

**CAUSAL AND INVESTIGATIVE CONNECTIONS OF THE CAUSABILITY OF THE
CAUSES OF ACUTE AND CHRONIC OSTEOMYELITIS DEPENDING ON THE AGE OF
PATIENTS****Nuraliev N. A.* and Ergashev V. A.**

Bukhara State Medical Institute, Bukhara, Uzbekistan Scientific Research Institute of Sanitation, Hygiene and Occupational Diseases, Tashkent, Uzbekistan.

***Corresponding Author: Nuraliev N. A.**

Bukhara State Medical Institute, Bukhara, Uzbekistan Scientific Research Institute of Sanitation, Hygiene and Occupational Diseases, Tashkent, Uzbekistan.

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ABSTRACT

The aim of the study was to study the cause-effect relationships of the incidence of pathogens of acute and chronic osteomyelitis depending on the age of patients in the dynamics. It was found that the main differences in the seeding of pathogens were: in children with acute and chronic osteomyelitis between sowing microorganisms, there are no significant differences, in adults this difference was 7.6 times higher in favor of chronic osteomyelitis; In children, *S.aureus* has no differences in sowing, in adults with chronic osteomyelitis this parameter was 7.3 times greater; In both forms of osteomyelitis, a narrow spectrum of pathogens was observed in children.

KEYWORDS: acute and chronic osteomyelitis, pathogens, sick children and adults, microbiological methods.

To date, it has been proven that the incidence of osteomyelitis is associated with social and economic factors. This pathology is characterized by a wide prevalence, a heavy course with a decrease in the protective factors of the organism under the influence of various internal and external negative factors.^[3,4,5,8]

The etiological agents of osteomyelitis belong to different genera and types of microorganisms. Gram-positive cocci, gram-negative bacteria, anaerobes, and various microscopic fungi have been identified among them^[1,2,6,7,9,10]

Practical and fundamental studies devoted to the pathogenesis, the clinic, treatment and prevention of osteomyelitis have been carried out, but studies devoted to microbiological aspects, the degree of sowing of etiological agents in various forms of the disease depending on age in the course of the course of the disease are rare.

The aim of the study was to study the cause-effect relationships of the incidence of pathogens of acute and chronic osteomyelitis depending on the age of patients in the dynamics.

Materials and methods of research. To perform this work, 448 patients with acute ($n = 53$) and chronic ($n = 395$) forms of osteomyelitis were examined, 380 of them ($84.8 \pm 1.7\%$) were adults and 68 ($15.2 \pm 1.7\%$) children. It was revealed that chronic osteomyelitis was more

frequent than acute in adults - $92.1 \pm 1.4\%$ ($n = 350$), respectively, against $7.9 \pm 1.4\%$ ($n = 30$). In the case of children, the same trend persisted - $66.2 \pm 5.7\%$ ($n = 45$), respectively, against $33.8 \pm 5.7\%$ ($n = 23$). It should be emphasized that although the tendency of sowing was close to each other, the difference was large in terms of the multiplicity of differences, whereas in adults the difference between the indices was 11.7 times, in children this parameter was 2.0 times.

Of the total contingent of patients 324 ($72.3 \pm 2.1\%$) were men and 124 patients ($27.7 \pm 2.1\%$) were women. If the ratio of women and men in adults was 1: 2.62, in girls and boys this parameter was 1: 2.58.

Positive osteomyelitis in adults was $66.3 \pm 2.4\%$ ($n = 252$), and in children this indicator was $41.2 \pm 6.0\%$ ($n = 28$). Hematogenous osteomyelitis in adult patients was manifested in $25.0 \pm 2.2\%$ ($n = 95$) cases, and in children this indicator was $42.6 \pm 6.0\%$ ($n = 29$). Of the examined contingent, $7.9 \pm 1.4\%$ ($n = 30$) adults and $16.2 \pm 4.5\%$ ($n = 11$) children (or their parents) could not indicate the cause of the illness.

