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Research Article

Bone and Joint Infections in Children: Features and Outcome at CHU Gabriel Touré

Traoré F[1], Maiga B[1], Amadou I[2], Keita A[1], Sacko K[1], Coulibaly YA1, Sidibé LN[1], Diakité AA[1], Dicko-Traoré F[1], Togo B[1], and Sylla M[1]

[1]*Department of Pediatrics, CHU Gabriel Toure, Bamako-Mali, Mali*

[2]*Department of Pedatric Surgery, CHU Gabriel Toure, Bamako-Mali, Mali*

***Corresponding author**

Fousseyni Traore, Department of Pediatrics, CHU Gabriel Toure, Bamako-Mali, Mali, Tel: (00223) 76726260

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Abstract

Aim: Osteoarticular infections in children are life-threatening and can lead to long-term disability. They require prompt medical care to reduce the risk of complications. The study was conducted in the paediatric department of the Gabriel Touré University Hospital. It was a prospective, descriptive clinical study lasting 18 months, from 1 January 2021 to 30 June 2022. Children aged 1 month to 15 years were included. The aim was to evaluate the features and therapeutic outcomes.

Results: Thirty-four (n=34) cases of osteoarticular infections were included. The hospital frequency was 1.66%. The mean age was 8 years (range 1-15 years). The Sex ratio was 3.25 (M=26; F=6). Eight patients had a history of sickle cell disease (23%). The topography of involvement was as follows: bone (n=19; 56%), joint (n=5; 15%), bone-joint (n=10; 29%). Humeral and femoral involvement accounted for 23.5% and 40% respectively. Blood cultures were performed on 22 samples, of which 8 were positive. The pathogens identified were *Staphylococcus aureus* (n=7; 32%) and Streptococcus pneumoniae (n=1; 4%). *Staphylococcus aureus* was proportionally sensitive to Oxacillin, Gentamycin and Ciprofloxacin in 85.7% of cases. Acute osteomyelitis accounted for 44% of cases. The mean duration of antibiotic treatment was 13.76±7.38 days, and 25 patients received appropriate antibiotics for a mean duration of 25.84±18.57 days. A combination of 3rd generation cephalosporin and aminoglycoside was used in 50% of cases. Surgical treatment consisted of flattening in 85% of cases (n=25). Red blood cell transfusion was performed in 82.3% of patients. The average hospital stay was 26 days (range: 10-65 days). Recovery was achieved in 97% of patients (n=33). One patient died due to sepsis.

Conclusion: Osteoarticular infections in children are still common in our teaching hospital. *Staphylococcus aureus* is the usual aetiology, but the emergence of new germs such as Salmonella and *Escherichia coli* requires attention.

INTRODUCTION

Bone and joint infections in children are potentially life-threatening and can lead to long-term disability. They require prompt treatment to reduce the risk of complications [1,2]. Their incidence is now estimated at between 5.5 to 12 cases per 100,000 children [3]. It is a medical and surgical emergency because of the serious consequences in terms of musculo-skeletal functionality and growth. All age groups are concerned, from newborns to adolescents [4]. Osteoarticular infections in children include several entities (septic arthritis, acute osteomyelitis, osteitis, osteoarthritis, spondylodiscitis). Infection of bones, marrow and/or joints in children most often occurs via the haematogenous route [5,6]. Diagnosis is generally based on clinical evidence, supported by biology, microbiology and imaging. In sub-Saharan Africa, the incidence of osteoarticular infections fluctuates. According to various studies, rates fluctuate between 6.8% and 26% [7].

In Mali, an initial study performed at the Gabriel Touré University Hospital in 2008 showed the magnitude of the problem. [8]. Early treatment consists of antibiotics, immobilisation of the affected extremity and, if necessary, surgical removal. Long-term antibiotic therapy is necessary to eradicate bone and joint infections. In the paediatric department of the Gabriel Touré University Hospital in Bamako (Mali), we are increasingly faced with the management of bone and joint infections. However, the lack of epidemioclinical and therapeutic data relating to this pathology inspired us to initiate this study in order to update our knowledge and understanding of this pathology.

