudarytos dvi buvusių pacientų grupės: neturintys

jokių skundų ir turintys skundų arba ribojantys fizinę veiklą. Analizuotos šių pacientų grupių ligos istorijos: amžius, lytis, ligos trukmė, osteomielito lokalizacija, sepsio, artrito, poantkaulinio pūlinio buvimas, maksimalus eritrocitų nusėdimo greitis, laikas iki operacijos, karščiavimo trukmė, rentgenologiniais tyrimais nustatyti pokyčiai. Naudoti statistinės analizės metodai: vidurkių, medianų ir dažnių lyginimas (*Student*, *Mann-Whitney-U*,  $\chi^2$  kriterijai). Pasirinkta įprasta leistina pirmos rūšies paklaida, kai alfa tikimybės dydis 0,05.

**Rezultatai.** 50-iai 1995–1996 metais gydytų pacientų skambinome telefonu ir išsiuntėme septynis laiškus. Su 14 pacientų (28 proc. visų skambučių) pavyko pasikalbėti telefonu, septyni iš jų atvyko pasitikrinti. Iš septynių siųstų laiškų gavome penkis atsakymus (71 proc.). Bendras atsakymų santykis buvo 33 proc. 13 buvusių pacientų (68 proc.) neturėjo jokių skundų, 6 (32 proc.) turėjo skundų, kuriuos jie galbūt sieja su persirgta liga. 15 (79 proc.) buvusių pacientų neriboja fizinės veiklos, 4 (21 proc.) – riboja savo fizinį aktyvumą. Patikrinus septynių atvykusių pasitikrinti pacientų sveikatą, jokių anatominių ar funkcinių nukrypimų nuo normos nerasta. Sudarius buvusių pacientų, kurie turėjo ir kurie neturėjo skundų ir neribojo fizinio aktyvumo, grupes ir palyginus šiose grupėse amžių, lytį, ligos trukmę, laiką iki operacijos, eritrocitų nusėdimo greitį, karščiavimo trukmę, lokalizacijos, sepsio, artrito, paraosalinio pūlinio ir rentgenologinių pokyčių dažnius, statistiškai reikšmingo skirtumo nerasta.

**Išvados.** Mūsų tyrimo duomenimis, 37 proc. pacientų, prieš 10 metų sirgusių ūminiu hematogeniniu osteomielitu, turi skundų, bet skundai nesusiję su ligos klinicine eiga.

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