Localization of the pathological process was more often observed on the bones of the thigh, shin, shoulder and foot ($P < 0.05$). This trend of occurrence was similar in both adults and sick children. In some cases, the pathological process was localized in both bones, because of this, 380 patients had 391 localizations. In total in 73.2% of cases in adults and 74.9% of cases in

children the pathological process was located on the bones of the thigh and lower leg. In patients with children, the localization of the pathological process on the bones of the knee, pelvis and clavicle was not observed.

The entire osteomyelitis diagnosis was verified with the help of clinical, clinical and instrumental (radiologic) and laboratory methods according to the International Statistical Classification of Diseases and Related Health Problems 10th Revision Version for (2007) and confirmed by bacteriological methods.

To assess the microbiological aspects of the studies performed, traditional microbiological methods were used. The identification of microorganisms was carried out according to Bergey's Manual Systematic Bacteriology (1997). For bacteriological studies, nutrient media from HiMedia (India) were used.

The statistical processing of the results was carried out by traditional methods of variation statistics on personal computers using the Excel program for biomedical research. When organizing and conducting the research, the principles of evidence-based medicine were used.

The results obtained and their discussion. From the examined 68 sick children, 78 strains were sown. There were no significant differences between detectability of monoculture ($53.9 \pm 5.6\%$, $n = 42$) and association of microorganisms ($46.2 \pm 5.6\%$, $n = 36$). The same information was obtained from the comparative evaluation of the seeding of Gram-positive cocci and Gram-negative bacteria.

In 380 adult patients with osteomyelitis, 399 strains were sown. Of these, 227 strains ($56.9 \pm 2.5\%$) were identified as monoculture, 172 strains ($43.1 \pm 2.5\%$) as an association of microorganisms. According to these parameters, the results of adults were close to those of sick children. In contrast, in adults, Gram-positive cocci was significantly more significant than Gram-negative bacteria as a monoculture ($36.4 \pm 2.4\%$, $n = 145$ vs. $16.9 \pm 1.9\%$, $n = 67$, respectively).

Attention is drawn to the fact that in children as a monoculture in the leading positions were in *S. aureus* and then in *P. aeruginosa*, in adults this sequence looked different: *S. aureus* ($22.3 \pm 2.1\%$, $n = 89$), *S. epidermidis* ($9.0 \pm 1.4\%$, $n = 36$), *E. coli* ($7.3 \pm 1.3\%$, $n = 29$), *P. aeruginosa* ($6.8 \pm 1.3\%$, $n = 27$). In the association of microorganisms in children, Gram-positive cocci (*S. aureus* and *S. epidermidis*) had the leading place in the degree of seeding, then the reverse picture was observed in adults, that is, *E. coli* ($8.3 \pm 1.4\%$, $n = 33$) and *P. aeruginosa* ($7.2 \pm 1.3\%$, $n = 29$). Another inter-age difference is that in adults in 11 cases ($2.7 \pm 0.8\%$) there was an increase in *Bacteroides* spp, which could not be identified in children.

When analyzing the results of the percentage of sowing of strains detected in the form of monoculture and association of microorganisms, it was found that 13 out of 13 strains in 4 pathogens showed differences, if *S. aureus* ($22.3 \pm 2.1\%$, $n = 89$ vs. $6.8 \pm 1.3\%$, $n = 27$) and *Klebsiella* spp ($4.5 \pm 1.0\%$, $n = 18$ versus $1.0 \pm 0.5\%$, $n = 4$) were significantly more sown as a monoculture, then *Bacteroides* spp and *Candida* spp could not be identified as a monoculture, but was detected as an association of microorganisms ($2.7 \pm 0.8\%$, $n = 11$ and $2.5 \pm 0.8\%$, $n = 10$, respectively), respectively. In children, this distinct difference was observed only by the sowing of *P. aeruginosa* ($11.5 \pm 3.6\%$, $n = 9$ vs. $2.6 \pm 1.8\%$, $n = 2$).

The results of the comparative analysis of seeding as a monoculture and the association of microorganisms of some strains different among themselves as a function of age are shown in Fig. 1.

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The results of the comparative analysis of seeding as a monoculture and the association of microorganisms of some strains different among themselves as a function of age are shown in Fig. 1.