METHODOLOGY

The research was performed in the paediatrics department of the Gabriel Touré University Hospital. It was a prospective and descriptive study over a period of 18 months, from 1 January 2021 to 30 June 2022.The objectives were to assess the epidemiology and to describe the clinical, bacteriological and therapeutic

characteristics and outcome of osteoarticular infections. Children aged between 1 month and 15 years hospitalised for osteoarticular infections were included.

This was an exhaustive sampling procedure including all children hospitalised for osteoarticular infections and with a complete medical record. Data were collected from the clinical records of the patients. Each record was analysed using a survey form containing epidemiological, clinical, paraclinical and therapeutic data. The parameters collected were processed using SPSS 25.0 software (SPSS Inc., Chicago, IL). Quantitative variables were calculated as mean with standard deviation, while qualitative variables were expressed as numbers and percentages.

RESULTS

Thirty-four (n=34) cases of osteoarticular infections were included. The hospital frequency was 1.66%. The mean age was 8 years (range 1-15 years). Children aged 10 to 15 years were the most represented (47%). The sex ratio was 3.25 (M=26; F=6). Socioeconomic conditions were unfavourable in 85.3% of cases. Eight patients had a history of sickle cell disease (23%). The most frequent form was the homozygous SS form, accounting for 26.7% of cases. The distribution according to the origin of the infection was as follows (Table 1): post-traumatic (n=13; 38%), cutaneous (n=8; 23%), dental (n=1; 3%). Twelve patients (35%) had an unidentified source of infection. Pain, fever and swelling were the most frequent reasons for consultation, respectively 100%, 88% and 94%. The topography of involvement was as follows: bone (n=19; 56%), joint (n=5; 15%), bone-joint (n=10; 29%). Humeral and femoral involvement accounted for 23.5% and 40% respectively (Table 2). Blood cultures were taken from 22 samples, and were positive in eight of them. The germs identified were *Staphylococcus aureus* (n= 7; 32%) and *Streptococcus pneumoniae* (n=1; 4%). *Staphylococcus aureus* was proportionally sensitive to Oxacillin, Gentamycin and Ciprofloxacin in 85.7% of cases (Table 3). Cytobacteriological examination of the joint aspiration fluid revealed the following germs: *Staphylococcus aureus* (n=21; 72%), Salmonella sp (n=3;10%), *Escherichia coli* (n=2; 7%). Mean level of hemoglobin was 9 g/dl (range 4-10 g/dl). Neutrophil hyperleukocytosis was reported in 91% of patients. Over 97% of patients had elevated C-reactive protein levels. Standard X-ray imaging was performed for all patients (n=34; 100%). The most frequent findings were soft tissue thickening (n= 11; 37%) and diffuse bone demineralization (n= 6; 20%). Ultrasonographic examination of the knee revealed joint effusion in 41% of cases. Cytobacterial analysis of samples identified Staphylococcus Aureus in 72.4% of cases. The diagnosis is shown in Figure 1.

Acute osteomyelitis accounted for 44% of cases. The mean duration of probabilistic antibiotic therapy was 13.76±7.38 days. Twenty-five patients received appropriate antibiotic therapy for a mean duration of 25.84±18.57 days. The combination of cephalosporin and aminoglycoside was used in 50% of cases. Surgical treatment consisted of flattening in 85% of cases (n=25).

Table 1: Sources of infection

Sources	Number	Percent
Unidentified	12	35,3
Oral-dental	1	2,9
Cutaneous	8	23,5
Post-traumatic	13	38,2
Total	34	100

Table 2: Injury Topography

Sites	Number	Percent
Upper limb		
Humerus	8	23,5
Elbow	7	20,6
Radius/ulna	5	14,5
Wrist	2	5,9
Hand	1	2,9
Lower limb		
Femur	16	40
Knee	11	32,3
Tibia/Fibula	7	20,6
Foot	2	5,9
Hip	1	2,9
Dorsal	1	2,9

Table 3: Antibiogram of bacteria identified in blood cultures

Detected germs n= 8	Antibiogram	
	Sensitivity	MIC (%)
	Oxacillin	85,7
	Gentamycin	85,7
	Ciprofloxacin	85,7
Staphylococcus aureus	Erythromycin	57,1
	Cefoxitin	14,2
	Amoxi+ac clavulanic	14,2
	Clindamycin	14,5
Streptococcus pneumoniae		
	Fosfomycin	100
	Lincomycin	100
	Vancomycin	100

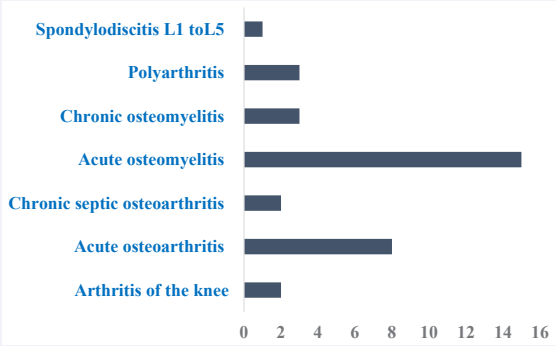

Figure 1 Types of bone infection.

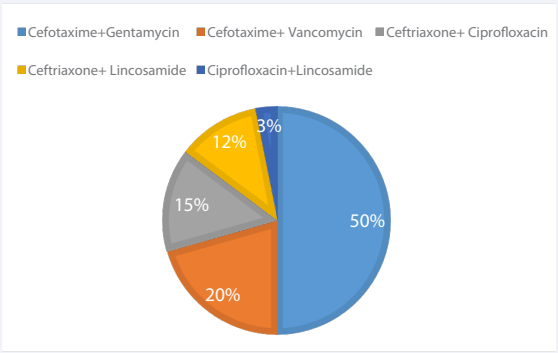

Figure 2 Used antibiotic combinations.

Red blood cell transfusion was performed in 82.3% of patients. The average hospital stay was 26 days (range: 10-65 days). Recovery was achieved in 97% of patients (n=33). One patient died of sepsis.