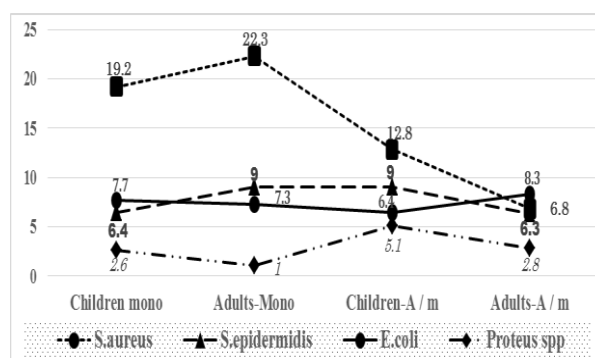


Fig. 1: Comparative rates of sowing of pathogens of osteomyelitis in children and adults, %.

Identified in adult patients as an association of microorganisms in 172 strains, 2 microorganisms were determined in 37 cases (in children in 15 cases), 3 microorganisms in 21 cases (in children in 2 cases), 4 microorganisms in 9 cases (in children). The results show that in adults, the association of microorganisms is more common than in children.

Attention is drawn to the fact that intergrowth differences and cause-effect relationships among patients have been revealed by the percentage of seeding of pathogens. They looked like this:

- In children with acute and chronic osteomyelitis, significant differences ($P > 0.05$) between seeding of gram-positive and Gram-negative microorganisms were not detected, and in adults this figure was significantly higher ($P < 0.001$) in patients with chronic osteomyelitis 7.6 times;
- If there were no significant differences in the sowing of *S. aureus* in children depending on the form of the disease, then the adult patients were significantly different ($P < 0.001$) among themselves - in chronic osteomyelitis 7.3 times more;
- In children with acute osteomyelitis, 4 genera and types of pathogens were identified, and in adult patients 10 genera and species (2.5 times more);
- In children with chronic osteomyelitis, 10 genera and types of pathogens were sown, and in adults 13 genera and species (1.3 times more);
- in acute osteomyelitis, regardless of the age of the patients, *Klebsiella* spp, *P. aeruginosa* and *Candida* spp were not sown, but in chronic osteomyelitis they were identified as causative agents;
- In the acute form of the disease, the associations of microorganisms were significantly less observed than in the chronic form of the disease, respectively 1 case for 2 microorganisms against 83 cases for 2, 3 and 4 microorganisms.

A comparative analysis of the results obtained showed that there are noticeable differences between the microbial landscape of acute and chronic osteomyelitis in patients with children and adults (Fig. 2).

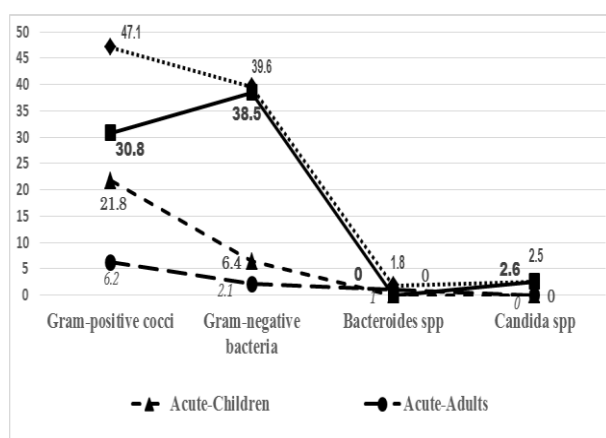


Fig. 2: The indicators of distribution of causative agents of osteomyelitis depending on the form of the disease and age of patients, %.

It was revealed that with post-traumatic osteomyelitis in adults, microorganisms were sown significantly more than in hematogenous osteomyelitis. Significant differences for reasons of the disease, depending on the age of the patients were not observed ($P > 0.05$). The figures, the tendency of their changes, the cause-effect

relations remained at the same level. If patients with post-traumatic osteomyelitis failed to identify *S.hemolyticus*, *S.pyogenes*, *Enterobacter* spp, and *Bacteroides* spp, then adults were not inoculated with *E.faecalis* and *Enterobacter* spp. The spectrum of pathogens sown during hematogenous osteomyelitis is narrow with respect to post-traumatic (9 strains versus 11) - $P < 0.05$ - $P < 0.001$.