DISCUSSION

The retrospective aspect of our study presents certain constraints. Our data were collected exclusively from hospitalization files. In the absence of a digital filing system, patient records are generally poorly managed and incomplete (missing pages, some results disaggregated, some pages stained with fluid, etc.). As a result, certain data could not be specified (compliance with oral treatment and post-hospitalization residual effects). Despite these limitations, these results can be discussed with other studies. The in-hospital frequency of osteoarticular infections was 1.66%. This result is lower than those published by P. Bedji [9], who reported 2.80%. Osteoarticular infections can occur at any age. Children aged between 5 and 15, with a mean age of 8.5, were the predominant group in our study (47.1%). This result is similar to those reported by N. Stoesse et al. [**10**], (mean age: 7.3), H. Oubejja et al. [**11**], (mean age: 7.5) and El Hamdi [12] (mean age: 9.7). Children at this age are much more active, and consequently exposed to the risk of injury and trauma. Males prevailed in our study, with a sex ratio of 3.25. Jana FC Neto et al., in their case series of twenty patients with osteoarticular infections, report similar data concerning male predominance [13]. Surveys conducted in the USA on the epidemiology of osteomyelitis and septic arthritis in children have confirmed the male predominance of infection [14]. EL Hamdi reported a sex ratio of 1.57, and the male tendency commonly observed in the literature, can be explained by the boys' turbulence, which exposes them more to trauma. In our sample, socio-economic conditions were unfavorable in 85.3% of cases, and only 14.7% were favorable or acceptable. This result is similar to that of Jamilla EL HAMRI [15], where patients with a low socio-economic level represented 70.51% of cases and those with a medium or high socio-economic level only 29.49%. In sub-Saharan Africa, sickle cell disease is the main cause of osteoarticular infections in children, particularly osteomyelitis. Infections are generally facilitated by the existence of bone infarction following vaso-occlusive crises [16,17]. In our series, 23.5% of patients had a history of sickle cell disease, while Lamini N'Soundhal et al., found that 44.64% of children had sickle cell disease, attesting to the role of sickle cell disease in the development of osteoarticular infections [18]. Several authors reported the notion of a source of infection. In our study, trauma was founded in 38.2% of cases. In Ferroni case study, trauma was suspected in 44% of cases [19]. Trauma is implicated in 30-40% of osteoarticular infections [20,21]. Trauma, through the micro-haematomas created and the inflammatory processes of post-traumatic repair, is likely to lead to a localized circulatory slowdown in the sinusoidal loops, thus favoring bacterial seeding. Typically, the complaint is pain. In young children, pain may be difficult to localize, with lameness or functional impotence the only clinical sign. According to Juchler Céline, local inflammatory signs (edema, redness, heat and/or joint effusion) are observed in around 70% of cases, and more frequently in arthritis than in osteomyelitis. Fever is a classic but inconstant sign, found in only 60% of cases [22]. In our study, pain was found in all patients (100%), followed by fever (88.2%) and functional impotence (79.4%). In the current study, bone involvement (55.8% of cases) was more frequent than osteoarticular involvement (29.4%) and joint involvement (14.7%). Our results are comparable to those of Bedjj, who reported a bone involvement rate of 61.40% [9]. All bones can be affected, but long bones such as the femur and tibia are the most affected. In our study, the femur alone was affected in 40% of cases. Some authors have reported that the percentage of the lower limb affected varies between 70% and 77% [23-25]. H. Oubejja et al., and El Hamdi reported lower limb involvement in 93% and 91.30% respectively. The metaphysial fertility of the knee and the high frequency of trauma largely contribute to this tendency. Ninety-one percent of patients had hyperleucocytosis. These findings are higher than those of EL Hamdi, L. N'Soundhal and Trigui et al., who found hyperleukocytosis in 75% and 80, 2% [12,18]. C-reactive protein is useful both in diagnosis and in monitoring response to treatment. It is usually elevated at the outset, but C-reactive protein tends to normalize more rapidly with appropriate treatment, indicating good progression [26-28]. In our study, 97% of our patients had high C-reactive protein, and this finding was in agreement with that of N. Le Sau, who had 95% high C-reactive protein at diagnosis [6]. C-reactive protein is an effective biological marker for surveillance of treatment of osteoarticular infections in children. According to the literature, the positivity rate for blood cultures is between 30% and 60%, and for aspiration between 30% and 80% [29-32]. The reasons for these figures are probably numerous: diagnostic criteria for osteoarticular infection may be too extensive, or the infection may have been treated with prior antibiotic therapy. In our study, 64.7% of our patients had performed blood cultures and 36.4% were positive, similar to the results reported in the literature and by Kouame Ygs. Blood cultures were performed in 56.2% of cases, with a positivity rate of 40% [33]. In Senegal, blood cultures were positive in 33.33% of cases [34]. We observed a predominance of *Staphylococcus aureus* (gram-positive cocci) with 87.5%. Our bacteriological data do not differ from those of the literature and Kouame YGS. The relative frequency of *Staphylococcus aureus* is between 50 and 90% [35,36]. *Staphylococcus Aureus*

is the germ most frequently isolated in osteoarticular infections. X-rays should be the first-line investigation. The earliest signs are extraosseous [37]. Conventional X-ray is often normal in the early stages, and will be supplanted by ultrasonography to detect sub-periosteal abscesses or intra-articular effusion. With regards to the diagnosis of osteoarticular infections, our results are inferior to those of Kouamé YGS et al., who found 58.5% osteomyelitis and 42.5% osteoarthritis. J El Hamri, who reported arthritis (39.7%), osteomyelitis (25.64%) and osteoarthritis (34.6%). Antibiotic therapy should be initiated as early as possible [30,39,40]. Initially, it should be probabilistic, then adapted to the germs encountered. Several authors use a combination of oxacillin and an aminoglycoside. A cephalosporin may also be used. The antibiotic is given intravenously, with the duration varying from 10 days to 3 weeks, followed by oral administration to 4-6 weeks. We achieved a complete recovery in 97% of patients. One patient died (3%) in the context of sepsis. Our cure rate is similar to that reported in the literature.

CONCLUSION

Osteoarticular infections remain frequent in our setting, affecting mostly boys aged 5 to 15. In our study, Staphylococcus aureus is the most common aetiology of osteoarticular infections, but particular attention should be given to the emergence of *Salmonella* and *Escherichia coli*. A prospective study on the etiology of osteoarticular infections is therefore needed.

ETHICAL CONSIDERATIONS

Upon admission, the patient's parents or legal guardians approved their participation in a clinical research project. The national ethics committee approved the research protocol.

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