Attention is drawn to the fact that in hematogenous osteomyelitis in both age groups *S.hemolyticus*, *S.pyogenes*, *S.saprophyticus* and *Candida* spp. Were not sown. For reasons of formation of osteomyelitis, there is no inter-age difference between sick children and adults.

Studies have shown that the study of the composition of etiologic agents, their degree of occurrence, the relationship between the percentage of seeding of pathogens, the inter-age differences allow us to understand the place of microorganisms in the formation of osteomyelitis, to determine the cause-effect relationships between them, to formulate treatment tactics and to determine the prognosis of the outcome of the pathological process.

At the next stage of the study, the landscape of pathogens of children and adults sown from patients with osteomyelitis in the course of the course of the disease was studied. All studies were performed before surgery, 1, 3, 7, 14 days after surgery. An analysis of the results of studies of 9 children, 14 adults with acute osteomyelitis, 17 children, and 28 adults with chronic osteomyelitis is given.

The results show that children and adults with acute osteomyelitis in the dynamics of the course of the disease (before, 1, 3, 7, 14 days after the operation) studied pathogens were rarely sown. The dynamics of growth in children ($n = 9$) was in the following sequence: before surgery 100%; in 1 day there is no growth; after 3 days growth in $11.1 \pm 10.5\%$, in 7 days in $11.1 \pm 10.5\%$ cases, after 14 days of growth there. In adults, the same results were observed: before surgery 100%; in 1 day there is no growth; in 3 days growth in $7.1 \pm 6.8\%$; in 7 days in $14.3 \pm 9.3\%$ of cases; after 14 days of growth there.

The close results obtained in both age groups indicate the continuing tendency of the extinction of the pathological process, the minimal process transition to the chronic form, the positive prognosis of the outcome of the disease.

In children and adults with chronic osteomyelitis in the course of the course of the disease, the percentage of growth of pathogens was significantly greater than in the acute form ($P < 0.001$). Dynamics of growth in children ($n = 17$) was in the following sequence: before surgery 100%; in 1 day there is no growth; after 3 days, the increase was $58.8 \pm 11.9\%$, after 7 days in $64.7 \pm 11.6\%$, after 14 days in $88.2 \pm 7.8\%$ of cases.

Adults observed similar results: 100%; $14.3 \pm 6.6\%$, $71.4 \pm 8.5\%$, $82.1 \pm 7.2\%$ and 100%. In chronic osteomyelitis, in all cases, it was noted that before the operation, the growth of etiological agents was observed, the gradual increase in the percentage of their sowing was noted in the course of the disease, and at the end of the observation period the seeding reached its peak. In adults, this upward trend was evident and significantly higher than the same rates of sick children.

The lack of an appropriate effect during this time indicates an increased risk of a pathological process from acute to chronic, an unfavorable prognosis of the outcome of the disease. Increase in the percentage of seeding of pathogens in the course of the course of the disease is recommended as one of the microbiological prognostic criteria that determines the transition of the pathological process from acute to chronic form of the disease.

CONCLUSIONS

1. The main differences in the incidence of pathogens were: in children with acute and chronic osteomyelitis between sowing microorganisms, there are no significant differences, in adults this difference was 7.6 times higher in favor of chronic osteomyelitis; In children, *S.aureus* has no differences in sowing, in adults with chronic osteomyelitis this parameter was 7.3 times greater; with both forms of osteomyelitis, the spectrum of pathogens in children was narrow; in the acute form of the disease, regardless of age, *Klebsiella* spp, *P. aeruginosa*, *Candida* spp were not sown, but in the chronic form they were identified; in an acute form of association observed less than in chronic form.
2. In the dynamics of the course of the disease in acute osteomyelitis, the seeding of pathogens in both age groups was minimal, and at the end of the observation period a negative bacteriological result was noted. In chronic osteomyelitis in the course of the disease, the incidence of etiological agents was significantly greater than in acute osteomyelitis.

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